INVENERGY RENEWABLES CANADA DEVELOPMENT ULC

ENVIRONMENTAL IMPACT STATEMENT

SKINNERS POND WIND ENERGY CENTRE

PRINCE COUNTY,
PRINCE EDWARD ISLAND

APRIL 2023

ENVIRONMENTAL IMPACT STATEMENT SKINNERS POND WIND ENERGY CENTRE

PRINCE COUNTY, PRINCE EDWARD ISLAND

INVENERGY RENEWABLES CANADA DEVELOPMENT ULC

PROJECT NO.: TE211027
APRIL 2023

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EXECUTIVE SUMMARY

Invenergy Renewables Canada Development ULC (Invenergy) proposes to develop and operate up to a 99-megawatt (MW) wind farm. The Skinners Pond Wind Energy Centre, hereafter referred to as the "Project", would be located between Palmer Road, Ascension Road, Route 14, and Thompson Road at the western edge of the Province in Prince County, near Tignish, (PEI). The Study Area consists of approximately 2,088 hectares (ha) with approximately 92.8 ha being the Project footprint. The Study Area is currently a mix of agricultural and wooded lands, with low density residential development distributed around its perimeter. All Project properties are privately owned and subject to land option agreements with Invenergy. Prior to construction, the options will be exercised and long-term lease or covenant agreements will be put into place for the duration of the Project.

The proposed Project construction is anticipated to begin late 2024, with operations to begin in mid to late 2025. The Project will consist of up to 15 wind turbines, each capable of producing 6.2 or 6.6 MW for a total nameplate production of 93 to 99 MW; turbine laneways to each turbine, electrical collector lines to connect the turbines, and a Project substation as well as an operations and maintenance (O&M) building. Key environmental features identified within the Study Area are watercourses, wetlands, avian fauna (birds and bats), terrestrial wildlife, fish, terrestrial flora as well as identified Species-at-Risk. While the Project land agreements extend up to 50 years, the initial operation phase of this Project's assets is expected to be 30 years at which time the assets may either be re-powered or decommissioned. The goal of the Project is for Invenergy to assist the province of PEI in achieving their goal of having 100% renewable energy by 2050. Direct, measurable benefits of the Project to the Province and Canada will include:

- reduced emissions, thereby contributing to Canada's objective of reducing national total greenhouse gas (GHG) emissions by 30% from 2005 levels by the year 2030 and PEI's goal of 55% by 2030;
- enabling the province of PEI to generate approximately 360 to 390 GWh/year of electricity from renewable power at this location alone;
- lowered dependence on imports of electricity to the Province;
- more stabilized electricity costs within the Province; and
- Up to $49,500 per year to the community benefit fund (CBF) for the local area, not including additional benefits for wages, construction and operations spending and secondary effects.

This report addresses the environmental effects of the construction, operation and maintenance, and decommissioning project phases. The desktop information review and field studies have shown that no significant adverse residual impacts on the valued components (VCs) are likely. The generation of electricity from renewable resources such as wind is in accordance with federal and provincial strategies since it contributes to the reduction of GHG emissions and air pollutants. The Skinners Pond Wind Energy Centre, once approved, would contribute to the reduction of GHG emissions required to meet Canada's and the province of PEI's targets.

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LIST OF ACRONYMS

ACCDC	Atlantic Canada Conservation Data Centre
AQHI	Air Quality Health Index
AQMS	Air Quality Management System
ATC	Air Traffic Control
CAAQS	Canadian Ambient Air Quality Standard
CanWEA	Canadian Wind Energy Association
CEAA	*Canadian Environmental Assessment Act*
cm	Centimetre
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSD	Census Subdivision
CWS	Canadian Wildlife Service
dBA	Decibel
DFO	Fisheries and Oceans Canada
DND	Department of National Defence
DUC	Ducks Unlimited Canada
ECC	Environmental Components of Concern
ECCC	Environment and Climate Change Canada
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ft	Feet
GPS	Global Positioning System
GWh/year	Gigawatt hours per year
ha	Hectare
HDD	Horizontal Directional Drilling
IAA	*Impact Assessment Act*
IAAC	Impact Assessment Agency of Canada
IBA	Important Bird Area
IEC	International Electrotechnical Commission
km	Kilometre
km/h	Kilometre per hour
km^2	Square kilometre
LTE	Long Term Evolution
$\mu g/m^3$	Micrograms per cubic metre
µm	Micrometre
m^3	Cubic metres
m/s	Metres per second
MBBA	Maritime Breeding Bird Atlas
MECL	Maritime Electric Company Limited
MET	Meteorological
min	minute
mm	Millimetre
MW	megawatts
NAAQO	National Ambient Air Quality Objective
NAPS	National Air Pollution Surveillance Network
NB	New Brunswick

NO_x	Nitrogen oxides
NO_2	Nitrogen dioxide
NS	Nova Scotia
O&M	Operations and Maintenance
PEI	Prince Edward Island
PEIDAL	PEI Department of Agriculture and Land
PEI EECA	PEI Department of Environment, Energy and Climate Action
PEIDFC	PEI Department of Fisheries and Communities
PEIDGTC	PEI Department of Economic Growth, Tourism and Culture
PEIDTI	PEI Department of Transportation and Infrastructure
$PM_{2.5}$	Particulate Matter less than 2.5 microns in diameter
PM_{10}	Particulate Matter less than 10 microns in diameter
POL	Petroleum, Oil, and Lubricants
RABC	Radio Advisory Board of Canada
RCMP	Royal Canadian Mounted Police
RoW	Right of Way
RSZ	Rotor-swept zone
SAR	Species at Risk
SARA	*Species at Risk Act*
SCH	Small Craft Harbour
SO_2	Sulphur dioxide
SOCC	Species of Conservation Concern
StatsCan	Statistics Canada
UTM	Universal Transverse Mercator
VC	Valued Components
VOC	Volatile Organic Compound
WTG	Wind Turbine Generator
WNS	White-nose-syndrome
WWBZAP	Watercourse, Wetland and Buffer Zone Activity Permit

1 INTRODUCTION

In 2007, the Skinners Pond Wind Energy Centre Project (Skinners Pond, the Project) was initiated by a group of approximately 65 landowners interested in developing a wind project in the Skinners Pond area, approximately 8 kilometres (km) west of Tignish in West Prince, Prince Edward Island (PEI, the Province, the Island). The following year, Invenergy Renewables Canada Development ULC (Invenergy) was selected by these community members to develop the Project. Since then, the Project has attracted additional landowners, with over 85 participating in 2023.

In July 2020, the provincial and federal government announced funding for a transmission line from Sherbrooke, PEI to Summerside, PEI which will provide the required infrastructure for power transmission from the Project site. In 2021, Invenergy retained WSP E&I Canada Limited (WSP) to launch preliminary environmental studies of the Project Study Area (Figure 1.1).

The proposed Project is subject to a variety of provincial and federal environmental approvals and permitting, including a PEI Provincial Environmental Impact Statement (EIS) pursuant to the PEI Environmental Impact Assessment (EIA) Guidelines. Upon regulatory approval, Invenergy will obtain the relevant environmental approvals and permits required for construction which may include authorizations pursuant to the federal *Fisheries Act* as well as provincial approvals such as a Watercourse, Wetland and Buffer Zone Activity Permit (WWBZAP).

1.1 PROJECT NAME, PROPONENT AND CONTACT INFO

1.1.1 PROJECT NAME

Skinners Pond Wind Energy Centre

Contact Information for the Proponent:

Louis Robert
Director, Renewable Development
Invenergy Renewables Canada Development ULC
67 Mowat Avenue, Suite 335
Toronto, ON M6K 3E3
Tel: 1-438-408-7837
Email: lrobert@invenergy.com

Proponent Background:

Invenergy is the world's largest privately held developer, owner, and operator of sustainable energy solutions. Headquartered in Chicago, with regional offices in Toronto and Montreal, Invenergy has significant Canadian investment through their long-standing partnership with Quebec's pension fund, CDPQ. Globally, Invenergy invests C$348 million annually in the home communities where its projects are located via the creation of high-quality jobs, lease payments and local taxes.

The company has successfully developed more than 190 projects worldwide, totaling over 30,000 megawatts, including wind, solar, transmission infrastructure, natural gas power generation and advanced energy storage projects.

1.1.2 CONTACT INFORMATION FOR THE EIS AUTHOR:

WSP E&I Canada Limited
50 Troop Avenue, Suite, Unit 300
Dartmouth, Nova Scotia
B3B 1Z1
Bruce Fraser
Office: 1-902-468-2848
Email: bruce.fraser@wsp.com

1.2 PURPOSE AND NEED OF THE UNDERTAKING

The purpose of the Project is to harness the energetic West Prince wind resource, thereby assisting PEI in achieving their goal of powering the entire Island with renewable energy by 2050.

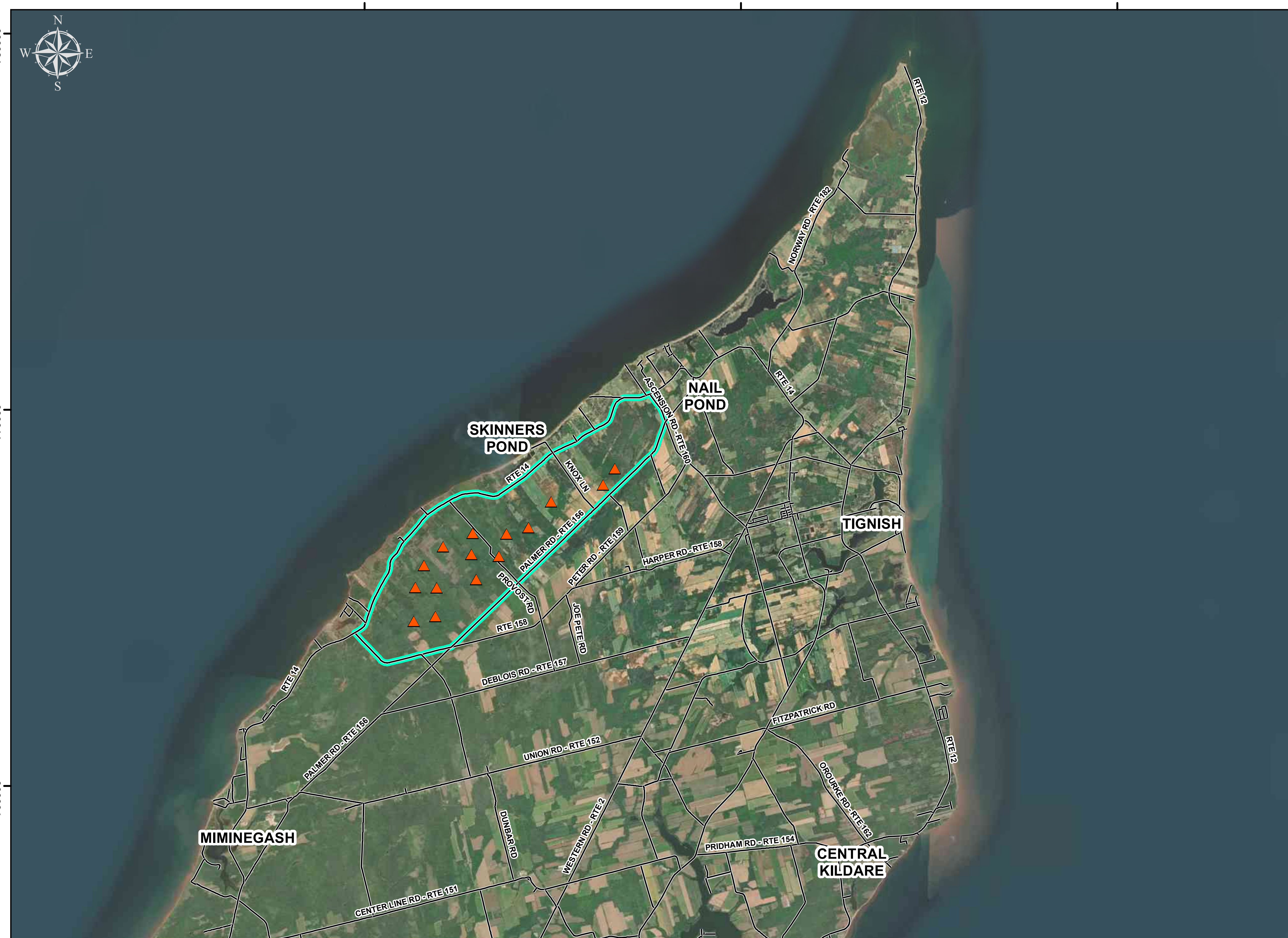
1.3 PROJECT COMPONENTS

The Project will consist of up to 15 Vestas or Siemens Gamesa wind turbines, each capable of producing 6.2 or 6.6 megawatts (MW) respectively, for a total nameplate production of 93 to 99 MW. It will also include turbine laneways to each turbine, electrical collector lines to connect the turbines, and a Project substation as well as an operations and maintenance (O&M) building. The components of the proposed Project layout will use approximately 92.8 ha (Project footprint).

1.4 STRUCTURE OF THE DOCUMENT

The activities and results of the assessment are presented as follows:

Section 1.0	Provides basic information to describe the need and justification for the Project and its proponent.
Section 2.0	Provides a description of the Project, activities and schedule.
Section 3.0	Describes the scope of the EIS, methodology of the assessment, temporal and spatial boundaries and the approach to the determination of significance.
Section 4.0	Describes the existing physical, biological and socio-economic environment of the Study Area.
Section 5.0	Describes the effects assessment, presents mitigation and residual effects for the valued environmental components of the Project and describes the effects of the environment on the Project.
Section 6.0	Presents the assessment of cumulative effects.
Section 7.0	Presents the consultation program.
Section 8.0	Presents potential monitoring, follow-up and mitigation.
Section 9.0	Summary of residual effects
Section 10.0	Conclusion
Section 11.0	List of supporting documents



LEGEND:
- Turbine
- Roads
- Project Area

BASEMAP IMAGERY: ESRI 2020

KEYMAP

CLIENT:

Invenergy

wsp

TITLE:

GENERAL SITE LOCATION

PROJECT:

SKINNERS POND
WIND ENERGY CENTRE

PROJECT NO:	DATE:
TE211027	MARCH 2023
REV NO: 1	DWN BY: CM
DATUM: NAD83 CSRS 2010	PROJECTION: PEI DBL STEREO

FIGURE:

FIGURE 1.1

SCALE: 1:100,000

0 1 2 4
Kilometres

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2 PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

There is a growing economic and environmental concern due to the continued and increased reliance on fossil fuels in Canada and around the world. Combustion of fossil fuels generates harmful pollutants such as sulphur dioxide (SO_2), oxides of nitrogen (NO_x), mercury, volatile organic compounds (VOCs) as well as greenhouse gas (GHG) emissions. These contribute to climate change and directly impact human and environmental health.

To address these concerns, the Canadian Government has joined over 120 countries in committing to achieving net-zero emissions by 2050, and a net-zero electricity system by 2035. PEI has pledged to reach net-zero GHG emissions by 2040.

With the growing demand for clean electricity to reach federal and provincial targets, the Skinners Pond Wind Energy Centre is a timely development with a unique origin story. Rather than being launched by a renewable energy company or government wind developer like most wind projects, Skinners Pond was conceived by a large group of forward-thinking landowners in a part of PEI that has a great history of establishing cooperatives – West Prince. As renewable energy started to become mainstream in the energy world, the Skinners Pond landowners watched closely and began to formulate a plan. They realized that their community was situated in one of the most energetic wind regimes in Atlantic Canada, and that their existing agricultural other land uses could easily accommodate and be compatible with the limited footprints typical of wind turbines and wind development.

In late 2007 and 2008, the landowners held several large meetings, soliciting development proposals from several different wind developers. Recognizing Invenergy's strength in developing unifying projects that benefit communities, the landowners specifically chose this enterprise. Since then, Invenergy has had the privilege of working closely with the community to design a project with a small environmental footprint that respects the wishes of the community and maximizes local and regional benefits. Invenergy is the world's largest privately held developer, owner and operator of sustainable energy solutions.

2.2 JUSTIFICATION FOR THE PROJECT

PEI (the Island) has pledged to reach net-zero GHG emissions by 2040, and Maritime Electric Company Limited (MECL) released its first sustainability report in July of 2022 to detail plans for reducing its GHG emissions by 55% by 2030. The plan includes increasing renewable energy production on the Island by an additional 100 MW of wind and 120 MW of solar. Skinners Pond has strong community support, and with Invenergy's extensive development experience, the Skinners Pond Wind Energy Centre will help PEI meet its ambitious emission reduction targets.

Direct, measurable benefits of the Project to Canada, the Province and region will include:

- Reduced emissions, thereby contributing to Canada's objective of reaching a net-zero electricity system by 2035;
- Compliance with PEI's *Renewable Energy Act*;
- Lowered dependence on imports of electricity to the Province;
- More stabilized electricity costs within the Province; and
- Economic development benefits to the local area.

2.3 ALTERNATIVES TO THE PROJECT

2.3.1 ALTERNATIVE TECHNOLOGY

Wind energy is the most productive use of this area's unique renewable resource (i.e., wind) and would add a significant source of renewable energy to the Province's electric system.

It's worth repeating that the Skinners Pond project originated from the community's aspirations. Identifying wind energy as both a source of energy for the Province and a means of fostering economic prosperity for the region was an insightful observation of the Project's host community, and Invenergy has embraced and acted decisively on their foresight.

Wind energy is well-suited for integration in the Skinners Pond environment. It is recognized for its numerous environmental benefits. Not only does wind energy require a small footprint relative to the energy it produces, but it is also compatible with agricultural and forestry uses in the surrounding area. Furthermore, advancements in wind energy technology offer increasing efficiency while minimizing potential impacts.

The scale of the project is also maximized based on the Project Study Area, the capacity of the future connection line (Sherbrooke), and the economies of scale associated with projects of this size in order to maintain a competitive long-term cost of electricity for the Province.

The announcement of the new transmission line specifically ties the transmission line funding to developing more renewable energy in PEI. Initially, the only wind power project the transmission line extension will connect is the Skinners Pond Wind Energy Centre. In the Proponent's discussions with the provincial and federal governments, the intention is to align the schedules of both projects.

Prior to the transmission line announcement, the Proponent reviewed smaller project sizes due to the transmission capacity in western PEI. With the transmission line becoming available, a larger project can now be accommodated allowing the Project to achieve greater economies of scale.

2.3.2 ALTERNATIVE LOCATIONS

There are three significant constraints that limit alternative locations for developers of utility scale wind projects: i) control of a high percentage of land in a large area within a community that is receptive to hosting wind turbines, ii) a highly energetic wind resource, and iii) availability capacity in nearby transmission infrastructure. Uniquely, Skinners Pond was formulated by the local landowners, has a high-quality wind resource, and the federal and provincial governments committed to constructing a new high-voltage transmission line to the Project.

In siting project infrastructure such as the Project Substation, O&M Building, construction laydown yard, and concrete batch plant, Skinners Pond sought locations that were:

- Relatively flat, to minimize grading costs, stormwater concerns, and additional area requiring cut and fill;
- Previously cleared, to minimize environmental impacts of clearing wooded or brushy areas,
- Near both a public road and a now-private road (and planned wind farm turbine laneway), to minimize the costs and environmental impacts of a longer driveway.

For the concrete batch plant site, in addition to the above criteria, Skinners Pond sought a location that was:

- Centrally located relative to the wind turbine sites to minimize overall travel time for trucks delivering concrete for wind turbine foundations;
- Situated a distance from residences to minimize dust and noise impacts; and
- Near a water source (potentially a groundwater supply system).

The general arrangement and design of a utility-scale wind facility is influenced by a range of factors, including energy production, landowner interest, topography, capital cost, and environmental impacts. The need to maximize energy production and deliver electricity at a competitive price requires locating turbines in locations with turbine-to-turbine spacings that minimize "wake" losses (i.e., losses that occur when a turbine is located too close downwind of another turbine). Proper spacing balances the need to minimize wake losses; minimizes capital costs (for roads and cables between turbines); makes best use of the available wind resource; and achieves economies of scale to overcome fixed costs for development, permitting, interconnection, construction management and mobilization.

The layout presented in this EIS has been developed through multiple design iterations including the relocation of Project elements in several cases to reduce environmental impacts based on preliminary field survey results. Following the detailed design and tendering process, which is still ongoing, the layout will be finalized based on a combination of ecological and technical feasibility factors. This may result in the ultimate removal of some currently identified routes should they prove to be redundant and less preferable alternatives. Thus, the Project activities will be located within the currently proposed footprint, but some route sections may ultimately be unnecessary and would not be developed.

2.3.3 NO BUILD ALTERNATIVE

As discussed in Section 2.1, the Province has set aggressive targets to reach net-zero GHG emissions by 2040. The construction of the Skinners Pond Wind Energy Centre will play a substantial part in further reducing the reliance on fossil fuels (domestic and/or imported), as well as improving grid efficiency by reducing line losses from electricity imports from neighbouring electrical grids. Transitioning to wind-based power is inherently more sustainable than continued reliance on traditional fossil fuels.

By not building the Facility, the Province and local community would also forgo:

- Reduction in electricity import costs from New Brunswick (NB);
- A reliable new source of fuel-free, carbon-free electricity for PEI and regional energy consumers;
- 360-390 GWh/year of incremental renewable energy delivered into the PEI grid; and
- Up to $49,500 per year to the community benefit fund (CBF) for the local area, not including additional benefits for wages, construction and operations spending and secondary effects.

2.4 PROJECT LOCATION

The Project is located on the western edge of the Province in Prince County, near Tignish (Figure 1.1). The Project Study Area is bounded by Palmer Road, Ascension Road, Route 14, and Thompson Road.

2.4.1 SITE LAYOUT

Figure 2.1 shows the proposed infrastructural layout of the Project, including locations of wind turbines, electric collection lines, and ancillary features such as turbine laneways, the electrical substation, the laydown yard, the temporary concrete batch plant, meteorological (MET) tower, and the O&M Building. Universal Transverse Mercator (UTM) geographical coordinates for the 15 turbine locations (T1 – T15) are provided in Table 2.1.

The Project footprint will comprise approximately 92.8 hectares (ha) within a Project Study Area of approximately 2,088 ha and directly impact 98 different properties. The Project Study Area is composed of mixed agricultural lands with some forested areas.

It should be noted that the number of properties directly impacted by the Project may change (i.e., fewer) when final selection of preferred routes is completed after the detailed design phase. The current proposed footprint includes a number of alternative routes for proposed access roads and electrical collector lines that have been assessed in this report but may ultimately be unnecessary and would not be developed.

Due to ongoing design optimization, three design changes were made in late 2022, for which environmental field studies could not be completed. These are:

- Location change of Turbine T14 to reduce noise impacts on the nearest receptor.
- Location change of Turbine T15 to reduce impacts on wetlands.
- Alternative electrical collector line route (shown as a dashed purple line on Figure 2.1) was identified following information gathered at the fall public open house where a landowner suggested use of an existing private access road on their property for the collector line to reduce overall environmental impacts.

The adjusted turbine locations are both still within the areas surveyed during 2022, but with some small extremities extending outside the survey corridors. Most of the proposed alternative electrical collector line was not surveyed. This affects the assessment of impacts on wetlands, species at risk, and archaeological and heritage recourses, for which site-specific field surveys are required to confirm the presence or absence of these features. The available desktop information for these areas has been used for this EIS submission. Confirmatory environmental field surveys will be conducted in these areas in early 2023 (starting in late May) and survey results with updated impact assessment conclusions will be provided in mid-2023.

LEGEND:

- Turbine
- Point of Interconnection Option
- MET Tower
- Turbine Laneway
- Roads
- Streams/Creeks
- Wetlands (Provincial)
- Power Collection Corridor
- Alternate Power Collection Corridor
- Property Boundary
- Project Area

L016 Footprint

- Electrical Substation
- O and M Building
- Power Collection Corridor
- Alternate Power Collection Corridor
- Turbine Laneway Corridor
- Turbine Foundation
- Turbine Temporary Laydown Area (Indicative)

ALL WIND FARM INFRASTRUCTURE MAPPING WAS PROVIDED BY INVENERGY LABELLED LAYOUT 016

CLIENT:

Invenergy

wsp

TITLE:

PROJECT DESCRIPTION

PROJECT:

SKINNERS POND WIND ENERGY CENTRE

PROJECT NO:	DATE:
TE211027	MARCH 2023
REV NO: 2	DWN BY: CM
DATUM: NAD83 CSRS 2010	PROJECTION: PEI DBL STEREO

FIGURE: **FIGURE 2.1**

SCALE: 1:30,000

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Metres

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Table 2.1: UTM Geographical Coordinates

Turbine Name	UTM	
	Easting	Northing
T1	411327.073	5197333.708
T2	411370.162	5198228.927
T3	411598.104	5198811.294
T4	411908.191	5197460.050
T5	411942.372	5198225.135
T6	412113.822	5199310.660
T7	412864.419	5199109.074
T8	412894.382	5199672.464
T9	412990.870	5198445.111
T10	413589.390	5199060.801
T11	413791.663	5199653.411
T12	414379.038	5199820.727
T13	414981.302	5200510.120
T14	416357.651	5200960.523
T15	416672.450	5201387.998
Note: UTM Zone 20, in NAD 83 datum		

2.4.2 LAND OWNERSHIP

All Project land within the Project Study Area is privately owned. Land use agreements will be established with landowners for location of the Project infrastructure and temporary laydown areas. Table 2.2 lists potentially affected properties (PIDs – Property Identification Numbers).

Table 2.2: Potential Lease and Covenant Agreements

PID	Ownership
11411	Private
516989	Private
875195	Private
11718	Private
11353	Private
11296	Private
11767	Private
846816	Private
11668	Private
11643	Private
11601	Private
11304	Private
11346	Private
11320	Private
767350	Private
11775	Private
646653	Private
747337	Private
12021	Private
630046	Private
11833	Private
1010230	Private
415224	Private
11825	Private
53762	Private
12104	Private

PID	Ownership
708636	Private
11999	Private
556969	Private
11817	Private
731919	Private
12070	Private
442513	Private
11809	Private
11858	Private
12096	Private
466938	Private
12062	Private
10249	Private
11841	Private
12054	Private
11874	Private
54974	Private
12088	Private
11932	Private
11924	Private
1388	Private
1453	Private
10272	Private
900555	Private
475988	Private
690586	Private
10397	Private
914283	Private
10165	Private
10132	Private
466920	Private
10223	Private
10298	Private
752584	Private
532481	Private
10249	Private
405720	Private
10330	Private
10306	Private
1067362	Private
10322	Private
832451	Private
10207	Private
460261	Private
10314	Private
10967	Private
10900	Private
886176	Private
1002351	Private
10892	Private
409805	Private
10991	Private
10983	Private
10942	Private
11015	Private

PID	Ownership
11080	Private
10959	Private
11023	Private
720912	Private
740159	Private
720920	Private
10934	Private
11122	Private
11049	Private
11114	Private
11064	Private
10876	Private
11106	Private
11072	Private
420596	Private
752410	Private
1020932	Private

2.5 PROJECT PLANNING AND PREPARATION

The Project will be implemented in one stage. This stage will consist of the installation of fifteen (15) wind turbines with a capacity of approximately 6.2 – 6.6 MW each, generating a total of 93 - 99 MW of electrical wind power. The expected annual energy production of this Project is 360-390-gigawatt hours per year (GWh/year).

Two types of similar large wind turbine models are being considered (Siemens Gamesa and Vestas). The dimensions (size ranges) are provided as follows:

- Total height: 195 to 200 m;
- Hub height: 110 to 119 m; and
- Rotor diameter: 162 to 170 m.

These models have similar, but unique physical and operational characteristics (e.g., noise profile). For the purpose of this EIA, the design characteristic from each model with the greatest potential impact shall be used as a conservative approach. Ultimately the selected turbine may be smaller than the assessment model but will in no case exceed the Project description parameters used in this environmental impact assessment.

In order to optimize Project layout several surveys are required. These include a meteorological survey, environmental surveys, geotechnical surveys and land surveys.

2.5.1 METEOROLOGICAL SURVEY

The purpose of a meteorological survey is to quantify the Project's wind regime prior to the construction of a wind project. A 60 m MET tower has been installed on site and recorded data since 2015. Directional vanes were mounted at the 47.5 and 52 m heights and a temperature sensor was mounted at 3 m. All instrument mounting follows recommended best practices set forth by the International Electrotechnical Commission (IEC) 61400-12 standard. A data logger was mounted near ground level and is equipped with a cellular data transmission device that transmits recorded data to an email account daily.

A wind LiDAR unit is also being considered for use within the proposed Project, which uses a ground mounted unit to measure wind speed at heights of up to 200 m. This will be confirmed based on final turbine design and operational guidelines.

2.5.2 ENVIRONMENTAL SURVEYS

In order to fully understand the environmental constraints of a Project, several environmental surveys were conducted. These include:

- General reconnaissance site visits / walk-throughs;
- Bird surveys;
- Bat surveys;
- Vegetation / rare plant surveys;
- Wetland surveys;
- Fish and aquatic habitat surveys; and
- Archaeological surveys.

Please note that flora and fauna species at risk (SAR) surveys were integrated in the vegetation, bird, bat, and fish habitat surveys. These surveys were completed over variable periods by the personnel indicated in Table 2.3. For more information regarding the methodology as well as results of these surveys please refer to Section 4.0 Existing Environment.

Table 2.3: Environmental Field Surveys

VC Field Component	Sub-component	Dates	Lead Surveyor
Birds	Nocturnal Owls	8 April 2022	Marley Aikens, M.Sc. Senior Bat/Bird Specialist
	Common Nighthawk	17 July 2021	
	Spring Migratory Birds	8 – 29 May 2021 10 – 30 Apr 2022	
	Breeding Birds	1 – 26 June 2021	
	Fall Migratory Birds	10 August – 23 October 2021	
	Winter Residents	December 2021 January, February and March 2022	
	Acoustic Monitoring: Spring Migration Fall Migration	23 April – 27 June 2022 15 July – 22 October 2021	
Bats	Acoustic	2 July – 22 October 2021 18 May – 26 June 2022	
Aquatics	Habitat Assessment	12 -16 September 2022	Elizabeth Robinson, B.Sc., CET, EPt. Intermediate Field Biologist
	E-fishing	14 -16 September 2022	
	Minnow Trapping	12 & 15 September 2022	
Wetlands	Delineation	23 – 25 September 2021 2 - 22 October 2021	Don Maynard, M.Sc. (Granville Ridge Consulting Inc.) Wetland Delineator
		25 July – 5 August 2022 11 - 16 September 2022 18 - 21 October 2022	Lyle Vicaire, B.Sc. (Maqamigew Anqotumeg) Terrestrial Biologist, Wetland Delineator
Plants	Spring Ephemerals	16 – 20 May 2022 6 – 8 June 2022	Elizabeth Robinson, B.Sc., CET, EPt. Senior Field Biologist

VC Field Component	Sub-component	Dates	Lead Surveyor
	Early Plants	25 June – 1 July 2021	
	Late Plants	24 - 28 August 2021	
Archaeological Resources	Walkover	September 2022	Darryl Kelman, MLitt, RPA Senior Archaeologist (Permit # IRS.02.2022-D. Kelman)

The results of these surveys allowed optimization of the layout of the Project by minimizing impacts to Valued Components (VCs) through avoidance where possible. In addition, they provide the Proponent with information regarding the necessary mitigation measures.

2.5.3 GEOTECHNICAL SURVEY

2.5.3.1 PRELIMINARY GEOTECHNICAL SURVEY

During the planning phase, a preliminary geotechnical survey was conducted in September 2022 to assess the general subsurface conditions by looking at the physical characteristics of soil and bedrock. The purpose of geotechnical investigations is to determine engineering recommendations for designing the earthworks and foundations for structures.

The survey generally consisted of standard field tests and laboratory analysis. Standard field tests included drilling, coring and testing five geotechnical borings as well as electrical resistivity testing. Test locations were accessed using track-mounted drill rigs, and boreholes were drilled to varying depths using a combination of auger drilling and rock coring.

2.5.3.2 PRE-CONSTRUCTION GEOTECHNICAL SURVEY

During pre-construction, Invenergy will conduct additional geotechnical investigations at each of the turbine locations and O&M facilities. Similar to the preliminary study, core samples collected during field tests are submitted to a laboratory for analysis to determine the physical characteristics (density, plasticity, grain size distribution, and natural water content) of soil and bedrock as well as test soil corrosivity and sulphate content. A pre-construction geotechnical survey led by a geological engineer will inform the final turbine tower foundation design.

2.5.4 LAND SURVEY

During the planning phase, land surveys are conducted to identify the exact location of the Project footprint as well as boundaries of properties located within the Project Study Area. Land surveys are necessary to ensure that the Project footprint is located accurately, and that no element of the Project footprint impacts properties that have not signed an agreement with the Proponent. Land surveys consist of placing markers at the corners or along the lines of parcels and the Project footprint. These markers are often in the form of iron rods in the ground. Cleared sight lines in wooded areas are generally 1.5 m wide.

2.6 CONSTRUCTION PHASE

Final engineering and design will take place during the Winter of 2023/2024; clearing during Fall/Winter 2024 will commence the construction phase. Road construction will be initiated Spring 2025, followed by electrical line and foundation installation between May and August. Turbines will be delivered through Spring and Summer 2025. The proposed turbines are anticipated to be commissioned and operational by the end of 2025.

The total construction process will entail:

- Clearing: crews will clear and grub areas where wind turbines, access and connector roads, electrical corridors and other facilities are planned. The clearing contractor will remove trees and shrubs from the staked areas. Most removed trees and branches will be chipped and used as mulch to minimize erosion unless landowner requests otherwise. The contractor will grub all areas in the limit of disturbance by removing stumps from the cleared area.
- Turbine laneway construction: this will include grading, compacting where needed, installing a road base and stormwater features where necessary, and top dressing with aggregate.
- Construction of O&M Building.
- Installation of collector lines: cable installation will use trenching and/or directional bores if needed.
- Construction of crane pad, lay-down areas, and turbine foundations: excavated foundations will be assembled with rebar, forms, cable conduits, and grounding systems.
- Electrical substation construction.
- Installation of turbines: this will include delivery and assembly of turbines.
- Testing and commissioning of turbines.
- Removal and restoration of all temporary works and restoration of the Site.

All electrical installations and materials will be compliant with the province of PEI's *Electrical Inspection Act* and the Canadian Electrical Code.

2.6.1 SITE PREPARATION

The initial construction activities will involve clearing through the fall months. In the spring, temporary construction facilities will be installed, turbine laneways will be grubbed and constructed. All necessary site water management and erosion and sediment control measures (primarily silt fence) will be installed prior to significant ground disturbing activities.

2.6.2 NEW AND EXISTING TURBINE LANEWAYS

The proposed locations for all turbine laneways and underground cables were chosen by design to minimize environmental impacts. All-season, unpaved turbine laneways will be required to access each turbine location from existing public roads during the construction, operation and decommissioning phases of the Project. The Project will be accessible primarily via two roads, i) Palmer Road, and ii) Route 14. Turbine laneways will be constructed approximately 6 m wide with a 1 m shoulder on each side, with a typical clearing width of 25 m depending on i) underground cable placement needs, and ii) turn radius needs to accommodate passage of turbine blades (Figure 2.1).

Turbine laneway construction will consist of the following:

- **Clearing and grubbing**: surveyors will stake planned limits of disturbance, then a clearing contractor will remove trees and shrubs from the marked areas, including the removal of tree stumps (grubbing).

Merchantable timber may be salvaged (depending on landowner preference), and non-merchantable fiber will be mulched and spread onsite to minimize erosion.

- **Grading:** contractors will strip and stockpile topsoil on one side of the road corridor and stabilize to mitigate erosion. Cut and fill will be used to smooth topography along the proposed turbine laneway. Topsoil stockpiles will be distributed prior to final completion of the project.
- **Road Base Installation**: Depending on site conditions, a road base of aggregate between 4” to 12” deep will be laid for the road base. The road will then be compacted to provide a smooth, erosion-resistant, safe surface.
- **Stormwater Features**: As part of the turbine laneway installation and/or final restoration, a contractor will install stormwater/drainage features.

It is estimated that road requirements will result in a temporary removal of approximately 54.68 ha of wooded or brushy areas (during construction) and a long-term displacement of 16 ha of potential forest production (during operation).

2.6.2.1 WATERCOURSE CROSSINGS

There are watercourse crossings along the proposed turbine laneways and power corridor rights-of-way (RoWs). Some crossings are at the location of existing culverts, and it is assumed these will need to be upgraded to accommodate the weight of construction equipment. Other crossings will require the installation of new culvert or bridge infrastructure. Both new and old crossing locations may require measures to control beavers and/or beaver dams. Any activities associated with these measures will be coordinated through and/or conducted by the relevant watershed association. Where necessary, prior to any Site work within 15 m of a watercourse and/or wetland, a Watercourse, Wetland and Buffer Zone Alteration Permit (WWBZAP) will be obtained.

2.6.3 ELECTRICAL SUBSTATION INSTALLATION

An electrical substation will be required to provide the interconnection with the PEI provincial grid. The proposed substation footprint will be approximately 75 m x 75 m, located on the southeast edge of the Project Study Area, northwest of the intersection of Palmer Road and Provost Road (Figure 2.1). Each turbine will be connected to the substation by underground collector lines. The collector lines will gather power from the turbines to the substation.

2.6.4 INTERCONNECTION CABLING

The underground cable will be installed between each turbine, along with fibre-optic communication cable, in a trench. A trenching machine will dig the trench measuring approximately 1.0 m wide and 1.5 m deep (below the frost line). The bottom of the trench will then be covered with a layer of natural backfill before laying the cable. The cable will be marked using magnetic warning tape prior to being covered and surrounded by compacted natural backfill. Metal signage will be used to mark the location of the buried cables.

Where the power collection cable crosses a waterbody, the crossing method will be horizontal directional drilling (HDD), such that there is no disturbance of the bed or bank of a watercourse.

2.6.5 OPERATIONS AND MAINTENANCE BUILDING

A permanent O&M building will be constructed adjacent to the substation to serve as a field office and garage. This building will have an onsite water well and septic system suitable for domestic water and waste volumes. The garage will have a concrete floor designed for temporary secure storage of small quantities of hazardous waste that may be generated during operations (e.g., cleaning chemicals, waste paint, oily rags, etc.). All hazardous waste will be stored in appropriate containers, sorted by type, and will be disposed offsite at a provincially-approved waste receiver. Domestic waste and recyclable materials will likewise be sorted by type and stored separately for removal to approved waste disposal sites or recycle depots.

2.6.6 DELIVERY OF EQUIPMENT

Based on preliminary transportation analysis, two ports may be used for turbine delivery. Due to offloading complexity, tower sections and blades will be delivered to the Port of Saint John in New Brunswick. The hub, nacelle, drivetrain, and other components will be delivered to the Port of Summerside in Prince Edward Island. Both routes require modifications of traffic signs, road shoulders, and other potential obstructions.

From the Port of Saint John, tower sections and blades will travel via Highway 100 and Highway 16 to the Confederation Bridge. After crossing the Confederation Bridge, trucks will continue on Highway 1A to Highway 2 where trucks will head west toward Skinners Pond. Trucks will travel on Highway 2 to Route 152.

Trucks continue southwest on Route 152 to Route 14 and will travel north on Route 14 to access the site entrances along the northern Project boundary. To access site entrances along the southern Project boundary, trucks will turn on to Route 155 and Route 156 from Route 14. Five temporary turn radii will be installed after modifications to the adjacent landscape between the Project site and the Highway 2 and Route 152 intersection. Once at the Project site, trucks will deliver components to the turbine pads via site laneways.

Deliveries to the Port of Summerside will exit eastbound on Highway 11 and merge on to Highway 1A. The trucks will then follow the same route as noted above via Highway 1A and Highway 2. If necessary, components will be stored at Slemon Park. Slemon Park will be accessed via Slemon Park Drive and Cannon Drive.

2.6.7 WIND TURBINE ASSEMBLY

Once turbine laneways reach wind turbine generator (WTG) sites, crews will prepare the assembly area for the various activities to occur as follows:

- **Foundation Excavation**: The contractor will excavate the area where the WTG foundation will be installed following similar clearing methods outlined in Section 2.6.2.
- **Foundation Construction**: Crews will pour a thin concrete “mud mat” and then begin assembling the re-bar, forms, cable conduits, grounding systems, and anchor bolt materials needed for the wind turbine foundation. Foundations are generally poured in two parts: the base and the pedestal that includes the anchor bolts to which the turbine tower will be bolted.
- **Backfill and Crane Pad Construction**: After the foundation is poured and cured, forms are removed, the foundation is backfilled with subsoil and compacted, and the crane pad is installed.
- **Pad-Mount Transformer**: Electricians typically install the pad-mount transformer and associated foundation or vault before the WTG has been assembled.

- **WTG Assembly**: Oversize vehicles are escorted to WTG sites where the components are offloaded and staged for erection by a series of cranes, the largest being a tracked crane capable of making the final and tallest lifts needed to assemble the nacelle and rotor.

Construction equipment for the Project will consist primarily of standard heavy construction machines (tracked and/or tired excavators, bulldozers, graders, double and single axle dump trucks, etc.). Tower and turbine erection will require a specialized heavy lift crane.

Based on the proposed locations of the turbines, it is recognized by the Proponent that this typical installation may require site-specific modifications to accommodate possible environmental constraints, such as nearby watercourses or wetlands (if applicable).

2.6.8 CRANE PADS, UNLOADING AND LAYDOWN AREAS

The components will be delivered directly to a temporary assembly area at each WTG location. The assembly area may vary depending on each turbine site (obstacles, limitations). The maximum temporary assembly area measures approximately 75 m x 165 m (1.23 ha) thereby conservatively requiring a total of 18.45 ha for fifteen turbines. Once the installation is complete, the assembly area will be restored with the exception of the concrete foundation pedestal, an aggregate “apron” around the base, and a compacted and aggregate-covered crane pad.

2.6.8.1 FOUNDATIONS

A spread footing foundation design will be used to support the turbines. Each turbine base will have dimensions of approximately 30 m by 30 m, excavated to a depth of 3 m. It is estimated that each turbine base will require approximately 1000 cubic metre (m^3) of concrete. The actual base will be approximately 27.6 m in diameter.

Foundations for the turbine towers will be fabricated using steel-reinforced concrete. The following steps are involved in construction of turbine foundations:

- Excavation of the area (approximately 800 to 900 m^2);
- Compacting the perimeter of the excavation;
- Installation of form work, rebar, backfilling and placement of concrete for the tower base; and
- Disposal of excess material.

An excavator will be used to dig the foundation. Subsoil will be moved and used to either infill any hollows onsite or be removed from the Site. The foundation itself will then be backfilled and compacted with selected fill and subsoil. The foundations will be left for a minimum period of one month to set prior to tower erection.

Following the erection of the towers, any disturbed areas adjacent to the work area will be re-seeded with existing native crops/grasses as appropriate.

The final foundation design will be subject to the results of the pre-construction geotechnical survey; generally, however, the depth of a foundation is typically approximately 3 m. No blasting will be required since the underlying bedrock is considered relatively soft and can be ripped by bulldozer or excavated, if necessary.

2.6.8.2 TEMPORARY CONCRETE BATCH PLANT

Due to the larger sized turbines selected, the required foundations will be roughly double the size of those previously installed in any wind energy project on PEI to date. There is concern that the large volume of concrete needed to be delivered during a single continuous pouring at each turbine would be vulnerable to interruptions if concrete is sourced offsite, which may compromise the structural integrity of the foundation. To ensure quality, efficient delivery, and completion of each foundation in a single pour, a temporary concrete batch plant will be installed onsite as part of the construction phase.

The batch plant will be located in the Laydown Yard adjacent to the substation with an approximate area of 100 m x 100 m. It is anticipated that the plant will need to be onsite for approximately sixteen weeks in mid- to late 2025. During the four-month temporary operation period, approximately 1 month will be actual pouring activities. Site preparation will include stripping topsoil, compaction/grading as necessary, and placement of a gravel surface.

Raw material will be stockpiled on site, including sand and gravel. The plant will include multiple conveyor systems which will generally not be enclosed. Material handling will be done with two front-end loaders. While in operation, the plant will produce 900 m^3 of concrete per day for a Project total of 15,500 m^3. The plant will run between the hours of 6 am to 6 pm up to seven days per week. Operations on weekends and holidays may be required but would be minimized to the extent possible (e.g. when necessary to complete a pour).

Power will be provided from grid if service is available without impacting temporary Project facilities. If sufficient grid power is not available, portable generators will be used. For this impact assessment, we are assuming that onsite generators will be used in order to represent the worst-case scenario for noise, emissions, and dust.

The plant will require a daily water supply of 315 m^3 up to a total project demand of 5,500 m^3. The preferred water supply option will be to truck water from an existing approved source to the site. However, it may become necessary to develop an onsite well system, to be installed during construction. Therefore, an onsite well system will be used as the assumed worst-case scenario for potential impacts. The utilization of local groundwater will require a Water Withdrawal Permit.

Trucking requirements per foundation will include:

Onsite

- 114 trips of 8 m^3 cement trucks for structural pour;
- 4 trips to seal slab; and
- 1 trip for water.

Offsite

- 66 trips for raw material (gravel and sand); and
- 5 trips for Portland cement, Fly Ash, Slag, and admixtures.

It is anticipated that 7 concrete ready-mix trucks will be used onsite. It is likely that there will be some idling while trucks are positioned for concrete pour and at the batch plant. Idling will be minimized to the extent possible.

There will be no onsite disposal of waste concrete, and wash water will be tested for compliance with regulatory water quality guidelines prior to discharge into the environment. Waste fluids that do not meet water quality guidelines will be treated onsite or removed for disposal at an approved waste receiver.

After all foundations are installed, the temporary concrete batch plant will be decommissioned such that:

- The batch plant will be cleaned onsite, with wash-water disposed of in accordance with local regulation.
- Components will be disassembled, prepared for transport, and hauled offsite.

- The batch plant area will be returned to previous state prior to construction.

2.6.9 TURBINE COMMISSIONING

The final activity of the Construction Phase consists of testing prior to start-up and physical adjustments to the turbines.

2.7 OPERATION PHASE

The operational life span of the turbines is rated as 30 years, during which maintenance activities will be required on a regular basis at the Skinners Pond Wind Energy Centre.

2.7.1 TURBINE LANEWAY MAINTENANCE

During the operation of the proposed wind farm, the turbine laneways will be maintained at a level suitable to boom truck-sized vehicles, but on a level below that required for heavy cranes. Re-grading and rolling of the turbine laneways may periodically be required for heavy lifting equipment (in case of major repairs). Ditches will have to be regularly maintained as well. In winter, snow clearing will be conducted. Cleared snow will not be dumped in a watercourse or wetland, or areas where meltwater might enter a watercourse or wetland.

2.7.2 TURBINE OPERATIONS

Operation of the wind farm will commence when the required approvals and authorizations are in place to supply energy into the grid.

The wind turbines selected for this Project generally operate within a defined range of wind speeds. The turbines will not operate in cases of mechanical breakdown, extreme weather, grid outages, or during periods of regular maintenance.

2.7.3 STRUCTURE MAINTENANCE AND CLEANING

Repair and replacement of damaged or deteriorated superstructure and substructure components are undertaken as required to ensure their structural integrity. Cleaning is undertaken to prevent the accumulation of dirt and debris which may restrict normal movement on the structure and/or retain moisture or chemicals, leading to structural component deterioration. Potential activities could include cleaning, lubrication, and painting. All waste generated in the removal of damaged and deteriorated components will be collected for proper disposal. All empty containers of paint, solvents, and cleaners will be disposed of in an appropriate manner at a Provincially approved location.

2.8 DECOMMISSIONING PHASE

Nearing the end of the 30-year operational life span of the turbines, decisions will be made with regard to continuing operations of the Skinners Pond Wind Energy Centre with new or refurbished turbines and/or other equipment, or dismantling the operation and returning the site to its original condition using modern technologies to accomplish this objective.

Decommissioning of the wind farm would require dismantling and removal of all physical components and machinery from the Site. The laneways would remain if the landowners so desired. Where turbine laneways will be decommissioned, watercourse crossings (if any) would be removed, and road surfaces would be restored to the original condition. The collector lines, powerline and substation would be removed. Concrete turbine pads and building foundations will be removed to a reasonable depth and reclaimed unless the landowner wishes to use them as they are. The equipment used for the deconstruction would be essentially the same as for the construction (e.g., heavy lifting and transport equipment, earth moving equipment and trucks to transport waste materials). Any areas disturbed by Project activities will be revegetated with appropriate native vegetation to prevent erosion.

Should the turbines be refurbished to increase the Project lifetime, heavy transport vehicles and a heavy lifting crane would be necessary to transport turbine parts as well as to deconstruct and reconstruct the turbines. All transformer and turbine liquids will be carefully collected, moved off-site and disposed at a licensed facility.

2.9 CONSTRUCTION SCHEDULE

The forecasted project schedule is outlined in Table 2.4.

Table 2.4: Project Schedule

Project Component	Date
EIS Completed	June 2023
Geotechnical Engineering Design	September 2023
Clearing and Grubbing	Mid – late 2024
Winter Shutdown	Late 2024 – Early 2025
Turbine Laneway Construction	Mid- 2025
Collector System Construction	Mid - 2025
Temporary Concrete Batch Plant Installation and Operations	Mid- Late 2025
Installation of Wind Turbine Foundations	Mid - 2025
Substation Installation	Mid- 2024 – Late 2025
Wind Turbine Erection	Mid- 2025
Commissioning of Wind Turbines and Substation	Late 2025
Removal of temporary concrete batch plant and stabilization / reclamation of temporary laydown areas.	Late 2025

3 APPROACH AND METHODOLOGY

3.1 REGULATORY ENVIRONMENT

The Project will be completed on several dozen parcels of land bounded by the Thompson Road, Palmer Road, Ascension Road and Route 14 under private ownership. There are no federal or provincial lands being used for the Project.

An approval under the PEI EIA Regulations for wind power generation is required for the Project as stipulated under Section 9 of the *PEI Environmental Protection Act*. The PEI Department of Environment, Energy and Climate Action (PEI EECA) has the mandate to oversee the Provincial EIA Approval process. In addition, the Project may require WWBZAP for alterations to watercourses/wetlands during the construction phase. The Project must also comply with requirements under the *Subdivision and Development Regulations of the Planning Act* for setbacks from habitable buildings and other structures. The Project does not have a known designated physical activity under the federal *Impact Assessment Act* (IAA) (replacing the *Canadian Environmental Assessment Act* 2012 (CEAA 2012) repealed the 28 August 2019).

The construction, operation, and maintenance of the Project will be undertaken in accordance with all applicable legislation, regulatory approvals, and relevant guidelines. Table 3.1 provides a list of environmental legislation, approvals, and guidelines that may be applicable to the proposed Project.

Table 3.1: Environmental Legislation and Guidelines that may be Applicable to the Proposed Project

Acts/Regulations/ Guidelines	Section/Regulations	Requirement	Department or Agency
1. Provincial Acts and Regulations			
Archaeology Act	S. 7(1)	Permit required to conduct an archaeological investigation.	PEI Executive Council Office
	Archaeology Regulations	Designation of archaeological site. Application for work permit.	
Electrical Inspection Act	S. 2	Canadian Electrical Code standards	PEI Department of Agriculture and Land (PEIDAL)
	General Regulations	Licensing of installations Permit to Supply Energy	
	Canadian Electrical Code Regulations	Compliance with Regulations	
Energy Corporation Act	General	Objectives and powers	PEI Department of Transportation and Infrastructure (PEIDTI)
Environmental Protection Act	S. 9-11	Approval of EIA Watercourses, Buffer Zones, Forested Buffer Zones	PEI Department of Environment, Energy and Climate Action (PEI EECA)
	Air Quality Regulations	Schedule A: Ambient Air Contaminant Ground Level Concentration Standards	
	Environmental Impact Assessment Fees Regulations	Requirement for EIA and fees	
	Water Extraction Permitting Policy	Permit required for water extraction	
	Excavation Pits Regulations	Permit required for excavation	

Acts/Regulations/ Guidelines	Section/Regulations	Requirement	Department or Agency
	Sewage Disposal Systems Regulations	Permit required for construction	
	Watercourse and Wetland Buffer Zone Activity Regulations	Required permits	
Fire Prevention Act	S.31	Control of fires during forest clearing	PEIDAL
Highway Traffic Act	S. 14	Special permit required if vehicle configuration not authorized	PEIDTI
Natural Areas Protection Act	General	Designation of natural areas	PEI EECA
Occupational Health and Safety Act	General Regulations	General	PEI Department of Economic Growth, Tourism and Culture (PEIDGTC)
	Fall Protection Regulations	Fall Arrest System	
	Scaffolding Regulations	If utilized	
	Workplace Hazardous Materials Information System Regulations	General	
Planning Act	Provincial Planning	Permit required for construction	PEI Department of Fisheries and Communities (PEIDFC)
	S. 54.1(2)	Minimum setback distance of at least four times the height of the turbine from the nearest habitable residence	
	S. 54.1(4)	May locate turbine closer than the prescribed setback with written consent of the residence owner.	
Roads Act	S. 4.1 Section 46	Granting of Easements along Public Roads Overweight Vehicle Permit	PEIDTI
	Highway Access Regulations	Entrance way Permit	
	Public Utility Easement (Fees) Regulations	Easement Fees	
Wildlife Conservation Act	S. 7	Endangered, Threatened, and Species of Special Concern	PEI EECA
2. Provincial Policies and Guidelines			
PEI Wetland Conservation Policy	General	Compliance to "No Net Loss" of wetlands or wetland function through avoidance, minimization or compensation	PEI EECA
PEI Watercourse and Wetland Alteration Guidelines	General	Permit required for all alterations made within 15 metres (m) of any watercourse or wetland boundary	PEI EECA
PEI Environmental Impact Assessment Guidelines		To adhere to the PEI EIA review process	PEI EECA
3. Federal Statutes			
Impact Assessment Act	6.1(d)	Ensure that Designated Projects are considered in a careful and precautionary manner to avoid significant adverse environmental effects.	Impact Assessment Agency of Canada (IAAC)
	7.1(a)	Applies to any change that may be caused to fish, aquatic species as	IAAC

Acts/Regulations/ Guidelines	Section/Regulations	Requirement	Department or Agency
		defined in the *Species at Risk Act* and migratory birds.	
Federal Policy on Wetlands Conservation		No net loss of wetland function.	Environment and Climate Change Canada (ECCC)
Fisheries Act	S.32	Prohibition of destruction of commercial fish except as authorized.	Fisheries and Oceans Canada (DFO)
	S.35	Prohibition of work or undertaking that causes Harmful Alteration, Disruption or Destruction (HADD) of fisheries habitat unless authorized.	DFO
	S. 36	Prohibition of deposit of a deleterious substance into waters frequented by fish.	ECCC (on behalf of DFO)
	S.37(1)	Requires submission of Plans to DFO.	DFO
Migratory Birds Convention Act (MBCA)	S. 6	Prohibits activities that will result in negative effects on migratory birds (listed under the *MBCA*) or their eggs, nests and young.	ECCC
	S 5.1	Prohibition of deposit of a deleterious substance into migratory bird habitat.	ECCC
Species-At-Risk Act (SARA)		Prohibits activities that will result in negative effects on Species-at-Risk (listed in Schedule 1 of SARA) or their Critical Habitat (as identified in a species Recovery Plan).	ECCC
Navigation Protection Act	S.5(2)	Minister determination that work does not interfere with navigation (exemption).	Transport Canada
	S.5(1)	Approval required for construction of work in Navigable Water if work will interfere with navigation.	Transport Canada
Minor Works and Waters Order under the *Navigation Protection Act* (Section 13)	S.5 S.10 S.11	In the context of this Project, a Navigable Waters Permit is not necessary for works classified as Aerial Cables – Power and Communication (S.5); Temporary Works (S.10) or in Minor Navigable Waters (S.11).	Transport Canada
Aeronautics Act	Aviation Regulations	Approval by Transport Canada for aeronautical obstruction clearance.	Transport Canada
4. Federal Guidelines and Standards			
Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms under the *Canadian Environmental Assessment Act*			ECCC
Wind Turbines and Birds – A Guidance	General		Canadian Wildlife Service (CWS) - ECCC

Acts/Regulations/ Guidelines	Section/Regulations	Requirement	Department or Agency
Document for Environmental Assessment			
Technical Information and Guidelines on the Assessment of the Potential Impact of Wind Turbines on Radiocommunication, Radar and Seismoacoustic Systems			Radio Advisory Board of Canada (RABC) and the Canadian Wind Energy Association (CanWEA) Note: CanWEA is now the Canadian Renewable Energy Association.
Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds	General		CWS – ECCC
Minor Waters User Guide 2010		Details under what conditions a watercourse can be deemed a Minor Navigable Water and be exempt from the *Navigable Waters Act* application process.	Transport Canada
Responsible Authority's Guide		Ensure environmental consideration incorporated into planning process (federal, money, lands, or jurisdiction).	IAAC
Canadian Environmental Protection Act	Canada-Wide Standards	Canada – Wide Standards for Particulate Matter (PM) and Ozone, Canadian Council of Ministers of the Environment (CCME), June 2000;	ECCC
	National Ambient Air Quality Objectives (NAAQOs)		National Advisory Committee Working Group on Air Quality Objectives and Guidelines

3.2 SCOPE OF THE PROJECT AND ITS ASSESSMENT

Since the Project is not a known designated physical activity under the IAA, the scope of the EIS is to be carried out in accordance with the requirements of the Province's EIA Guidelines (revised January 2010) under the Province's *Environmental Protection Act*. Revisions to these Guidelines include "Appendix B: Special Note for Wind Turbine Projects" from the *Environmental Protection Act* found in Appendix A of the EIS. It stipulates that all proposals must include an associated power corridor proposal.

3.3 METHODOLOGY OF ENVIRONMENTAL IMPACT ASSESSMENT

To facilitate the review of identified issues, an understanding and description of the environment within which the activities will occur, or potentially have an influence on, was developed from a review of existing information. Potential positive and negative interactions between Project activities and the environment were identified.

Where negative interactions were anticipated and potential effects were a concern, methods for mitigating the effects were proposed.

An environmental assessment is a complete process, which should begin at the earliest stages of planning and remain in force throughout the life of a project, moving through a series of steps:

- Describing the project and establishing environmental baseline conditions.
- Scoping the issues and establishing the boundaries of the assessment.
- Assessing the potential environmental effects of the project, including residual and cumulative effects.
- Identifying potential mitigation measures to eliminate or minimize potential adverse effects.
- Environmental effects monitoring and follow-up programs.

For the purpose of this EIA, the interactions (effects) between Project activities and Environmental Components of Concern (ECCs) are examined to select a defined set of Valued Components (VCs) that will be assessed. The significance of potential interactions and the likelihood of the interactions are also considered. Possible measures to mitigate impacts are identified and, where residual impacts are identified, measures to compensate have been considered. Impact of malfunctions and accidents, as well as cumulative effects, are to be included in the evaluation of the environmental effects.

The technique of Beanlands and Duinker (1983) and the guidance provided by various federal and provincial documents were employed to assist in the design and conduct of the environmental assessment. This approach emphasizes the use of VCs as the focal points for impact assessment. Generally, VCs are defined as those aspects of the ecosystem or associated socio-economic systems that are important to humans.

The environmental assessment focuses on the evaluation of potential interactions between project components and activities on the one side, and VCs that were identified through an issues-scoping process on the other side. Two approaches were taken for identifying VCs, upon which the assessment focuses. First, those parameters for which Provincial and Federal Regulations are in place were identified. Second, a scoping exercise was conducted, based upon previous environmental assessment experience with similar Project components, consultation, and available information related to the environment near the Project site. As suggested by Beanlands and Duinker (1983), VCs were determined on the basis of perceived public concerns related to social, cultural, economic, or aesthetic values. The VCs were also chosen to reflect the scientific concerns of the professional community.

Issues scoping is an important part in the VC identification process. The issues scoping process for this assessment included: review of past, relevant environmental and scientific reports; review of public concerns; regulatory agency consultation; and the study team’s professional judgment.

The first step in the selection of VCs involved issues scoping to identify ECCs, and was based on:

- Concerns expressed by various stakeholders, including the scientific community, as well as comments from the public, government departments and agencies.
- Review of applicable statutes and regulations.
- Review of similar projects such as Summerside Wind Farm, East Point Wind Farm, West Cape Wind Farm, Hermanville/Clearspring Wind Farm, Eastern Kings Wind Project and WEICan Wind Energy Research and Development Park and Storage System.
- Consideration of available literature and reference materials.
- Perceived public concerns related to social, cultural, economic, or aesthetic values.

The approach to the selection of VCs involves an initial evaluation to determine the likelihood of an interaction or linkage (pathway) between ECCs and project activities, including all the components of the Project. Where linkages between ECCs and project activities exist and potential effects are of concern, these components are selected as VCs and subject to further analyses.

ECCs with existing federal or provincial environmental regulations, such as endangered species and migratory species, are all of concern and were selected as VCs. Issues that regulators are concerned about were also selected as VCs, such as bat populations due to the presence of white-nose-syndrome (WNS). In addition, any issues raised by the public, as well as most ECCs with an existing pathway, have been selected as VC. If not, the exclusion is explained.

The assessment of the potential effects of the environment on the Project, including extreme weather events, was conducted during the Project design phase. Extreme events that apply include storms and icing. Storms and icing are referenced with regard to the ability to shut down the turbines, if required, and also the design of the turbines to accommodate high winds. Any mitigation project design modifications that may have been required were incorporated in the final project design that is described in this document.

3.4 TEMPORAL AND SPATIAL BOUNDARIES OF THE PROJECT

The traditional approach to project bounding involves assessing changes to the environment within the physical boundaries of development. Beanlands and Duinker (1983) determined that in order to properly evaluate impacts, physical and biological properties must be determined temporally and spatially. This approach has been taken for the determination of bounds for the assessment of the proposed Project. The effects of a specific project activity on a VC may differ in both space and time from the effect of any other activity. Some project activities may have long-term consequences, while others will be of short duration.

Temporal project bounding for the proposed Project includes the short-term clearing (mid to late 2024) and construction activities (mid 2025 to late 2025) as well as the long-term operation of the wind energy facility (turbine lifetime 30 years) and its decommissioning, including Site remediation. There is some temporal variability, since a refurbishment of the turbines at the end of their regular lifetime is likely, which could double the lifetime of the wind generator facility. In addition, the duration of the effects will probably vary with the VC and the Project activity.

Therefore, different temporal boundaries may be used to reflect:

- The nature and duration of the effect;
- The characteristics of the indicator; and
- The types of actions and projects that will need to be considered within the cumulative effects assessment.

For the purposes of this Study, the temporal bounds for the Project have been categorized into three stages:

- Construction Period.
- Operations and Maintenance.
- Decommissioning/Refurbishment.

The physical boundaries for assessing potential effects will typically be established by determining the spatial extent of an effect of a Project component or activity. The physical perimeter of the Project Study Area is as illustrated on Figure 2.1, but the spatial boundaries may vary depending on the individual VC (Study Area). For example, for endangered plant species, the Study Area will be restricted to the lay-down areas, turbine laneways and ancillary structures. However, for socioeconomic impacts, the boundary extends the Study Area to include the census subdivision (CSD) of the Tignish Fire District at a minimum. Scientific and technical knowledge, input from the public, and professional experience was used to develop the temporal and spatial boundaries.

3.5 APPROACH TO DETERMINATION OF SIGNIFICANCE

The assessment or determination of the significance of potential effects will be based on the Responsible Authority's Guide developed by the Agency, with consideration of other relevant Federal and Provincial regulatory requirements.

The Responsible Authority's Guide has been successfully applied to similar projects in the past and has been widely accepted by government and regulatory agencies within Canada, as the standard for the completion of EIAs. The Reference Guide entitled "Determining Whether A Project Is Likely To Cause Significant Adverse Environmental Effects" included in the Responsible Authority's Guide (The Agency 1994) will be used as the basis for determining the significance of identified potential effects. This determination consists of the following steps:

- Determine whether the environmental effect is adverse;
- Determine whether the adverse environmental effect is significant; and
- Determine whether the significant environmental effect is likely.

Significance of adverse effects will be directly related to regulatory guidelines and statute requirements where applicable. The assessment will determine whether the residual environmental effects of the Project are significant or non-significant after application of mitigation measures.

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

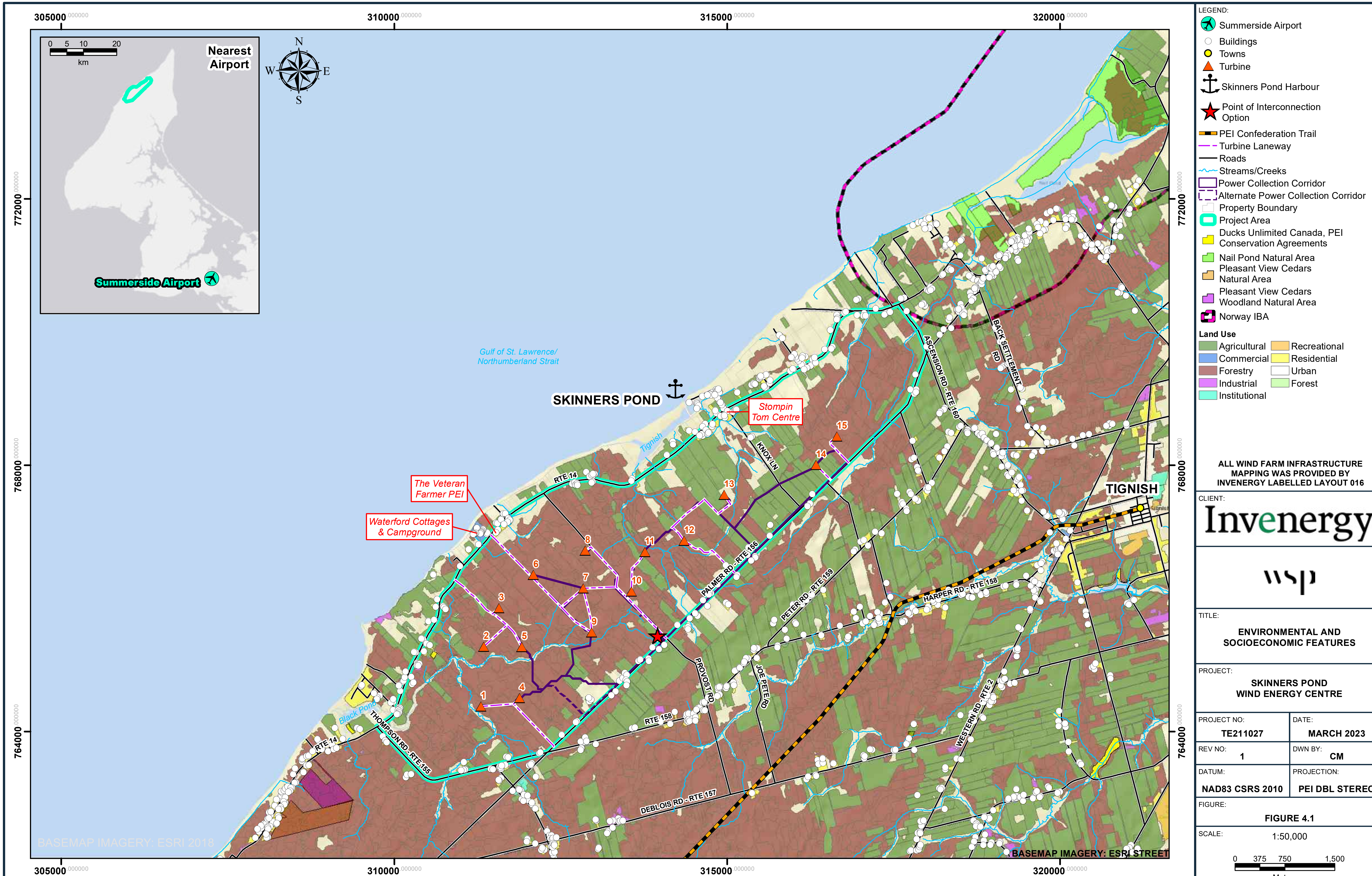
3.6 OTHER UNDERTAKINGS – CUMULATIVE EFFECTS

The effects assessment identifies other planned and reasonably foreseeable activities that could overlap in time and space with the proposed wind project construction and operation. Where such overlap is recognized, the potential for cumulative effects and requirements for mitigation measures is discussed. Cumulative effects may occur where the two or more separate projects or activities have the same effect on the same valued environmental component. The resulting cumulative effects could be greater than the effects of each separate activity when considered in isolation. The significance levels of the cumulative residual adverse effects, if any, is determined applying the same methodology criteria presented above.

4 EXISTING ENVIRONMENT

This section provides a description of the environmental and the socioeconomic setting for the Study Area (Figure 4.1) and includes those components of the environment potentially affected by the proposed Project, or those which may influence or place constraints on the execution of Project-related activities.

The environmental setting is presented to allow assessment of the potential impacts of the proposed Project. Description of the setting includes an overview of regional and local geological, aquatic, wetland, terrestrial and atmospheric characteristics in addition to designated areas and other critical habitat features of the Study Area.



CLIENT:

Invenergy

wsp

TITLE:

ENVIRONMENTAL AND SOCIOECONOMIC FEATURES

PROJECT:

SKINNERS POND WIND ENERGY CENTRE

PROJECT NO:	DATE:
TE211027	MARCH 2023
REV NO: 1	DWN BY: CM
DATUM: NAD83 CSRS 2010	PROJECTION: PEI DBL STEREO

FIGURE: FIGURE 4.1

SCALE: 1:50,000

0 375 750 1,500
Metres

Path: Q:\PROJECTS\TE211027_Invenergy_Canada_EIA_Windfarm_PE\13 GIS\MXD\TE211027_FIGURE_4_1_EnvtSocioeconomicFeatures.mxd User: candace.macdonald Date: 3/28/2023

4.1 PHYSICAL ENVIRONMENT

PEI is situated in the Gulf of St. Lawrence, off the Atlantic coast of the Canadian mainland. It is separated from New Brunswick (NB) and Nova Scotia (NS) by the Northumberland Strait. PEI is approximately 250 km long and varies in width from 6.5 to 50 km with a maximum surface elevation of 127 m above sea level (van de Poll 1983). According to topographic mapping the Study Area ranges between 10 and 40 m above sea level (PEI Public Land Atlas, 2014).

4.1.1 GEOPHYSICAL ENVIRONMENT

PEI is considered its own ecoregion in the Maritime Ecozone, where the Maritime Plain comprises flat to gently dipping late Palaeozoic sandstones, siltstone, and conglomerates. This undulating plain is mantled with loamy glacial till, fluvioglacial deposits, and level marine sediments of varying depth, the dominant soils being Humo-Ferric Podzols. Significant inclusions are Gleysols, Gray Luvisols, Mesisols on flat and bowl bogs, and Fibrisols on domed bogs and fens (Canadian Council on Ecological Areas (CCEA), 2021).

4.1.1.1 BEDROCK

PEI bedrock is primarily composed of PEI “Redbeds” that are further divided into five formal formations. The bedrock underlying the Study Area is the Kildare Capes Formation of Megacyclic Sequence II, comprising of conglomerate, sandstone and siltstone.

The primary issue pertaining to the geological substrate and construction is potential exposure of sulphide-containing rocks to oxygen (atmospheric conditions). This exposure can lead to acid rock drainage (ARD) (Howells and Fox 1998). ARD is characterized by low pH (pH 2 - 4) and high dissolved metals content (Howells and Fox 1998); in particular aluminum, manganese and iron as well as trace elements such as copper, nickel and cobalt (Fox *et al.*, 1997). The rate of acid formation is dependent upon the type of sulphide mineral and environmental conditions such as ambient temperature, the amount of rainfall, the presence or absence of bacteria, and the availability of oxidants (Fox et al., 1997). The sulphide concentrations in the Redbeds of PEI are low; ARD is therefore not a concern for the Study Area.

4.1.1.2 SURFICIAL SUBSTRATE

The interactive Soils of Canada map categorize the soil for the Tignish region as Soil Order ID 53400131, which is dominantly podzolic (70%) with approximately 10% each of brunisolic, gleysolic and luvisolic components (Government of Canada 2021a).

The Canada Land Inventory (CLI), which categorizes soil types based on agricultural productivity, rates soils in the Project Site area as being dominant Class 3 S, which is capable of supporting sustained use for cultivated field crops with moderate to severe limitations. The subclass “s” is characterized by soil limitations such as undesirable structure, low permeability, restricted rooting zone, and low natural fertility.

4.1.2 SEISMICITY

PEI is rated as being low on the seismic hazard map (Earthquakes Canada 2019). The most recent earthquake near PEI occurred in June 2019; a magnitude of 2 recorded offshore of West Prince, 19 km west of Alberton. The quake occurred at a depth of 18 km and at that depth the event was not a “felt” quake. The only earthquake that was “felt” in PEI occurred in January 1982; this quake did not actually occur on PEI but in Northcentral NB where a 5.7

magnitude event was felt throughout most of the Maritime provinces. The potential for an earthquake of sufficient magnitude to disrupt the operation of the Project is remote and not likely to occur within the Project's temporal boundaries (30 years).

4.1.3 ATMOSPHERIC ENVIRONMENT

4.1.3.1 CLIMATE

Prince Edward Island has a "temperate continental" climate marked by relatively large daily and day-to-day ranges of temperature, especially during the spring and fall, and moderate rainfall. Prince Edward Island lies in the "prevailing westerlies" characteristic of mid-latitudes in the northern hemisphere. Within this general circulation are embedded air masses originating at higher or lower latitudes that interact to produce storm systems. Prince Edward Island experiences a relatively large number of storm systems that contribute to a roughly twice-weekly shift between fair and cloudy and stormy weather.

The mild coastal climate of PEI is significantly influenced by the warmer waters of the Northumberland Strait and Gulf of St. Lawrence. The bordering ocean environment delays the onset of the seasons by several weeks (EC 2006). Yearly and daily weather patterns are marked by variability, with conditions rarely persisting for long periods of time. Winters are characteristically long but relatively milder than the rest of Canada while spring arrives late and is cool. Summers are also cooler and are pronounced by southwest breezes (The Canadian Encyclopedia 2009). During the winter months and early spring, while the Gulf of St. Lawrence freezes over, PEI experiences more continental weather patterns like the interior of NB (The Weather Network 2019). PEI is sheltered by surrounding provinces and therefore experiences less fog than its neighbours (The Canadian Encyclopedia 2009).

The climate of the Study Area has been characterized using Canadian Climate Normals, based on long-term meteorological data collected by ECCC from 1981 to 2010 (ECCC 2019b). The climate station closest to the Project with available data is Alberton, located approximately 14 km southeast of the Site (Table 4.1) and the Summerside Airport Weather station approximately 75 km southeast of the Site (Table 4.2).

Table 4.1: Alberton Station Climate Normals and Extremes (1981-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature												
Daily Average (°C)	-8.2	-7.7	-3.3	2.4	8.7	14.5	18.7	18.6	14.4	8.4	2.6	-3.5
Daily Maximum (°C)	-3.9	-3.2	0.7	6.1	13.3	19.1	23.2	23.1	18.7	12.2	5.7	0.0
Daily Minimum (°C)	-12.5	-12.1	-7.3	-1.4	4.1	9.8	14.1	14.0	10.0	4.4	-0.5	-7.0
Extreme Maximum (°C)	13.2	14.5	15.6	22.5	32.8	33.2	33.0	**33.3**	33.2	25.5	21.0	14.0
Date (yyyy/dd)	1999/24	1994/20	1979/24	1987/21	1977/22	2001/27	1999/17	**1976/22**	2001/09	2003/11	1982/05	1990/23
Extreme Minimum (°C)	-31.7	**-33.0**	-26.0	-15.0	-7.2	-1.7	3.0	1.5	-3.3	-6.7	-16.7	-26.1
Date (yyyy/dd)	1976/12	**1990/27**	1984/09	1978/04	1972/02	1978/02	1992/04	1982/29	1978/30	1971/20	1978/22	1970/24
Precipitation												
Rainfall (mm)	22.8	18.4	32.6	58.3	90.8	82.1	86.3	79.7	91.6	96.1	84.3	42.9
Snowfall (cm)	73.6	56.0	48.3	21.8	1.8	0	0	0	0	0.1	14.8	50.8
Precipitation (mm)	96.4	74.5	80.9	80.1	92.7	82.1	86.3	79.7	91.6	96.1	99.1	93.7
Extreme Daily Rainfall (mm)	32.5	43.4	39.5	40.0	45.0	51.0	47.0	**102.0**	93.8	59.4	56.2	39.4
Date (yyyy/dd)	1978/26	1979/27	2003/30	2004/03	1992/29	1985/06	2001/22	**1989/05**	1999/22	1976/09	1991/11	1983/13
Extreme Daily Snowfall (cm)	46.0	38.6	48.8	41.1	11.4	0	0	0	0	15.2	19.0	**56.1**
Date (yyyy/dd)	2001/06	2004/19	1999/07	1997/01	1977/11	1970/01	1970/01	1969/16	1969/01	1974/20	1997/27	**2003/15**
Days with:												
Maximum Temperature >0°C	7.6	8.2	18.1	28.3	31	30	31	31	30	31	27.0	15.4
Measurable Rainfall	3.0	2.7	4.8	9.9	13.2	11.9	11.2	11.4	11.3	12.6	11.9	5.8
Measurable Snowfall	10.6	8.2	7.7	3.7	0.36	0	0	0	0	0.08	3.3	9.2
Measurable Precipitation	12.8	10.2	11.5	12.7	13.3	11.9	11.2	11.4	11.3	12.6	14.5	14.0

Notes:
Source: EC, 2022-11-30;
https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnProv&lstProvince=PE&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=6519&dispBack=0

Table 4.2: Summerside A Station Climate Normals and Extremes (1981-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind Speed												
Speed (km/hr)(1)	18.0	17.9	18.1	17.7	16.3	14.9	14.1	13.3	14.6	16.2	17.6	18.6
Most Frequent Direction(1)	W	W	N	N	S	S	SW	SW	SW	W	NW	W
Maximum Hourly Speed (km/hr)	**121**	105	105	109	77	89	64	74	97	105	93	97
Date (yyyy/dd)	**1961/20**	1961/27	1960/09	1963/11	1963/10	1959/20	1960/31	1980/16	1954/11	1962/08	1962/15	1963/19
Direction of Maximum Speed	N	NW	N	N	NW	N	S	N	SE	N	N	N
Maximum Gust Speed (km/hr)	143	**145**	135	138	100	137	98	104	138	129	122	127
Date (yyyy/dd)	1961/20	**1976/02**	1963/07	1963/11	1961/23	1963/10	1961/24	1980/16	1964/28	1962/08	1962/23	1960/12

Notes:
Source: EC, 2022-11-30;
https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnProv&lstProvince=PE&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=6547&dispBack=0
Note: (1) Average Speed and most frequent direction was not available from the Summerside A station; the data included for average wind speed and most frequent direction is from the Charlottetown A Weather Station.

Alberton Weather Station is at an elevation of 3 m with latitude 45° 51’ N and longitude 64° 01’ W and is located approximately 20 km south southeast of the Skinners Pond. The Summerside A Station is at an elevation of 19.5 m with latitude 46° 26’ 20 N and longitude 63° 49’ 54 W and is located approximately 75 km southeast of the Project Study Area and is included for its wind speed and direction data since these parameters are not available from the Alberton Station. These distances from the site support their spatial representativeness since they place them in the same general synoptic flow regime as well as most mesoscale systems; however, since the Summerside A Station is more inland, it is likely winds from the northwest quadrant would be stronger at Skinners Pond. These stations are the closest to the Project Study Area that provide the commonly observed meteorological parameters.

Temperatures

The range of temperatures at the site is rather large from winter to summer. Summers are relatively cool; for example, the warmest average daily maximum temperature recorded at the Alberton Station during summer months was 23.2 °C in the month of July. The record high temperature at the Alberton Station was 33.3 °C in the month of August of 1976. Winters are cold with an average daily minimum temperature in January at the Alberton Station of -12.5°C. The lowest recorded temperature at the Alberton Station was -33.0 °C in February of 1990. The most significant aspect of winter is the marked day-to-day variation caused by the alternation of Arctic and maritime air.

Average temperatures recorded at Alberton reflect the mild climate of PEI, ranging from 18.7°C in July to -8.2°C in January, with an average temperature of 5.5°C.

Precipitation

In general, precipitation in PEI is well distributed throughout the year. Precipitation is slightly greater in the late fall and early winter because of the more frequent and intense storm activity. In most years there is a good supply of rain during the spring and summer.

The total precipitation averages 1053 millimetres (mm) per year, of which approximately 25% per cent is in the form of snow. Rainfall occurs every month, ranging from 18.4 mm in February to 96.1 mm in October. The highest daily rainfall on record was 102 mm in August 1989. Snowfall occurs from November to May, ranging from 1.8 centimetres (cm) to 73.6 cm. The highest daily snowfall on record was 56.1 cm in December 2003.

Wind

The wind at any given location is often quite different from the wind conditions which prevail even at a short distance away. The variation that occurs in both wind direction and speed results from the characteristics of natural and man-made obstructions, topography, and surface cover. Along the coast, an onshore sea breeze circulation often sets up, particularly during a warm, sunny afternoon in the spring or early summer.

Unfortunately, wind data is not available from the Alberton Station. Wind information is available from the Summerside Airport Weather Station as shown in Table 4.2. A peak gust of 145 km/h was recorded in February 1976. Unfortunately, Environment Canada did not provide average monthly wind speeds for the Summerside Airport Weather Station, however, average monthly wind speeds were available from the Charlottetown Airport Weather Station, which is located approximately 100 km to the southeast. Winds at Charlottetown Airport Weather Station are moderate with the highest speeds occurring in the winter with an average of 18.1 km/h for the month of March. The lightest winds occur in summer with a monthly average wind speed of 13.3 km/h in August. The mean wind speed for the year is 16.5 km/h. The prevailing wind direction at the Charlottetown Airport

Station is from the north in March and April, south/southwest from May through September and from the west from October through February.

Severe Weather

Storms frequently occur in and around Canada's Atlantic coast; the region has more storms per year than any other region in the country. With a variety of weather conditions from hurricane-force winds to heavy precipitation, storm systems can pass rapidly through or stall and batter the region for several days. Other conditions associated with these storms include freezing spray, reduced visibility in snow, rain, or fog, and numbing wind chills, especially in the storm's wake.

In late summer and fall the remnants of a hurricane or tropical storm are felt at least once a year in Prince Edward Island. On September 24, 2022, Hurricane Fiona swept through Atlantic Canada as a post-tropical cyclone with unprecedented force for PEI. Wind gusts were measured at up to 136 km/h at North Cape with 71 mm rain (CBC News 2022). Fiona resulted in over 660 million dollars in damage in Atlantic Canada. In Prince Edward Island 95% of the population was without power for two days and in some areas as much as 30 feet of shoreline was lost.

According to a flash density map, Summerside (the nearest city with data) had experienced a total of 9,415 lightning strikes and an average of 14.3 days per year with lightning from 1999 - 2018 (ECCC 2019).

Thermal Inversion

Under certain conditions, an atmospheric thermal inversion layer occurs. Thermal inversions result when a layer of cooler air is trapped near ground level by a layer of warmer air above. Under these conditions, the vertical motion of air flow is strongly suppressed. If the base of the inversion lies above the level of the plume, then the volume of air available for dilution is limited. The elevated inversion acts as a lid, restricting vertical mixing, reducing dilution and increasing ground-level concentrations in areas with high emissions.

4.1.3.2 AIR QUALITY REGULATION

PEI has an *Environmental Protection Act*, which includes Air Quality Regulations. The Air Quality Regulation contains maximum ambient air contaminant levels for air quality in PEI. The maximum ambient air contaminant levels will be determined (a) based on ground level concentrations standards set out in Schedule A or (b) based on such factors as may be determined by the Minister. Table 4.3 shows the applicable provincial standards relating to ambient air quality as set out in Schedule A of the Air Quality Regulations.

Table 4.3: Air Quality Guidelines in PEI

Pollutant	Averaging Period			
	1 Hour	8 Hour	24 Hour	1 Year
Carbon monoxide	35 mg/m^3	15 mg/m^3	-	-
Hydrogen sulphide	15 µg/m^3	-	5 µg/m^3	-
Nitrogen dioxide	400 µg/m^3	-	-	100 µg/m^3
Sulphur dioxide*	900 µg/m^3	-	300 µg/m^3	60 µg/m^3
Total Suspended Particulate	-	-	120 µg/m^3	70 µg/m^3

Note: * µg/m^3: micrograms per cubic metre

Prince Edward Island does not have objectives available for PM with aerodynamic diameter less than 10 microns in diameter (PM_{10}) and PM with aerodynamic diameter less than 2.5 microns in diameter ($PM_{2.5}$).

The Canadian Council of Ministers of the Environment (CCME) have developed a Canada-Wide Standard (CWS) for $PM_{2.5}$ of 27 µg/m^3, based on a 24-hour average over three consecutive years.

The Ontario Ministry of Environment Conservation and Parks (MECP) provides an ambient air quality criterion of 50 µg/m^3 for PM_{10} based on a 24-hour averaging period.

The Ontario MECP criterion for PM_{10} and CWS for $PM_{2.5}$ will be used for the project since PEI ambient air quality standards are not available for these parameters.

It should be noted that in October 2012 jurisdictions, except for Quebec, agreed to begin implementing a new federal air quality management system (AQMS). AQMS is a comprehensive approach for improving air quality in Canada and is the product of collaboration by the federal, provincial and territorial governments and stakeholders. It includes:

- New Canadian Ambient Air Quality Standards (CAAQS) to set the bar for outdoor air quality management across the country.
- Industrial emissions requirements that set a base of performance for major industries in Canada.
- A framework for air zone air management within the provinces and territories that enables action tailored to specific sources of air emissions in a given area.
- Regional airsheds that facilitate coordinated action where air pollution crosses a border.
- Improved intergovernmental collaboration to reduce emissions from the transportation sector.

The CAAQS will be established as objectives under the *Canadian Environmental Protection Act 1999* and will replace the existing Canada-Wide Standards under CCME. Table 4.4 provides a list of the CAAQS fine particulate matter, ozone, NO_2 and SO_2 standards.

Table 4.4: Canadian Ambient Air Quality Standards (CAAQS) for Fine Particulate Matter ($PM_{2.5}$), Ozone, Nitrogen Dioxide and Sulfur Dioxide

	Averaging Period	Standards (2020)	Standards (2025)	Metric
$PM_{2.5}$	24-hour (Calendar Day)	27 µg/m^3	27 µg/m^3	The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations.
	Annual (Calendar Year)	8.8 µg/m^3	8.8 µg/m^3	The 3-year average of the annual average concentrations.
Ozone	8-hour	62 ppb (122 µg/m^3)	60 ppb (117.8 µg/m^3)	The 3-year average of the annual 4th highest daily maximum 8-hour average concentrations.
NO_2	1-hour	60 ppb (113 µg/m^3)	42 ppb (79 µg/m^3)	Achievement based on the 3-year average of the NO_2 daily maximum 1-hour average concentrations.
	Annual	17 ppb (32 µg/m^3)	12 ppb (22.6 µg/m^3)	Achievement based on average over a single calendar year of all the 1-hour average NO_2 concentrations.
SO_2	1-hour	70 ppb (183.4 µg/m^3)	65 ppb (170.3 µg/m^3)	Achievement based on 99th percentile of daily 1-hour maximum, averaged over three consecutive years.
	Annual	5 ppb (13.1 µg/m^3)	4 ppb (10.5 µg/m^3)	Achievement based on annual average of 1-hour concentrations over one year.

Note: Source: https://ccme.ca/en/air-quality-report

The AQMS is designed to address the challenges of air quality management, including cross-jurisdictional issues, and deliver a Canada-wide approach that provides flexibility to deal with regional differences in air quality issues while, at the same time, ensuring a level of consistency so that Canadians can be assured of good air quality outcomes.

For industry, the AQMS proposes establishing base-level industrial emissions requirements (BLIERS) in major industrial sectors, initially for SO_2, NO_x, VOCs and TPM. Eventually other pollutants may be addressed. The BLIERS are intended to ensure that all significant industrial sources in Canada, regardless of where facilities are located, meet an acceptable benchmark of environmental performance. Wherever possible, the BLIERS would build on existing pollution controls, agreements and protocols that assure the appropriate standard of emissions performance.

BLIERS would be set under a federally-led, time-limited federal/provincial/territorial consensus process, with stakeholder involvement, and will be reviewed regularly to ensure they reflect technological improvements.

Environment and Climate Change Canada is implementing BLIERs using a mix of regulatory and non-regulatory instruments. The sectors considered under AQMS are:

- Aluminum and alumina;
- Base metal smelting;
- Cement;
- Chemicals;
- Electricity;
- Fertilizers;
- Iron ore pellets;
- Iron, steel and ilmenite;
- Oil sands;
- Petroleum refining;
- Pipelines;
- Potash;
- Pulp and paper; and
- Upstream oil and gas.

Currently, wind farms are not a targeted sector under the BLIERs system.

Greenhouse Gases

Currently in Prince Edward Island and Canada, for proposed industrial projects, there is no standard approach available to assess greenhouse gas (GHG) emissions and the impacts these projects have on climate change. Typically, for environmental assessments, GHGs have either not been assessed or when they have been assessed they have been compared to either a similar industrial sector in Canada or against regional GHG inventories. GHGs are difficult to assess since the contribution of an individual project cannot be measured (Murphy and Gillam 2013). However, according to the IPCC “anthropogenic greenhouse gas emissions are extremely likely to have been the dominant cause of the observed warning since the mid-20th century” (Murphy and Gillam 2013). In the absence of a regulatory approach to assess industrial project GHGs, there have been papers developed to provide practical guidance on the assessment of GHGs in Canada. These papers used guidance from literature and from regulatory agencies together with specific practitioners working on industrial projects to generate a practical procedure that practitioners may use when assessing GHGs in an EIA.

Table 4.5, below, provides a summary of information extracted from the Murphy paper including values representing total direct emissions of a project on an annual basis with proposed elements of assessment to consider.

Table 4.5: Greenhouse Gases and Climate in EIA – Elements to Consider

GHG Emissions (tonnes CO_2e/year)	What's considered re GHGs, climate change?	Qualitative Rating	Elements of the Assessment
GHGs < 1000	None	Nominal but not zero	None
10,000 < GHGs < 25,000	Quantification of GHGs	Low	Quantify, present data
25,000 < GHGs <100,000	Quantification, mitigation	Low	Look at possible mitigation, quantify, sector profile, place in context, decide on further elements
100,000 < GHGs < 1,000,000	Quantification, mitigation, effects of environment on project (one part of adaptation)	Medium	As above AND prepare GHG Management Plan; in the context of local program requirements, consider embodied emissions and potential for offsets; describe existing climate conditions; summarize available downscaling information; use impact models as needed; consider how changes in sea level rise, precipitation, winds, and temperature may affect project and surroundings nearby.
GHGs >1,000,000	As above AND adaptation with project vulnerability and resilience analyses	High	As above, AND consider by way of design features, adaptation analyses, including vulnerability and resilience, (consider PIEVC Protocol or equivalent, PIEVC 2011) in light of type of project, where it's located and how nearby infrastructure may be affected.

4.1.3.3 BASELINE AIR QUALITY

Air quality is influenced by the concentrations of air contaminants in the atmosphere. Air contaminants are emitted by both natural and anthropogenic sources and are transported, dispersed, or concentrated by meteorological and topographical conditions. Air contaminants eventually settle or are washed out of the atmosphere by rain and are deposited on vegetation, livestock, soil, water surfaces, and other objects. In some cases, contaminants may be redistributed into the atmosphere by wind. The air quality of PEI is influenced by local emissions and those from provinces to the west and the northeastern US (PEI EECA, 2022b).

It is useful to examine the existing releases of air contaminants from local sources in the assessment area. This serves as a benchmark for comparing the emissions related to the proposed Project and to assist in the assessment of cumulative environmental effects. These existing releases of air contaminants are generally classified into two categories: criteria air contaminants (CACs), which include particulate matters, sulphur dioxide, nitrogen oxides, carbon monoxide, and greenhouse gases (GHGs). This section provides a discussion of criteria air contaminants that are associated with the project, greenhouse gases, a summary of representative baseline data and provincial climate change commitments.

There are no existing or future planned industrial sources in the immediate area of Skinners Pond. The main sources of air quality emissions near Skinners Pond are from farming, home heating, and vehicle traffic on highways.

Construction activities can generally be categorized into site preparation/road construction, concrete making, concrete foundation installation, and wind farm component installation. Operation of the concrete plant will mainly consist of earth moving, piling, storage and transporting of the concrete from the plant to the wind farm location. During construction, activities will include the use of internal combustion engines in various cranes, front end loaders, concrete batch trucks, and worker commuting vehicles. Concrete making and transport of materials over unpaved roads will generate dust (TSP and PM_{10}). The moving of materials to make concrete and transport of concrete and wind farm materials will result in exhaust emissions containing NO_2, SO_2, CO, $PM_{2.5}$, and VOCs.

Criteria Air Contaminants

This section provides a summary of CAC emissions for all sources in Prince Edward Island (Table 4.6) and for major regulatory permitted industrial sources (Table 4.7) in the area that submit emissions information to the National Pollutant Release Inventory (NPRI). The NPRI is a legislated, nation-wide, publicly accessible inventory of pollutants released, disposed of, and recycled by facilities in Canada. Facilities which meet reporting requirements are required to report to the NPRI under the *Canadian Environmental Protection Act* (CEPA). The most recent year, 2020, of available data was included in Tables 4.6 and 4.7.

Table 4.6: Environment Canada Air Pollutants Emissions Inventory - 2020 CAC Emissions of Prince Edward Island (tonnes/year)

Category	TPM	PM_{10}	$PM_{2.5}$	SO_x	NO_x	VOC	CO
Total Ores and Mineral Industries	221	63	23	0.3	1.2	1	2.8
Cement and Concrete Industry	131	40	20	0	0	0	0
Total Oil and Gas	0	0	0	0	0	230	0
Total Electric Power Generation	1.1	0.79	0.58	15	5.3	0.05	0.54
Total Manufacturing	2.5	1.6	1.3	34	66	59	51
Total Transportation and Mobile Equipment	174	173	124	22	2761	1150	13485
Total Agriculture	10240	2877	1012	7.5	11	816	2.6
Total Commercial/Residential/Institutional	1214	1142	1134	162	317	1927	6632
Total Incineration and Waste	56	45	28	30	141	49	117
Total Paints and Solvents	0	0	0	0	0	781	0
Total Dust	37654	10494	1147	0	0	0	0
Unpaved Roads	34186	9734	968	0	0	0	0
Total Fires	1.5	1.5	1.4	0	0.19	1.5	8.4
TOTAL	49,565	14,798	3,472	271	3,302	5,016	20,300

Note: Source: EC, 2022: https://pollution-waste.canada.ca/air-emission-inventory/

Table 4.7: CAC Air Emissions (tonnes) from Permitted Sources in the Assessment Area - 2021

Source	CO	NOx	SO_2	VOCs	TSP	PM_{10}	$PM_{2.5}$
Cavendish Farms Corporation – New Annan (4875)	47.4	63.9	46.6	-	-	3.1	2.3
BioVectra Inc. – Charlottetown (2421)	-	-	-	16.2	-	-	-
Maritime Electric – Charlottetown (4268)	0.9	3.5	3.9	0.02	0.4	0.3	0.2
City of Charlottetown (5090)	-	14.7	-	-	-	0.4	0.4
Irving Oil Commercial G.P. – Charlottetown (5090)	-	-	-	23.2	-	-	-
BioVectra Inc. – Charlottetown (6097)	-	-	-	25.9	-	-	-
Maritime Electric – Borden-Carleton (29819)	0.01	3.1	0.003	0.001	0.015	0.015	0.015
Total	48.3	85.2	50.5	65.3	0.4	3.8	2.9

Note: Source: EC, 2022; https://pollution-waste.canada.ca/national-release-inventory/

A review of Table 4.6 indicates the majority of total particulate and PM_{10} emissions are generated by unpaved roads. Dust from unpaved roads contributed approximately 70% to the total particulate estimate, 66% to the PM_{10} totals and 28% to the $PM_{2.5}$ totals. Particulate emissions from the cement and concrete industry contributed approximately 0.0026% to the total particulate estimate, 0.0027% to the PM_{10} totals and 0.0058% to the $PM_{2.5}$ totals. Agriculture contributes approximately 20.7% to the total particulate estimate, 19.4% to the PM_{10} totals, 29% to the $PM_{2.5}$ totals and 16% to the VOC totals. Transportation and Mobile Equipment contributes the most to the provincial NO_2 (83.6%) and CO (66.4%) levels. Commercial/Residential/Institutional contributes the most to the provincial SO_2 (59.7%) and VOC (38.4%) levels. Under the Commercial/Residential/ Institutional category home firewood burning contributes the most VOCs and residential fuel combustion contributes the most SO_2.

According to Environment Canada's NPRI, there are no sources reporting to the NPRI within a 50 km radius of the Project Study Area. Table 4.7 provides a summary of industry that report CAC emissions to the NPRI in Prince Edward Island.

The closest regulatory permitted point sources reporting to the NPRI is Cavendish Farms Corporation located in New Annan approximately 70 km to the southeast of the Project Study Area. Except for one Maritime Electric site located in Borden-Carleton, all other sources are located in Charlottetown. Compared to the provincial CAC totals, the permitted sources represent very little compared to the total provincial quantities (Table 4.7): 0.238% for CO; 2.58% for NO_2; 1.30% for VOCs; 0.0008% for TSP; 0.026% for PM_{10}; and 0.084% for $PM_{2.5}$. The permitted sources do contribute 18.6% to the SO_2 provincial quantities.

Greenhouse Gases

Greenhouse gasses (GHGs) including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) can be emitted from natural and anthropogenic sources. Emissions from biogenic or other sources generally exhibit little variation from one year to the next and are nominal when compared to those resulting from the combustion of fossil fuels.

Total GHG emissions are normally reported as CO_2-equivalents (CO_2e). This is accomplished by multiplying the emission rate of each compound by the global warming potential (GWP) relative to CO_2. $CsaO_2e$ considers the global warming potential of the three main greenhouse gases: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The global warming potential of these gases are as follows: CO_2 = 1.0, CH_4 = 21 and N_2O = 310. Therefore, the carbon dioxide equivalency factor (CO_2e) is equal to ((CO_2 mass x 1.0) + (CH_4 mass x 21) + (N_2O mass x 310)).

The Canada total GHG emissions for the years 2009 and 2014 and 2019 are presented in Table 4.8 (Environment Canada 2012d). The Year 2019 is the most current year reported by Environment Canada.

Table 4.8: Greenhouse Gas Emissions: Canada

Category	2009 Emissions (kt CO_2e)	2014 Emissions (kt CO_2e)	2019 Emissions (kt CO_2e)
Energy	562,000	584,000	589,000
Industrial Processes and Product Use	47,500	53,900	54,300
Agriculture	56,000	58,000	59,000
Waste	28,000	27,000	28,000
Total	694,000	723,000	730,000

Note: Source: EC 2022: https://publications.gc.ca/collections/collection_2021/eccc/En81-4-2019-3-eng.pdf

In 2019, energy accounted for almost 81% of the CO_2e emitted in Canada, with public electricity and heat production accounting for almost 44% of the CO_2e emitted. Mining contributes approximately 0.87% to the total. There is an increasing trend in GHG emissions in the last five years. Between 2014 and 2019, Canada saw GHG emissions increase by 7,000 kilotons (kt) CO_2e (approximately 1%).

The Prince Edward Island total GHG emissions for the year 2019 is presented in Table 4.9.

Table 4.9: Greenhouse Gas Emissions: Prince Edward Island

Category	2019 Emissions (kt CO_2e)
Energy	1200
Industrial Processes and Product Use	61
Agriculture	400
Waste	99
Total	1,760

Note: Source: EC 2022: https://publications.gc.ca/collections/collection_2021/eccc/En81-4-2019-3-eng.pdf

In 2019, energy accounted for almost 68.2% of the CO_2e emitted in Prince Edward Island, with residential energy use accounting for more than 59% of the CO_2e emitted in the Province. Prince Edward Island contributes only 0.002% to the Canadian CO_2e totals.

Ambient Air Concentrations

The immediate area surrounding Skinners Pond is primarily rural with less than 2000 people (estimated) residing in the area.

Through the Environment Canada National Air Pollution Surveillance (NAPS) program, Prince Edward Island operates an air monitoring network consisting of three stations: Wellington, Southampton and Charlottetown. The closest station is the Wellington station which is located approximately 60 km to the south southeast of Skinners Pond. In 2020 all these stations monitor for $PM_{2.5}$ and NO_2 as part of the NAPS program. Sulfur dioxide (SO_2) was also monitored at the Charlottetown station in 2020.

Refer to Table 4.10 for a summary of 2020 ambient air monitoring data for all three stations.

Table 4.10: Baseline Ambient Air Monitoring Data (2020) for the Prince Edward Island NAPS Stations

NAPS Location	Distance from Skinners Pond	$PM_{2.5}$ Annual Average (ug/m³)	NO_2 Annual Average (ug/m³)	SO_2 Annual Average (ug/m³)
Wellington	60 km	5	1.9	NA
Charlottetown	100 km	7	3.8	0.79
Southampton	115 km	5	0	NA

Notes: Source: EC 2022: National Air Pollution Surveillance (NAPS) Program - Environment and Climate Change Canada Data
NA denotes not applicable.

The annual concentrations for NO_2 (0 to 3.8 $\mu g/m^3$) and SO_2 (0.79 $\mu g/m^3$) are considered low compared to the respective Prince Edward Island annual standards of 100 $\mu g/m^3$ for NO_2 and 60 $\mu g/m^3$ for SO_2. The $PM_{2.5}$ annual average for 2020 ranged from a low of 5 $\mu g/m^3$ at the Wellington and Southampton stations to a high of 7 $\mu g/m^3$ at the Charlottetown station. The annual concentrations at the Wellington and Southampton stations represent over 55% of the $PM_{2.5}$ CWS and the annual average at the Charlottetown station is almost 80% of the CWS.

4.1.3.4 CLIMATE CHANGE

The Government of Prince Edward Island has developed a five-year Climate Change Action Plan that provides a framework for both adapting to changing climate as well as reducing greenhouse gas emissions. Prince Edward Island's residential, commercial, and infrastructure on the coast will become increasingly vulnerable to sea level rise and storm activity. The Government of Prince Edward Island is preparing for these coming changes by addressing the following:

- Adapting to Climate Change;
- Reducing Greenhouse Gas Emissions;
- Carbon Sequestration;
- Education and Capacity Building; and
- Research and Knowledge Building.

The following are commitments to address the above:

- The Government will take proactive measures to reduce Prince Edward Island's vulnerability to the impacts of climate change, and to take advantage of new opportunities that contribute to a prosperous and resilient economy.
- The Government, together with residents, businesses, and industries, will reduce provincial greenhouse gas emissions by 30% below 2005 levels by 2030.
- The Government will work to protect and enhance the ecosystem, while encouraging practices that increase carbon sequestration.
- The Government will help Islanders understand and take responsibility for the environmental impacts of their actions by developing education programs and integrating climate change principles into learning environments.
- The Government will work with Indigenous, provincial, and regional partners to advance climate change research and knowledge in Prince Edward Island.

4.1.4 WIND RESOURCES

The winds of PEI are on average stronger than those in the neighbouring Maritime provinces, with the strongest winds occurring during the colder months. Typically, in October to April, winds prevail from the west or northwest, while during the summer, winds prevail from the south and southwest (EC 2006).

According to the Canadian Wind Energy Atlas, the mean windspeed at the site of the Study Area, located in Quadrangle 21, is 8.80 metres/second (m/s) at 80 m above ground and 7.66 m/s at 50 m above ground. The highest wind speeds of 10.37 m/s and 9.21 m/s at 80 m and 50 m, respectively, are recorded in the winter (ECCC 2016).

4.1.5 ACOUSTIC ENVIRONMENT

The predominant source of noise in the area is generated by wind. Other existing sources of noise in the surrounding area would be associated with fixed traffic and related establishments, agricultural activity, forestry activities and recreational activities (hunting, ATV usage, etc.).

The federal and provincial noise exposure limit for PEI is described as the maximum permitted exposure level for 8 hours at 85 dBA and is based on continuous noise (CCOHS 2016). PEI's Occupational Health and Safety Act General Regulations Sec 8.3 outlines the provincial noise exposure limits. For an exposure duration of 8 hours, the exposure limit is 85 dBA. For an exposure duration of 24 hours, the exposure limit is 80 dBA (Government of PEI 2013).

Typical average ambient sound levels in rural areas range from 40-45 dB(A) in the daytime and 30-35 dB(A) at night. In windy areas, the average ambient sound can be 50-55 dB(A) or higher.

Currently there is no provincially or federally regulated noise limit for wind farms on Prince Edward Island. A noise limit of 45 dB(A) has been a commonly used guideline for this jurisdiction. The World Health Organization's "Guidelines for Community Noise" (WHO 1999) identifies the main health risks associated with noise and derives acceptable environmental noise limits for various activities and environments. These noise limits identify 50 dB(A) as the point at which moderate annoyance can begin in outdoor living areas. 45 dB(A) is identified as the noise limit outside of a bedroom with the window open, before sleep disturbance can become an issue.

4.1.6 HYDROLOGY

The Open Data Portal provided by PEI EECA contains provincial records for environmental monitoring, including groundwater, as well as issued reports (PEI EECA 2022a) used to describe the existing hydrological environment.

4.1.6.1 GROUNDWATER

PEI's geology consists of Permo-Carboniferous (310-300 mya) sandstone bedrock, unknown in thickness and consists of fine to medium grained sandstone with minor siltstone and mudstone lenses. The Permo-Carboniferous sandstone red beds range from late Carboniferous to middle/early Permian in age and the beds are flat lying or dipping slightly to the east, northeast or north by about 1-3 degrees. The red beds are overlain by a relatively thin layer of glacial deposits ranging from <1 m to 10 m in thickness and are further divided into five formal formations. The bedrock underlying the Study Area is the Kildare Capes Formation of Megacyclic Sequence II, comprises conglomerate, sandstone and siltstone (Rivard 2014).

The sole source water supply aquifer for the Island (for municipal and residential sources) consists of the upper portion of the red bed sandstone formations, known as the "PEI Group" (Rivard *et al.,* 2008), with the saturated till forming an unconfined/semi-unconfined fractured porous layer across the Island. The aquifer has significant fracture permeability dominated by horizontal bedding plane fractures, in addition to intergranular porosity. Most residential and small communal wells derive their water supply from wells drilled into this aquifer – though a good aquifer, pumping from wells too close in proximity can initiate overlap in their cone of depression and thereby create temporal interference between wells. Recharge to the aquifer in the form of rainfall precipitation and snowmelt is typically seasonal with the best recharge period being the spring freshet and fall wet period.

Figure 4.2 shows a schematic of the water budget for the Maritimes Basin adapted from Rivard *et al.,* (2008) and provided in Rivera (2014) as Figure 14.16. For PEI, the annual average recharge to groundwater can reach up to 300 to 400 mm per year. The figure also depicts the potential horizontal and vertical groundwater movement through sandstone units.

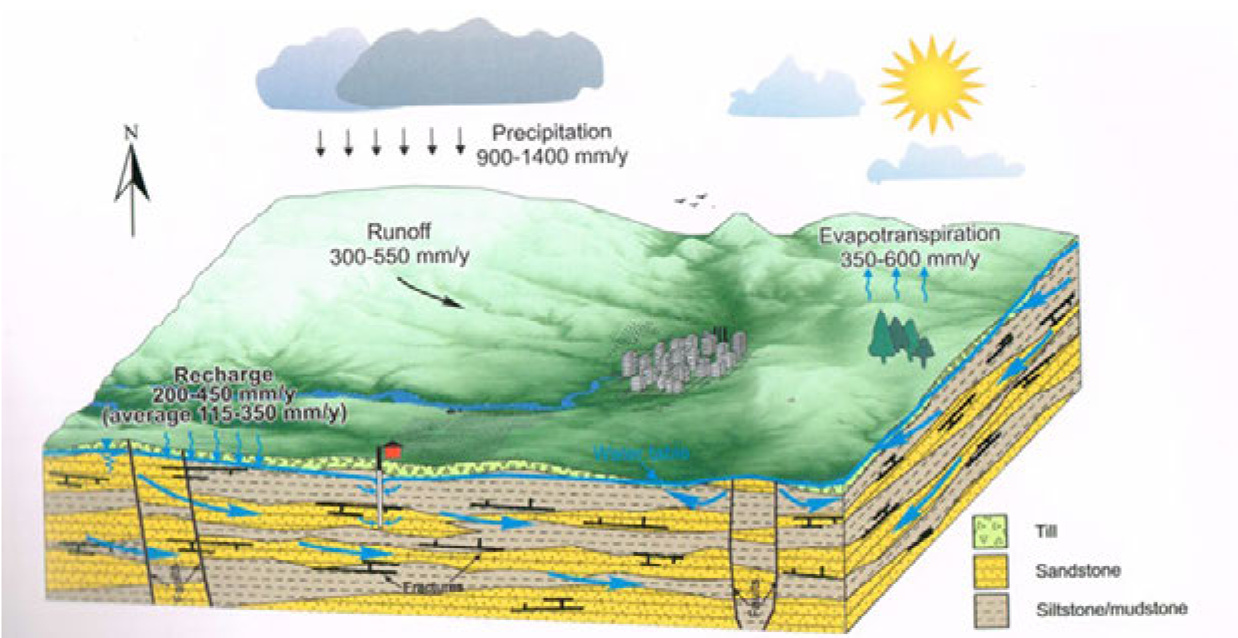


Figure 4.2: Schematic of water budget parameters for the Maritimes Basin

Residents in the surrounding areas rely upon domestic water wells for their drinking water; water levels being within a range of 6 to 15 m. PEI currently maintains fourteen (14) groundwater level observation wells across the Province. The groundwater monitoring well nearest the Project is located in Bloomfield (46.772, -64.220) where water levels recorded since 1967 average at 38 m, with a deviation of approximately 0.5 m. Drilling records for domestic wells in the Project Study Area report a water depth ranging from 6 to 15 m.

Local drinking water quality data for September 2016 and April 2019 as analysed by the PWI Provincial Laboratory for the Skinners Pond Watershed is available at the PEI EECA website and illustrated in Table 4.11. No exceedances of Health Canada's Guidelines for Canadian Drinking Water Quality (Health Canada 2020) have been identified.

Table 4.11: Well Water Quality for Skinners Pond Watershed

Parameter	Unit	2016	2019	Guideline
Alkalinity (Total)	mg/L	922	154	-
Arsenic (dissolved)	µg/L	4	0.5	10
Calcium (dissolved)	mg/L	51.8	60.0	-
Chloride	mg/L	136.1	38.5	250
Iron (dissolved)	µg/L	9.0	2.0	300
Magnesium (dissolved)	mg/L	5.42	5.55	-
Manganese (dissolved)	µg/L	3.0	0.50	20 / 120
Nitrate-N	mg/L	1.2	2.10	10
pH	pH	7.6	7.8	7.0 – 10.5
Phosphorus (dissolved)	mg/L	0.03	0.03	-
Potassium (dissolved)	mg/L	1.55	1.22	-
Selenium (dissolved)	µg/L	4.00	0.20	50
Sodium (dissolved)	mg/L	85.1	21.5	200
Sulfate (calc)	mg/L	8.6	9.22	500
Uranium (dissolved)	µg/L	4.0	3.00	20

4.1.6.2 SURFACE WATER

Project activities will be located within the Skinners Pond and Black Pond Brook Watersheds. There are two unnamed watercourses that flow north across the northeast portion of the site into Skinners Pond. Black Pond Brook flows from the east and southwest of the Site toward Black Pond. These watercourses have multiple branching tributaries that originate within the Project Study Area, flowing north and northwest across the Site. The proposed layout will result in multiple turbine laneways and powerline corridor crossings. The physical characteristics of these watercourses are described in further detail in Section 4.2.6. Surface water flow is variable, occasionally interrupted by beaver dam activity. The site watercourses are generally small and narrow in shallow gullies, with ponding resulting where beaver dams are present.

The PEI Water Quality Report Card for 2020 rates the Skinners Pond Watershed (10.22 km^2) as "Good". In this area, land use is roughly 21% agriculture and 53% forestry. There are no records of anoxic events or fish kills and sediment-laden run-off (red water) is reportedly infrequent in the area. The open data portal does not provide raw data for the nearest monitoring station (Nail Pond, Station ID MSC 53).

4.2 BIOLOGICAL ENVIRONMENT

PEI is located within the Atlantic Maritime Ecozone, which consists of unique ecosystems such as mixed-wood Acadian forests, sand dunes along seaboards and coastal islands. It has been heavily influenced by human settlement, which is especially notable in PEI. The majority of Acadian forests in the Province were transformed into farmland, and extensive timber harvesting has resulted in there being little original mixed-wood forest remaining. Prior to extensive farming, the forest cover on PEI was predominantly deciduous and widely vegetated with sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and beech (*Fagus sp*.) (Rowe 1972). Old, abandoned fields are converting to white spruce (*Picea glauca*) and red spruce *(Picea rubens*) dominated forest. In the western region of the Province, black spruce (*Picea mariana*) and tamarack (*Larix laricina*) are prevalent in wetlands (Ecological Stratification Working Group 1995).

4.2.1 SPECIES AT RISK

The following section focuses on Species at Risk (SAR) (i.e., endangered, threatened, of special concern, and rare species), which may be subject to potential disturbance as a result of Project development. Available information on the known occurrence of floral and faunal SAR in the Study Area was compiled and reviewed to determine their presence relative to the proposed infrastructure. Sources included published and unpublished listings of occurrences of such species.

The federal *Species at Risk Act* (SARA) came into force in June 2003 as a component of a three-part national strategy for the protection of wildlife SAR, which also includes commitments under the Accord for the Protection of SAR and activities under the Habitat Stewardship Program for SAR. The listing process begins with a species assessment that is conducted by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). SARA uses the COSEWIC scientific assessment when making the listing decision. Once a species is added to Schedule 1, it benefits from all the legal protection afforded and the mandatory recovery planning required under SARA. The Act provides federal legislation to prevent wildlife species from becoming extinct and to provide for their recovery. Under the Act, an ongoing process of monitoring, assessment, response, recovery, and evaluation will be undertaken to improve the species status and ecosystem. The prohibitions and offences portions of the Act came into effect in June 2004. The status of species protected under SARA can be found at the SAR Public Registry (SARPR) online at https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html.

COSEWIC and SARA categorize rare species into three main groups according to their status within the Province:

- Endangered: A wildlife species facing imminent extirpation or extinction.
- Threatened: A wildlife species likely to become endangered if limiting factors are not reversed.
- Special Concern: A wildlife species that may become a threatened or endangered species due to a combination of biological characteristics and identified threats.

The Fish and Wildlife Division of the PEI EECA provides additional species protection through its *Wildlife Conservation Act*. The Act includes provisions for the protection of SAR and their habitats. A Provincial SAR Advisory Committee is in place to assess the Province's wildlife resources and advise the Minister of PEI EECA of those species that should be listed by SARA for the Province. Where the Minister considers a species meets the criteria for Endangered, Threatened or Special Concern status the Lieutenant Governor in Council may, by regulations, designate the species as such.

The Atlantic Canada Conservation Data Centre (ACCDC) is part of the NatureServe network, a non-government agency which maintains conservation data for the Atlantic provinces. An information response was received from the ACCDC on the 9 November, 2022, for a list of occurrences of rare and endangered flora and fauna within and near the proposed Study Area. The paragraphs below detail species of conservation concern that could potentially occur in the vicinity of the proposed Project. Species ranked S1, S2, and S3 are considered to be extremely rare to uncommon within its range in the Province. Species ranked S4 and S5 are not discussed since these species are widespread and their occurrences are common to abundant.

The 5 km buffer around the Study Area contains 367 records of 98 vascular plants and 23 records of nonvascular plants. With regards to fauna, 202 records of 40 vertebrate fauna and 5 records of 4 invertebrate fauna were reported. For a complete list of SAR and priority species (i.e., sensitive species without legislative protection) identified in the ACCDC report see Appendix B. Further information on some of these species are provided in the specific flora and fauna sections of Section 4.

4.2.1.1 DESIGNATED FEATURES

Available information on designated areas and other habitat features identified as sensitive or critical was compiled and reviewed to determine their location in relation to the Study Area (ACCDC 2022).

A number of natural areas within the province of PEI have been either formally protected or inventoried as sites of potential significance and are recommended for protection as Conservation Areas or Significant Natural Areas. According to *the Natural Areas Protection Act* (PEI EECA 2021), a natural area:

- Contains natural ecosystems or constitutes the habitat of rare, endangered or uncommon plant or animal species;
- Contains unusual botanical, zoological, geological, morphological or paleontological features;
- Exhibits exceptional and diversified scenery;
- Provides haven for seasonal concentrations of birds and animals; or
- Provides opportunities for scientific and educational programs in aspects of the natural environment.

Conservation Areas are federally or provincially managed areas and are identified by ECCC (Protecting Our Natural Heritage: Conservation Areas in Atlantic Canada, Environment Canada, Undated). Categories under the heading of Conservation Areas include:

- Protected natural areas;
- Wildlife management / protection areas;
- National wildlife areas / migratory bird sanctuaries; and
- Designated wetlands / Eastern Habitat Joint Venture (EHJVs) areas.

Categories under the heading Significant Natural Areas include:

- Environmentally significant areas;
- Critical natural areas;
- Nature reserves; and
- National and provincial parks.

As of January 2018, including both private and public land, PEI has approximately 9,423 ha of classified Natural Areas under the *Natural Areas Protection Act*. Of these sites, two are within 5 km of the Project Study Area: Pleasant View Cedars Natural Area (58.4 ha) and the Nail Pond Natural Area (157.7 ha).

All Conservation Areas and Significant Natural Areas listed above were identified by Federal and/or Provincial regulatory authorities as areas for consideration and protection and are illustrated on Figure 4.1.

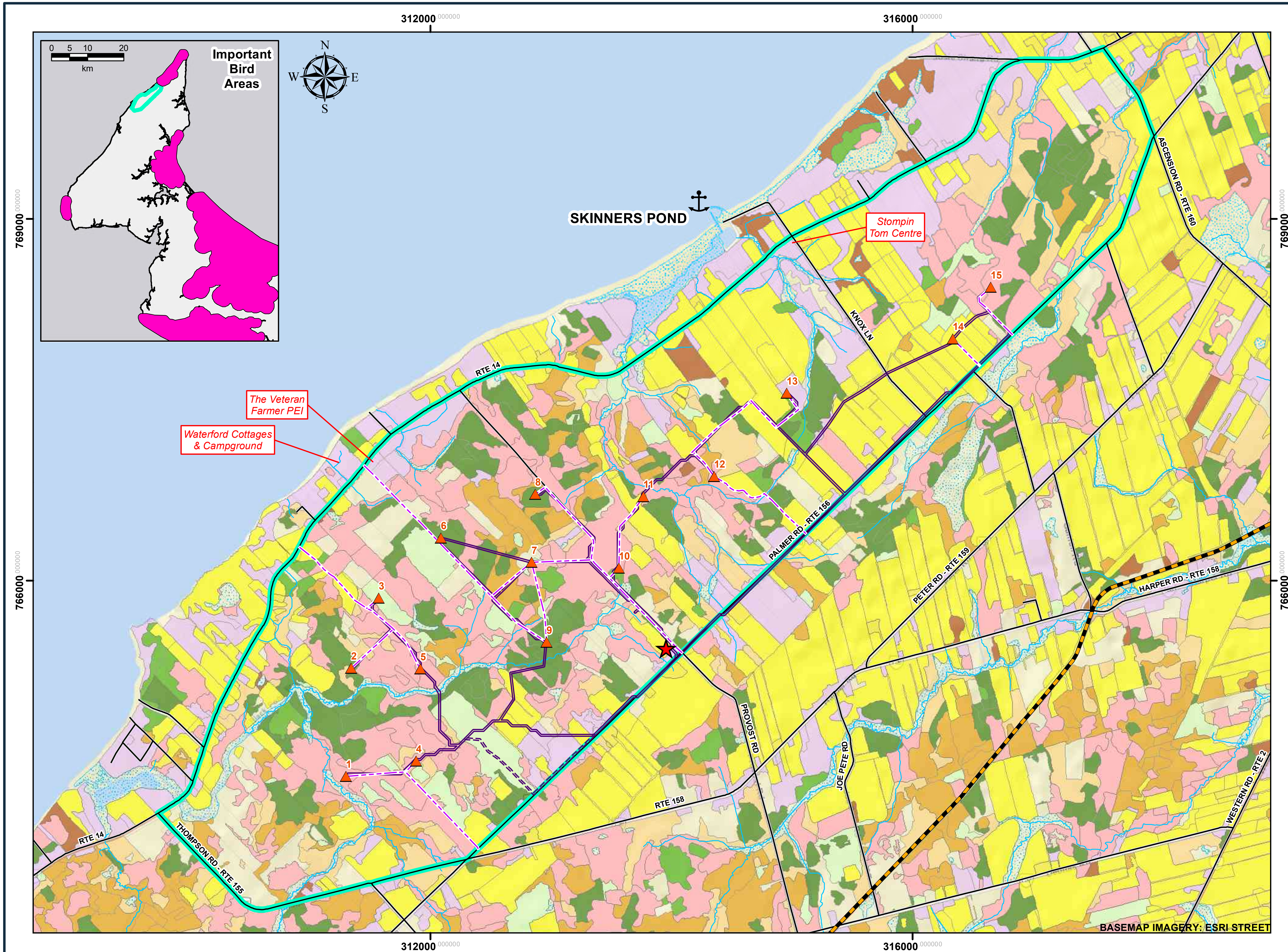
Ducks Unlimited Canada (DUC) works with government, industry and landowners to conserve wetlands that are critical to waterfowl, wildlife and the environment (DUC 2019). There is one privately owned DUC area within 5 km of the Site.

4.2.2 TERRESTRIAL FLORA

The western area of the Province is dominated by conifers on upland flats and in broad valley bottoms. Coniferous forest is composed of white spruce, black spruce, balsam fir (*Abies balsamea*), and tamarack. Other common species include red maple (*Acer rubrum*), red spruce, Eastern white cedar (*Thuja occidentalis*), Eastern hemlock (*Tsuga canadensis*), and occasionally Eastern white pine (*Pinus strobus*) (Rowe 1972). Based on the forest outline (The Government of Prince Edward Island 2000), and field surveys, the Study Area was divided into 10 terrestrial habitats, illustrated on Figure 4.3. The following indicates the percent (%) coverage of each type for the 2088 ha Project Study Area:

- Agricultural (20.6%);
- Clear Cut (4.4%);
- Mixed Forest (24.2%);
- Immature Coniferous Forest (1.5%);
- Mature Coniferous Forest (8.2%);
- Immature Deciduous Forest (5.5%);
- Mature Deciduous Forest (5.5%);
- Shrub (0.7%);
- Grassland (9.3%); and
- Wetland (2.5%).

Agricultural includes all land currently used for farming as well as meadows and/or fallow fields currently not in use. Clearcut includes disturbed areas of slash and selective timber harvesting. Mixed forest is defined by the presence of balsam fir, trembling aspen, red maple, birch, tamarack, balsam poplar, Eastern white cedar and red spruce. Coniferous forest includes predominantly Eastern white cedar, red spruce, tamarack, and balsam fir. Deciduous forest includes predominantly trembling aspen, balsam poplar, red maple, alders, and dogwoods. Clearcut encompasses disturbed forest that has been harvested recently or historically. Shrub/ grass lands are areas previously used for agriculture which have become overgrown with either grass or shrubs, predominantly speckled alder and dogwood sp.



LEGEND:

- Turbine
- Skinners Pond Harbour
- Point of Interconnection Option
- PEI Confederation Trail
- Turbine Laneway
- Roads
- Streams/Creeks
- Wetlands (Provincial)
- Power Collection Corridor
- Alternate Power Collection Corridor
- Property Boundary
- Project Area
- Important Bird Areas

Land Use

- Agricultural
- Clear cut
- Mixed Forest
- Immature Coniferous
- Mature Coniferous
- Immature Deciduous
- Mature Deciduous
- Grassland
- Shrub

ALL WIND FARM INFRASTRUCTURE MAPPING WAS PROVIDED BY INVENERGY LABELLED LAYOUT 016

KEYMAP

CLIENT:

Invenergy

wsp

TITLE:

TERRESTRIAL HABITAT

PROJECT:

SKINNERS POND WIND ENERGY CENTRE

PROJECT NO: **TE211027**	DATE: **MARCH 2023**
REV NO: **1**	DWN BY: **CM**
DATUM: **NAD83 CSRS 2010**	PROJECTION: **PEI DBL STEREO**

FIGURE:

FIGURE 4.3

SCALE: 1:30,000

0 250 500 1,000
Metres

Path: Q:\PROJECTS\TE211027_Invenergy_Canada_EIA_Windfarm_PE\13 GIS\MXD\TE211027_FIGURE_4_2_TerrestrialHabitat.mxd User: candace.macdonald Date: 3/28/2023

4.2.2.1 DESKTOP STUDIES

No plant species protected by Provincial regulations or listed under SARA schedule 1 were identified by the ACCDC within 5 km of the Project. A single occurrence of wrinkled shingle lichen (*Pannaria lurida*) designated "Threatened" under SARA, and four occurrences of black ash (*Fraxinus nigra*), designated "Threatened" under COSEWIC, were recorded within 10 km of the Project. ACCDC reported SAR and Species of Conservation Concern (SOCC) are displayed in Appendix B.

Plant SOCC that are known to occur within 5 km of the Project Site and therefore potentially may occur within the Project footprint are presented in Table 4.12 (ACCDC 2022).

Table 4.12: Plant SOCC that May Be Present Within or Near the Project Study Area

Scientific Name	Common Name	S-Rank	Habitat*
Agrimonia gryposepala	Hooked Agrimony	S3	Disturbed areas, forest edges, and forests
Andromeda polfoila var. latifolia	Glaucous-leaved Bog Rosemary	S2S3	Bogs and fens
Arethusa bulbosa	Dragon's Mouth	S2S3	Wetlands and wetland margins, meadows, and fields
Carex bebbii	Bebb's Sedge	S3S4	Meadows and fields, shores of rivers or lakes, swamps
Carex flava	Yellow Sedge	S3S4	Meadows, fields, and riparian areas
Carex radiata	Eastern Star Sedge	S2	Forests
Carex vesicaria	Inflated Sedge	S1	Wetlands and riparian areas
Catabrosa aquatica	Water Whorl Grass	S2	Wet areas including meadows and riparian areas
Cirsium muticum	Swamp Thistle	S3	Wetland margins, riparian areas, and brackish or salt marshes and flats
Conioselinum chinense	Chinese Hemlock-parsley	S1	Floodplains, forests, swamps, and riparian areas
Cuscuta gronovii	Swamp Dodder	S3	Disturbed habitats, meadows, fields, riparian areas, shrubland, thickets, and wetland margins
Cypripedium reginae	Showy Lady's-Slipper	S2S3	Fens, swamps, wetland margins
Diphasiastrum tristachyum	Blue Ground-cedar	S3	Disturbed habitats, forests and forest edges, meadows, and fields
Empetrum nigrum	Black Crowberry	S3	Cliffs, ridges, sandplains, and barrens
Eupatorium perfoliatum	Common Boneset	S3S4	Disturbed areas, marshes, riparian areas, wetlands, and wetland margins
Euphorbia polygonifolia	Seaside Spurge	S2S3	Coastal beaches and dunes
Fraxinus americana	White Ash	S2S3	Floodplains and forests
Geum macrophyllum	Large-Leaved Avens	S3S4	Rich woods, thickets
Juncus dudleyi	Dudley's Rush	S3	Disturbed habitats, meadows, fields, and riparian areas
Juncus alpinoarticulatus ssp. americanus	Northern Green Rush	S3	Fens, marshes, meadows, fields, tidal marshes or flats, and riparian areas
Malaxis unifolia	Green Adder's-Mouth	S3	Disturbed habitats, swamps, and wetland margins
Moneses uniflora	One-flowered Wintergreen	S3	Cool, mossy, mostly coniferous woods
Mimulus ringens	Square-stemmed Monkeyflower	S3S4	Tidal marshes or flats, marshes, swamps, riparian areas, and wetland margins
Oclemena nemoralis	Bog Aster	S3	Disturbed habitats, bogs, fens, meadows, fields, riparian areas, and wetland margins
Packera aurea	Golden Groundsel	S2	Meadows, fields, swamps, riparian areas, and wetland margins
Petasites frigidus var. palmatus	Northern Sweet Coltsfoot	S3	Fens and swamps

Scientific Name	Common Name	S-Rank	Habitat*
Agrimonia gryposepala	Hooked Agrimony	S3	Disturbed areas, forest edges, and forests
Andromeda polfoila var. latifolia	Glaucous-leaved Bog Rosemary	S2S3	Bogs and fens
Arethusa bulbosa	Dragon's Mouth	S2S3	Wetlands and wetland margins, meadows, and fields
Carex bebbii	Bebb's Sedge	S3S4	Meadows and fields, shores of rivers or lakes, swamps
Carex flava	Yellow Sedge	S3S4	Meadows, fields, and riparian areas
Pinus banksiana	Jack Pine	S2S3	Disturbed habitats and bogs
Pogonia ophioglossoides	Rose Pogonia	S3	Disturbed habitats, bogs, fens, meadows, fields, and wetland margins
Potamogeton alpinus	Alpine Pondweed	S3	Freshwater
Polystichum acrostichoides	Christmas Fern	S2S3	Rich woods, rocky slopes
Pyrola asarifolia	Pink Pyrola	S2S3	Forests, swamps, and riparian areas
Quercus rubra	Northern Red Oak	S3S4	Forests and woodlands
Ranunculus pensylvanicus	Pennsylvania Buttercup	S1	Disturbed habitats, marshes, swamps, and riparian areas
Sanicula marilandica	Maryland Sanicle	S3S4	Woods, thickets, meadows, shores
Scirpus pedicellatus	Stalked Bulrush	S1	Marshes, meadows, fields, riparian areas, and wetland margins
Thuja occidentalis	Eastern White Cedar	S3S4	Cliffs, fens, forests, ridges, swamps, woodlands, and riparian areas
Ulmus americana	White Elm	S3	Disturbed areas, floodplains, forests, meadows, field, swamps, and riparian areas
Vaccinium uliginosum	Alpine Bilberry	S1	Alpine or subalpine zones, mountain summits and plateaus, and ridges or ledges
Viburnum opulus var. americanum	Highbush Cranberry	S3	Disturbed habitats, meadows, fields, swamps, riparian areas, and wetland margins

Note: * Habitat as described in Native Plant Trust 2022; Flora of North America 2019; Hinds 2000

None of the SARA protected species are anticipated to be present within the Project footprint.

4.2.2.2 FIELD SURVEYS

Survey Methodology

Vegetation surveys were conducted at the Site from the 6 – 8 June, 2021, and again from 16 – 20 May and 6-8 June, 2022. Each turbine and associated turbine laneways, power collector line corridors, and substation were surveyed. SAR surveys consisted of optically controlled meanders throughout the Study area to achieve maximum diversity of potential species found, a full observed species list is found in Appendix B, Table 1.

At that time, most flowering plants including asters and goldenrods were in bloom. Early spring ephemerals that typically bloom between May and early July were identified to species.

Field Survey Results

Table 4.13 describes the vegetative habitats of the proposed locations for the wind turbines, turbine laneways, powerlines, and substation facility as described in provincial forest inventory mapping and listed above.

Table 4.13: Habitat Types Within the Study Area

Turbine Number	Habitat Type		Vegetation Description
	Mapped	Field Identified	
T1	Mixed Forest	Immature Deciduous	Trembling aspen, gray birch, red maple, and balsam fir with an understorey of Canada mayflower (*Maianthemum canadense*) and wild raisin (*Viburnum cassanoides*).

Turbine Number	Habitat Type		Vegetation Description
	Mapped	Field Identified	
T2	Immature Deciduous	Immature Deciduous	Birch, balsam poplar, and trembling aspen, with an understory of moss, Canada mayflower, red maple, balsam fir, wild raisin, and blue bead lily (*Clintonia borealis*).
T3	Clearcut	Regenerating Clearcut (Mixed Forest)	Recently clearcut, regenerating with trembling aspen, gray birch, red maple, and balsam fir with an understorey of Canada bunchberry (*Cornus canadensis*) and Canada mayflower.
T4	Mixed Forest	Immature Mixed Forest	Previously clearcut, with trembling aspen, gray birch, red maple, and balsam fir with an understorey of Canada mayflower and wild raisin.
T5	Mixed Forest	Immature Mixed Forest	Previously clearcut, regenerating with white birch, trembling aspen, balsam fir, and red maple, with an understorey of Canada mayflower and round-leaved dogwood.
T6	Mature Coniferous	Immature Coniferous	Previously clearcut, regenerating with red spruce, gray birch (*Betula populifolia*), tamarack, and balsam fir with shrub cover of sheep laurel (*Kalmia angustifolia*), rhodora *(Rhododendron canadense*), Labrador tea (*Rhododendron tomentosum*), meadowsweet (*Spiraea alba*), wild raisin, as well as an understorey of large cranberry (*Vaccinium macrocarpon*) and Canada bunchberry.
T7	Mixed Forest	Immature Mixed Forest	Recently clearcut, regenerating with balsam poplar, trembling aspen with shrub cover including rhodora, Labrador tea, sheep laurel, and low-bush blueberry.
T8	Mature Coniferous	Mature Coniferous	Red spruce, balsam fir, with an understorey of red maple, trembling aspen, and white birch and ground cover including woodfern, dwarf raspberry, starflower, Canada mayflower, and gooseberry.
T9	Mature Coniferous	Mature Coniferous	Eastern white cedar with an understory of balsam fir and sparse red maple. Ground cover is goldthread (*Coptis trifolia*), Canada mayflower, Canada bunchberry, and rhodora.
T10	Mixed Forest	Immature Mixed Forest	Tamarack, white birch, trembling aspen, balsam fir, red spruce, Eastern white cedar, with an understorey of speckled alder, wild raisin, honeysuckle, and red elderberry. Significant deadfall present. Groundcover includes Canada mayflower, dwarf raspberry, Canada bunchberry, rhodora, and moss.
T11	Agricultural	Agricultural	Grassy field.
T12	Mixed Forest	Clearcut	Extensive deadfall and slash in this area. Recently clearcut.
T13	Grassland	Agricultural	Clover field.
T14	Mixed Forest	Agricultural	Grassy field.
T15	Mature Coniferous	Mature Coniferous	Mature Eastern white cedar stand.
Substation	Agricultural	Agricultural	Grassy field.

Agricultural land is predominantly potato field, clover field, and fallow field beginning to vegetate with Dogwood sp. Clearcut, or disturbed areas across the site range from new clearcuts to tamarack plantations, and regenerating forest of predominantly trembling and largetooth aspen, balsam poplar, balsam fir, birch, and red maple. The disturbed forest shrub layer and understorey habitat is typical of disturbed areas comprising species such as pin cherry (*Prunus pensylvanica*), fireweed (*Chamerion angustifolium*), goldenrods (*Solidago sp.*) and asters.

Mixed forest is the dominant forest type of the Project Study Area and is composed of mostly red maple, white birch (*Betula papyrifera*), balsam fir (*Abies balsamea*), white spruce *(Picea glauca*) and poplar (*Populas spp*.) in the overstorey. When not bare, the understorey is predominantly bracken ferns (*Pteridium aquilinum*), wild sarsaparilla (*Aralia nudicaulis*), bunchberry (*Cornus canadensis*) and wild lily-of-the-valley (*Maianthemum canadense*). Other common species observed included wild raisin, fire cherry, wood ferns (*Dryopteris sp*.), bluebead lily (*Clintonia borealis*), starflower (*Trientalis borealis*), twinflower (*Linnaea borealis*), and mayflower (*Epigaea repens*).

Coniferous forest is present in patches across the Project Study Area. There are mature tamarack, Eastern white cedar, and red spruce forests with an understorey of bare ground. Immature coniferous forest is predominantly composed of red spruce, tamarack, and balsam fir with sparse young red maple.

Extensive riparian wetland habitat is present across the Site and detailed in Section 4.2.3. Cattail marsh habitat potentially suitable for avian species like lesser yellowlegs was observed in Wetlands 11, 12, and 14. Lesser yellowlegs is listed as Threatened by COSEWIC and the species is further discussed in Section 4.2.4.

4.2.2.3 FLORAL SPECIES OF CONCERN

During the vegetation surveys conducted in May, June, and August, a few uncommon plant species were observed in relatively close proximity to turbine laneways, collector lines, and laydown areas (Table 4.14).

Table 4.14: Floral Species of Concern Observed During 2021 - 2022 Vegetation Surveys

Scientific Name	Common Name	ACCDC Rank	General Status of Species in PEI	Location
Fraxinus americana	White Ash	S2S3	Vulnerable	Along proposed power lines near T4
Geum macrophyllum	Large-leaved Avens	S3S4	Apparently Secure	Turbine laneway near T15
Moneses uniflora	One-flowered Wintergreen	S3	Vulnerable	Forest near T1, on the Southwest side of the watercourse
Oclemena nemoralis	Bog Aster	S3	Vulnerable	Turbine laneway between T3 and T5
Packera aurea	Golden Groundsel	S2	Imperilled	Bordering agricultural field near T1
Pogonia ophioglossoides	Rose Pogonia	S3	Vulnerable	Found in a wet meadow adjacent to agricultural field near the turbine laneway to T1 and T4
Thuja occidentalis	Eastern White Cedar	S3S4	Apparently Secure	Common across the Site footprint

Recommendations have been made in Section 5.2.6 to ensure that essential habitat and the species themselves are not harmed.

As mentioned in Section 2.1, a portion of the proposed footprint was not field surveyed at the adjusted locations of Turbines T14 and T15, and along the proposed alternative electrical collector corridor adjacent to Palmer Road. These areas do not have high potential for species at risk to occur based on available desktop information but this will need to be confirmed with field surveys in May/June of 2023 and provided in an addendum report.

4.2.3 WETLANDS

PEI has a policy of no-net-loss of wetlands as described in the Watercourse and Wetland Protection Regulations under the Province's *Environmental Protection Ac*t. PEI EECA requires a permit for any alternation within 15 m of the bank of a watercourse or wetland. In addition, permanently impacted wetlands must be compensated at a 1:1 ratio or greater to achieve the objectives for no net loss of wetland function. Compensation for the loss of wetland is required when an approval to impact a wetland is issued under the Act.

Both collectively and as individual units, wetland resources serve a variety of important ecological and socioeconomic functions. The value of wetlands to society and their ecological value are derived from their biological productivity, biodiversity, and functional role in processing surface and groundwater.

Wetlands are generally characterized by the presence of saturated soils in the upper 30 cm, sufficient to develop hydrophytic soils and vegetation; with types varying from a closed peat bog to an open water body dominated by submergent vegetation. By providing natural flood control, points of recharge and discharge of groundwater, acting as filters, and by trapping silt, wetlands play an important role in the hydrological cycle and generally enhance the water regime. Since they provide habitat for a wide variety of plants and animals, they can be highly productive and often exceed adjacent uplands in their productivity, biodiversity, and much higher incidence of rare species and SAR. Ecological wetland values may include sustenance for waterfowl; sources of fish production; storage and slow release of water; erosion protection; and areas of aesthetic or recreational enjoyment. Wetlands have been impacted historically through diking, filling, drainage, flooding, and other disturbances, causing the number and extent of wetlands to decrease substantially (Bond *et al.*, 1992).

4.2.3.1 METHODOLOGY

The wetland delineation was conducted using the methodology developed by the US Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory 1987), and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region, (U.S Army Corps of Engineers 2012). This protocol has been adopted by Canadian regulators and practitioners. The wetland determination and boundary delineation method are based on of the use of three parameters that must all be present for a wetland determination: wetland (hydrophytic) vegetation, hydric soil, and evidence of wetland hydrology.

Site visits were conducted by Lyle Vicaire (Maqimgew Anqotumeg Inc.), with assistance of Ryan Power (Boreal Environmental) in August and September. Both surveyors are experienced Field Biologists and certified wetland delineators.

At representative locations along the boundary, paired sampling points are placed (one within the wetland, and one in the adjacent upland) where the three parameters are measured and recorded on data forms. Each wetland boundary was recorded using a Garmin GPSMAP 64X and a Garmin GPSMAP 64Xe, with an accuracy of (3 to 5 m).

The wetland survey report of work conducted in 2022 is presented in Appendix C.

4.2.3.2 RESULTS

A total of 23 wetlands comprising 40.08 hectares (ha) were identified and delineated within the Project Study Area perimeter, with a majority of the wetlands being Forested Seepage Swamps. Surveys for each delineated wetland (WL) were completed over the course of four site visits in 2022:

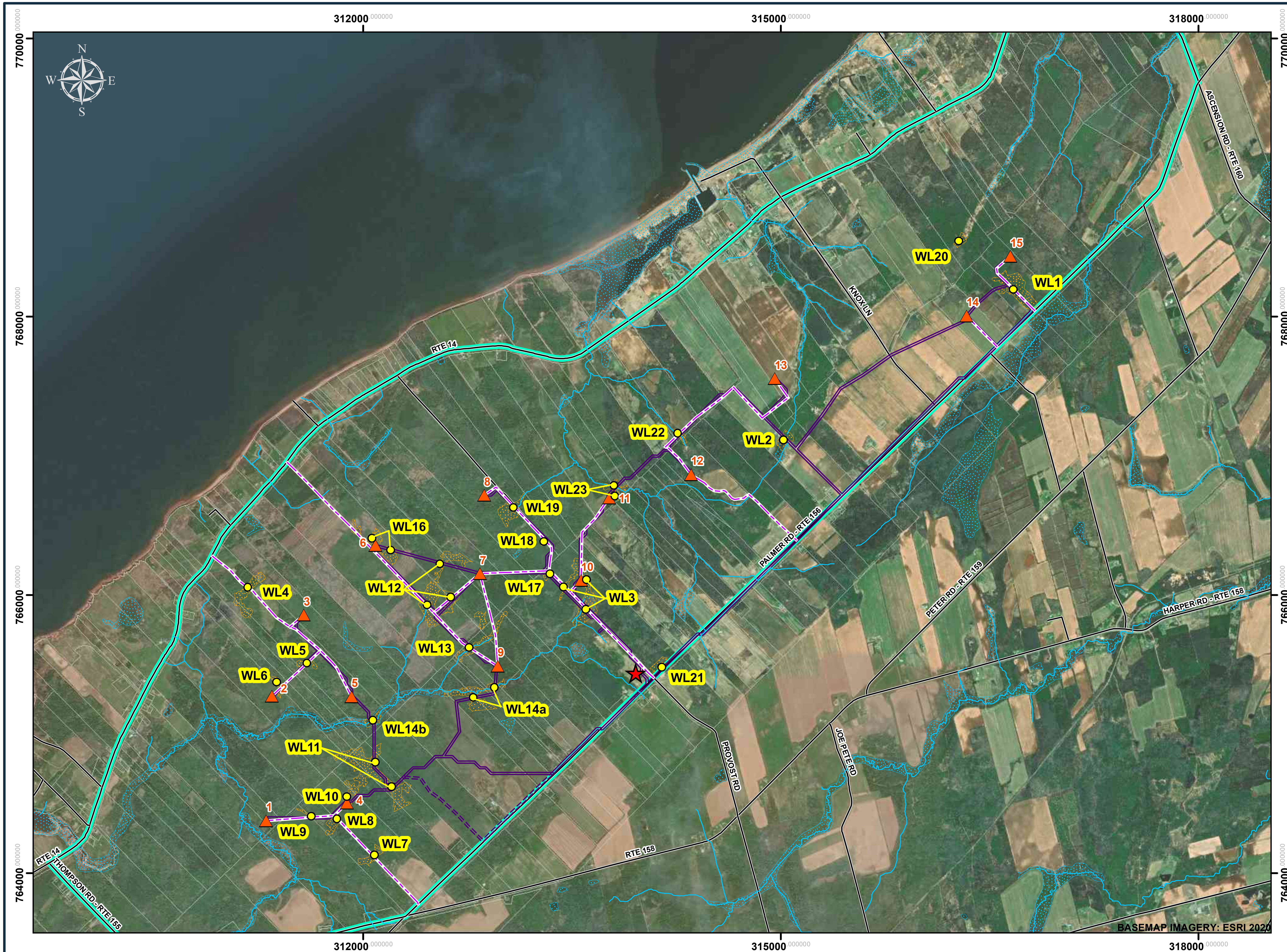
- WL1, W2, WL3 (25 – 29 July);
- WL4, WL5, WL6, WL7, WL8, WL9 and WL10 (2 – 5 August);
- WL11, WL12, WL13, WL14, WL15, WL16, WL17, WL18 and WL19 (12 - 16 September); and
- WL20, WL21, WL22, and WL23 (18 - 19 October).

Table 4.15 describes the size and location, and type of each WL, which are illustrated on Figure 4.4. The wetlands delineated were non-tidal types and presented evidence of past disturbances from agricultural, logging, or beaver activity. A large majority of the wetlands presented with Red Parent Material, resulting in problematic soils.

As mentioned in Section 2.1, a portion of the proposed footprint was not field surveyed at the adjusted locations of Turbines T14 and T15, and along the proposed alternative electrical collector corridor adjacent to Palmer Road. These areas do not have high potential for wetlands to occur based on available desktop information, but this will need to be confirmed with field surveys in June of 2023 and provided in an addendum report.

Table 4.15: Characteristics of Delineated Wetlands (WLs)

Wetland	Size (Ha)	Location	Type
WL1	3.86	-64.094960, 46.958831	Forested Seepage Swamp
WL2	0.98	-64.116313, 46.948675	Shrub Seepage Swamp
WL3	4.18	-64.134687, 46.937622	Forested Channel Swamp
WL4	2.26	-64.166644, 46.938681	Forested Seepage Swamp
WL5	0.40	-64.161674, 46.933782	Forested Seepage Swamp
WL6	0.44	-64.163773, 46.932544	Forested Seepage Swamp
WL7	0.92	-64.154532, 46.921401	Forested Seepage Swamp
WL8	0.72	-64.1584351, 46.9234513	Forested Seepage Swamp
WL9	0.17	-64.1607274, 46.9240210	Sloped Forested Seepage Swamp
WL10	0.25	-64.1570221, 46.9251200	Forested Seepage Swamp
WL11	7.25	-64.1549810, 46.9270893	Forested Seepage Swamp w/Beaver Pond
WL12	5.74	-64.1495890, 46.9380707	Forested Seepage Swamp w/Beaver Pond
WL13	1.82	-64.1456146, 46.9348229	Shrub Seepage Swamp
WL14a	3.11	-64.1456594, 46.9320327	Riverine Swamp w/Beaver Pond
WL14b	0.65	-64.1547119, 46.9302025	Riverine Swamp w/Beaver Pond
WL15	0.52	-64.1445469, 46.9369043	Forested Seepage Swamp
WL16	2.12	-64.1548644, 46.9419913	Forested Seepage Swamp w/regen clearcuts
WL17	0.16	-64.1384641, 46.9395958	Forested Seepage Swamp
WL18	0.06	-64.1388589, 46.9418388	Regen Shrub Seepage Swamp
WL19	1.80	-64.1421963, 46.9438664	Shrub Seepage Swamp
WL20	0.51	-64.0999352, 46.9617739	Shrub Seepage Swamp
WL21	0.79	-64.1278102, 46.9339751	Shrub Seepage Swamp
WL22	0.41	-64.1261594, 46.9489130	Forested Riverine Swamp
WL23	0.99	-64.1320313, 46.9448627	Shrub Riverine Swamp w/ Beaver Pond

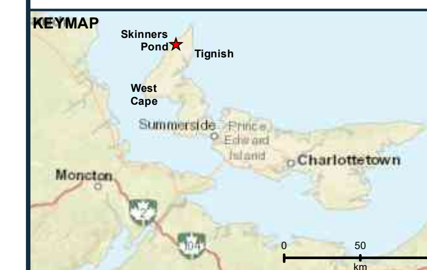


LEGEND:

- Wetland Intersection (WL)
- Turbine
- Point of Interconnection Option
- Turbine Laneway
- Roads
- Streams/Creeks
- Wetlands (Provincial)
- Field Verified Wetlands
- Power Collection Corridor
- Alternate Power Collection Corridor
- Property Boundary
- Project Area

ALL WIND FARM INFRASTRUCTURE MAPPING WAS PROVIDED BY INVENERGY LABELLED LAYOUT 016

KEYMAP



CLIENT:

Invenergy

wsp

TITLE:

WETLANDS

PROJECT:

SKINNERS POND WIND ENERGY CENTRE

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REV NO: 7	DWN BY: CM
DATUM: NAD83 CSRS 2010	PROJECTION: PEI DBL STEREO

FIGURE: FIGURE 4.4

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4.2.4 LOCAL AND MIGRATORY BIRDS

The fauna of greatest concern in context of the Project are bird and bat populations, since these groups have potential to interact with the turbines. For birds and bats, the primary identified potential negative effect of wind farms is displacement due to disturbance, along with habitat loss, collision, and barrier effects (Drewitt and Langston 2006). Bat work at the site will be further addressed in Section 4.2.5.

Displacement occurs during both the construction and operations phases of wind farms as a result of physical barriers (i.e., turbines); visual, noise and vibration impacts; as well as repeated vehicle movements related to maintenance (Drewitt and Langston 2006). The pattern and scale of disturbance depends upon the species, life cycle stage, availability of alternate habitats, and siting of the wind turbines with respect to important habitat areas. Fatalities due to collision are also of concern, although mortality due to wind turbines is much lower than other sources. According to Calvert *et al.*, (2013), annual bird deaths due to anthropogenic sources were estimated at 269 million, of which just 16,700 are from wind turbine collisions. Further, Zimmerling *et al.*, (2013) reported that mortality rates of birds at wind farms in Canada were not sufficient to cause population-level effects. Nonetheless, it is recognized that proper consideration must be taken prior to turbine construction to ensure that important habitats and migration corridors are avoided to the extent possible.

The Government of PEI reports that 368 species of birds have been recorded on PEI (PEI Department of Agriculture and Forestry 2014). Most migratory birds are protected under the federal *Migratory Birds Convention Act* (MBCA); exceptions include game birds (grouse, quail, pheasants), raptors (hawks, owls, eagles, falcons), corvids (crows and jays), and certain fish-eating species such as cormorants and kingfishers. Under this Act, no person shall disturb, destroy, or take a nest, egg, nest shelter, or nest box of a migratory bird without a permit.

Most species occurring on PEI are migratory, breeding in PEI in the summer and travelling to warmer southerly climates in winter. Other species occur in PEI year-round or pass through PEI during migration to breed further north. Migration typically occurs in the spring (mid-April to early June) and fall (late August to end of October). Migratory timing and routes are dependent on several factors including origin, species, and time of day that migration occurs. According to Environment and Climate Change Canada's (ECCC) general avoidance information for migratory birds, PEI is located in breeding zone C3 (ECCC 2018a). In this zone, the regional nesting period extends from mid- April to the end of August (ECCC 2018a), which is when most migratory birds protected under the MBCA breed. However, some bird species nest outside of this period, including some species protected (waterfowl, crossbills and waxwings) and not protected (corvids and raptors) under the MBCA.

4.2.4.1 DESKTOP STUDIES

Data from the Maritimes Breeding Bird Atlas (MBBA) were obtained for the two 10 X 10 km squares in which the Project Study Area is located (Square IDs 20MT10 and 20MS19; MBBA 2022). Species lists of birds recorded in the MBBA are presented in Table D.1 and Table D.2 in Appendix D. The Atlantic Canada Conservation Data Centre (ACCDC) database was consulted to obtain records of rare bird species occurrences within a 5 km radius of the centre point of the Project site and is discussed further in Section 4.2.1. Important habitat areas for birds that have been federally or provincially designated were identified using available mapping resources, including the Important Bird Areas (IBA) of Canada database (IBA 2022a). The IBA program is coordinated by BirdLife International and administered in Canada by the Canadian Nature Federation and Birds Canada (IBA 2022a). The criteria used to identify important habitat are internationally standardized, and are based on the presence of SAR, species with restricted range, habitats holding representative species assemblages, or a congregation of a significant proportion of a species' population during one or more seasons. These criteria are used to identify sites of national and international importance. A review of the IBA database showed that the nearest is Norway IBA (IBA ID: PE010) which encompasses the settlement of Norway, PEI, and overlaps the northern tip of the Project Study Area by approximately 40 m (Figure 4.1). The area meets IBA designation criteria because it supports an internationally significant colony of great cormorant (*Phalacrocorax carbo*). An estimated 1.75% of the North American great cormorant population nests along the coastal cliffs of the region; however, coastal erosion presents a serious threat to the nesting area (IBA 2022b). A second IBA, Cascumpec Bay / Alberton Harbour IBA, is located approximately 12 km southeast of the Project Study Area near Alberton, PEI (IBA ID: PE003; IBA, 2022c). This IBA supports small numbers (i.e., 2 - 7 pairs) of Endangered piping plover (*Charadrius melodus melodus*), a great blue heron (*Ardea herodia*) colony, and large numbers (i.e., 1700-2000 individuals) of staging Canada goose (*Branta canadensis*) (IBA 2022c). There are no other IBAs located within 25 km of the Project Study Area (IBA 2022a).

4.2.4.2 FIELD SURVEYS

A comprehensive, year-long survey program was implemented to gather information on seasonal use of the Project site and surrounding area by avifauna. Surveys were carried out by Fiep de Bie, Tyler Power, and Marley Aikens - three birders with extensive experience in bird identification across the Maritimes. The objectives of the study were to determine: 1) what species make use of the habitat at the proposed wind project site at different times of year; 2) of the species present at the Site, which may be most susceptible to collision with turbines based on flight height and behaviour; 3) the peak spring and fall migration periods at the Site, based on bird abundance and species diversity; and 4) whether any SAR or species of conservation concern (SOCC) make use of the proposed site during migration or for breeding.

Field Survey Methodology

Field surveys initiated in May 2021 consisted of four seasonal components:

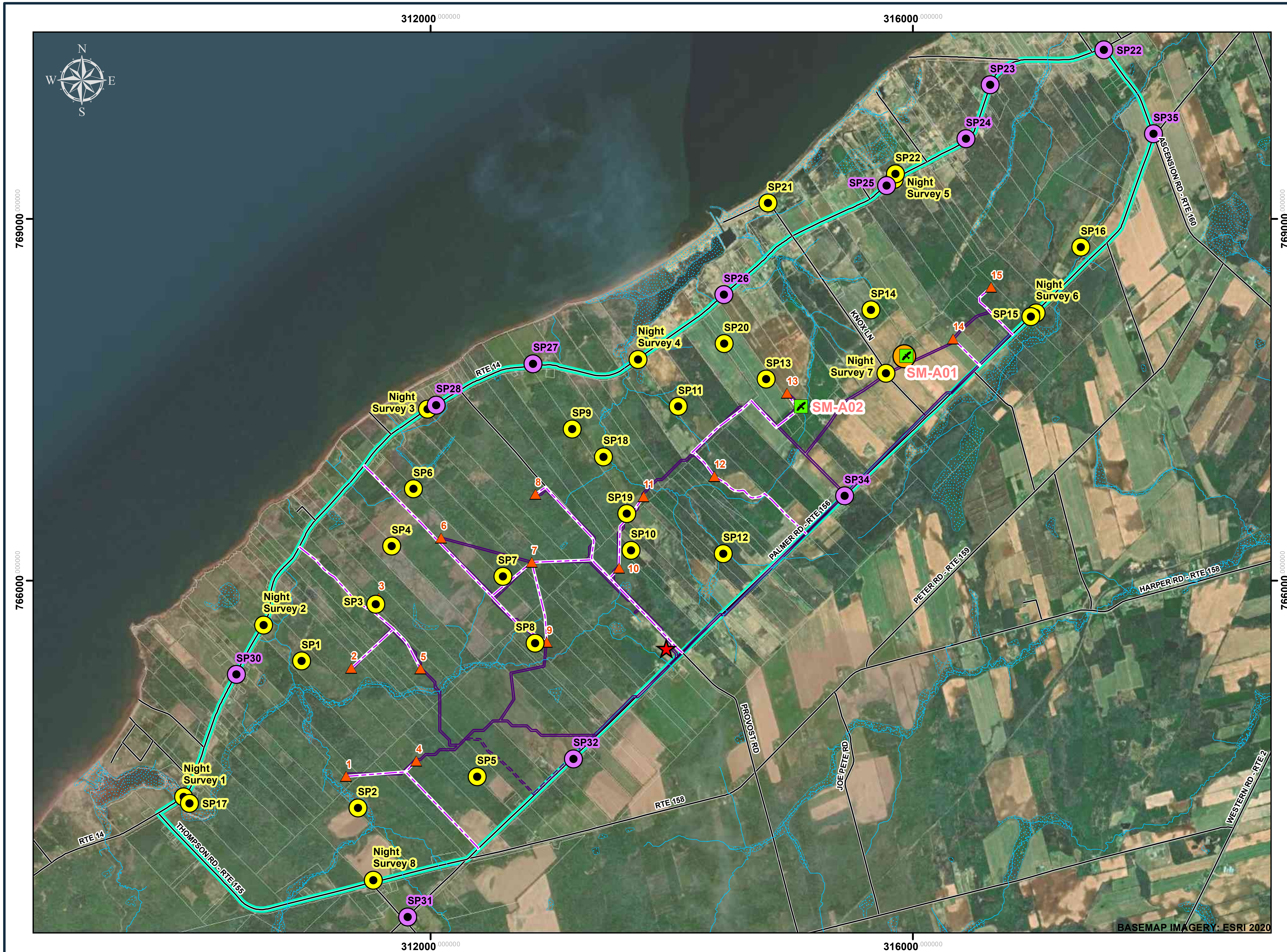
- Spring migration (April to early June);
- Peak breeding season (April for owls, July for common nighthawk, and June to early July for passerines);
- Autumn migration (August to end of October); and
- Winter resident surveys (December to March).

Avian survey point (SP) locations are illustrated in Figure 4.5.

Following guidance outlined in EC (2007), surveys were conducted at the times of day with the highest likelihood of detecting the target species (i.e., daytime for diurnal migrants, early morning for most breeding passerines, after sunset for owls and common nighthawks), and in favorable weather conditions to maximize detection probability (i.e., wind speeds of less than 20 kilometres per hour (km/h); no sustained precipitation).

Breeding bird surveys consisted of:

- A nighttime common nighthawk survey conducted on 17 July, 2021;
- Two rounds of early morning point count surveys targeting breeding passerines conducted over five dates between 1 June and 26 June, 2021;
- One nocturnal owl survey conducted on April 8, 2022.



LEGEND:

- Avian Survey Points (SP)
- Autumn-only Survey Points
- Avian Song Meter (SM-A)
- Turbine
- Point of Interconnection Option
- MET Tower
- Turbine Laneway
- Roads
- Streams/Creeks
- Wetlands (Provincial)
- Power Collection Corridor
- Alternate Power Collection Corridor
- Property Boundary
- Project Area

ALL WIND FARM INFRASTRUCTURE MAPPING WAS PROVIDED BY INVENERGY LABELLED LAYOUT 016

KEYMAP

CLIENT:

Invenergy

wsp

TITLE:

AVIAN SURVEY LOCATIONS

PROJECT:

SKINNERS POND WIND ENERGY CENTRE

PROJECT NO:	DATE:
TE211027	MARCH 2023
REV NO:	DWN BY:
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DATUM:	PROJECTION:
NAD83 CSRS 2010	PEI DBL STEREO

FIGURE:

FIGURE 4.5

SCALE:

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Metres

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The nocturnal owl survey followed Atlantic Canada Nocturnal Owl Survey protocol (BSC 2019). The survey consisted of boreal owl (*Aegolius funereus*) and barred owl (*Strix varia*) call playback interspersed with silent listening periods at eight survey stations spaced at least 2 km apart along the roadways surrounding the Project Study Area (BSC 2019). Each survey station was surveyed for a total of 11 minutes (min). The survey began 30 min before sunset and was completed within 2.5 hours of sunset (BSC 2019). The nighthawk survey followed the Canadian Nightjar Survey Protocol (Knight et al., 2019) and consisted of 6-min silent listening periods at the same eight survey stations used for the nocturnal owl survey. The survey began 30 min before sunset and as completed within 2.5 hours of sunset (Knight et al., 2019). All owls, nighthawks, and other nocturnal birds (e.g., American woodcock (*Scolopax minor*), Wilson's snipe (*Gallinago delicata*)) detected during the nighttime bird surveys were recorded. Information on noise interference sources (e.g., insect and traffic noise) and degree of interference (e.g., low, high) were recorded along with presence of non-target wildlife (e.g., mammals, frogs).

The early morning surveys followed Maritime Breeding Bird Atlas (MBBA) protocol and consisted of point counts at 22 survey stations stratified by habitat in and near the Project Study Area. The survey stations were representative of all major habitat types available at the Site as well as the coastline adjacent to the Project Study Area. Surveys began approximately 30 min before sunrise and were completed within five hours of sunrise (MBBA 2006). At each station, all bird species seen or heard during the 10-min silent listening period were recorded, along with incidental observations of non-target species (mammals and herptiles). Birds observed outside the 10-min listening periods were recorded as incidental bird observations. Each station was surveyed at least twice in June, aside from one station that became inaccessible in late June due to localized flooding.

Spring migration watch count surveys were conducted over eight dates between the 8 and 29 May 2021, and 10 April and 30 April, 2022. Fall migration watch count surveys were conducted over fourteen dates between 10 August and 23 October, 2022. The surveys consisted of 10-min watch counts at the same 22 stations used for the breeding bird surveys. For the Fall migration surveys and 2022 Spring migration surveys, eleven roadside stations were also surveyed for 10 min per station. The roadside stations provided a broader view of the Project Study Area and coastline, allowing for detection of bird flocks and observations of flight patterns (height and direction) of birds passing through the area. Due to the topography and size of the Project Study Area, this method was favoured over a longer watch count at a single location. The watch counts were conducted on an approximately weekly basis during the spring and fall migration periods.

During each migration watch count, the observer recorded species, counts, flight direction and height of birds passing through the Project site. The migration watch count program was designed to consider maximum potential turbine dimensions to ensure that field results met the requirements of the EIA once the model was ultimately selected. Therefore, flight heights were categorized on a generic scale (0-5) used for other wind projects on PEI: 0 = on ground; 1 = 0 - 10m; 2 = 10 - 50m; 3 = 50 - 100m; 4 = 100 - 150m; 5 = 150m+. It is noted that small bird species cannot be easily seen flying at high (>100 m) altitudes, and therefore the percentage of birds seen during migration counts is likely an underestimate. Furthermore, the number of individuals reported should not be considered an abundance estimate for the area. These counts are intended to provide an estimate of passage rates through the airspace of the Project site; thus, an individual may pass through the area more than once and therefore be counted multiple times.

Winter resident surveys were conducted once per month in December 2021 and January, February, and March 2022. These surveys followed the same methodology as the breeding bird surveys, in which all bird and incidental species were recorded during 10-min watch counts at the 22 survey stations.

Field Survey Results

A total of 8,103 individual birds comprising 112 species were detected during the entire 2021 and 2022 survey program, including five SAR and 27 SOCC (Table D.1 in Appendix D). The observed species having status under either SARA or the supporting body of COSEWIC were as follows:

- Canada warbler (*Cardellina canadensis;* SARA: Threatened, COSEWIC: Special Concern);
- Bank swallow (*Riperia* riperia; SARA/COSEWIC: Threatened);
- Barn swallow (*Hirundo rustica*; SARA/COSEWIC: Threatened);
- Bobolink (*Dolichonyx oryzivorus*; SARA/COSEWIC: Threatened); and
- Lesser yellowlegs (*Tringa flavipes*; SARA: No Status, COSEWIC: Threatened).

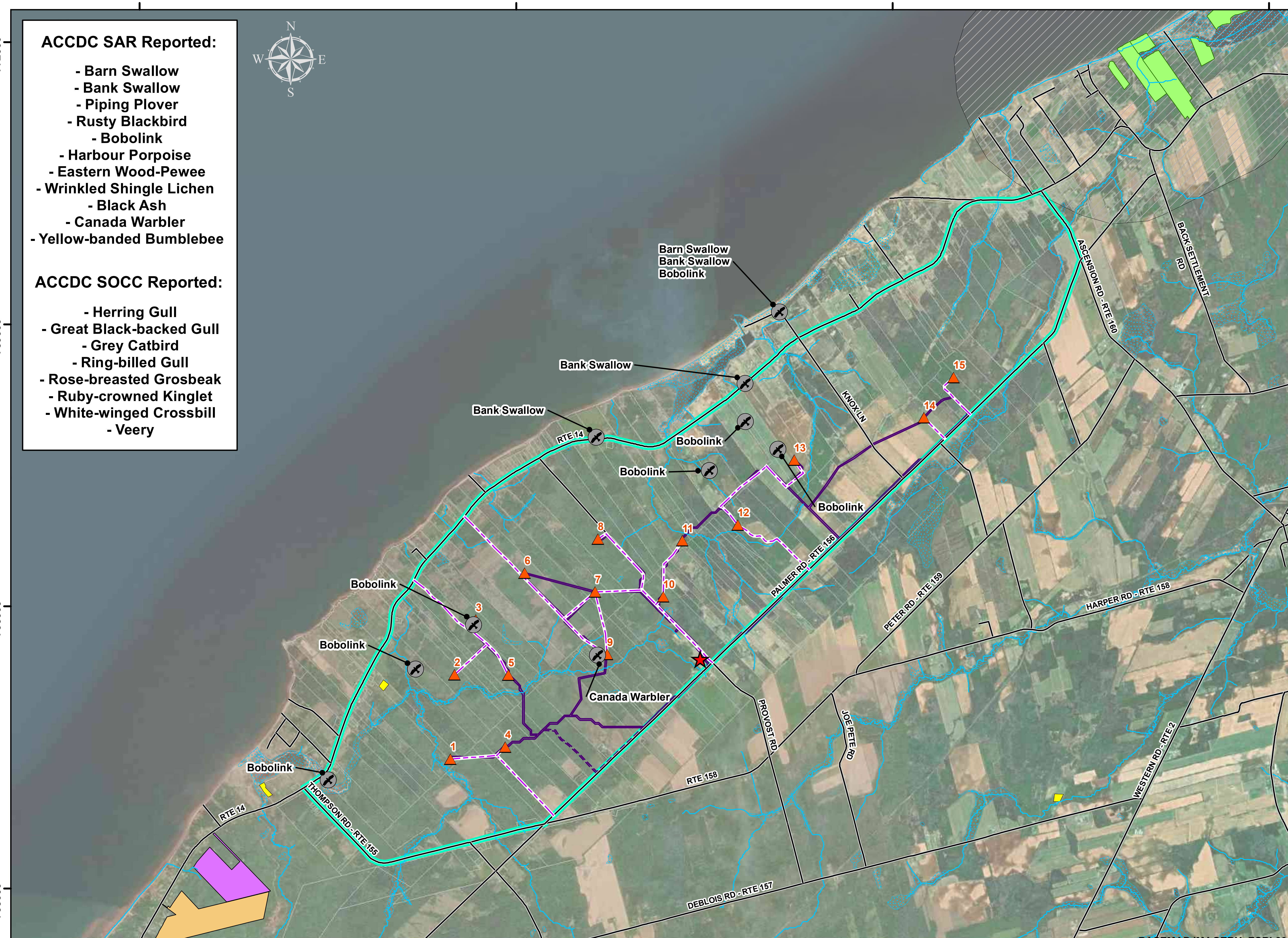
The locations for the SARA species observations are illustrated in Figure 4.6. These species are further discussed in Section 4.2.1.

No owls were observed during the nocturnal owl survey in April 2022; however, it should be noted that Northern saw-whet owl (*Aegolius acadicus*) was recorded singing on-territory during 9 intervals of the spring migration acoustic monitoring period (Table 4.16). There were nine observations of American woodcock (*Scolopax minor*), a predominantly nocturnal shorebird species that engages in aerial flight displays during the breeding season. No common nighthawks or other nocturnal birds were detected during the nighthawk survey in July 2021.

A total of 812 individuals comprising 57 species were detected during the breeding bird point count surveys, including three of the SAR observed during the program (listed above) and eight additional SOCC (Table D.3 in Appendix D). The most numerous species included American robin (*Turdus migratorius;* 73 observations), song sparrow (*Melospiza melodia*; 68 observations), and alder flycatcher (*Empidonax alnorum*; 65 observations). Most of the species observed during these surveys are known to breed in the region and were observed in suitable breeding habitat.

A total of 1,128 birds comprising 80 species were detected during spring migration watch count surveys in 2021 and 2022 (Table D.4 in Appendix D). The most numerous species included song sparrow (157 observations), American robin (124 observations), and common redpoll (*Acanthis flammeus;* 102 observations). Most species were observed individually or in smaller groups of 2 - 8 individuals (average group size = 3.7 birds). There was only one observation of a large flock (i.e., > 15 individuals) migrating through the Project Study Area, suggesting that the area is not a significant spring stopover area and is not situated along a major flyway. Most birds were observed on the ground or flying at a low altitude (14% on the ground, 80% in the 0 to 10 m range, 5% in the 10-50m range), with only 1% observed at an altitude higher than 50 m (Figure D.1 in Appendix D). The predominant flight direction during spring migration was north (23% of observations) and northeast (17% of observations).

A total of 4,192 individuals comprising 82 species were detected during fall migration watch count surveys in 2021 (Table D.6 in Appendix D). The most numerous species included European starling (*Sturnus vulgaris;* 840 observations), blue jay (*Cyanocitta cristata*; 563 observations), and American crow (*Corvus brachyrhynchos*; 377 observations). Although most individuals were observed individually or in smaller groups (2 to 15 individuals), there were numerous observations of larger flocks (15-250 individuals) using habitats within or near the Project Study Area. These flocks typically occurred near the coast along Route 14 and were rarely observed flying over or through the Project Study Area. Larger flocks were predominantly composed of resident birds or short-distance migrants such as European starling, blue jay, and herring gull (*Larus smithsonianus*). The predominant flight direction during fall migration was south (22% of observations) and north (22% of observations).



LEGEND:

- 2021 Bird SAR Observations
- Turbine
- Point of Interconnection Option
- Turbine Laneway
- Roads
- Streams/Creeks
- Wetlands (Provincial)
- Power Collection Corridor
- Alternate Power Collection Corridor
- Property Boundary
- Project Area

Managed Area

- Ducks Unlimited Canada, PEI Conservation Agreements
- Nail Pond Natural Area
- Norway IBA
- Pleasant View Cedars Natural Area
- Pleasant View Cedars Woodland Natural Area

ALL WIND FARM INFRASTRUCTURE MAPPING WAS PROVIDED BY INVENERGY LABELLED LAYOUT 016

CLIENT:

Invenergy

wsp

TITLE:

FIELD IDENTIFIED SPECIES AT RISK

PROJECT:

SKINNERS POND WIND ENERGY CENTRE

PROJECT NO:	DATE:
TE211027	MARCH 2023
REV NO: 5	DWN BY: CM
DATUM: NAD83 CSRS 2010	PROJECTION: PEI DBL STEREO

FIGURE:

FIGURE 4.6

SCALE: 1:40,000

0 375 750 1,500

Metres

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Table 4.16: Results of Acoustic Monitoring at Skinners Pond

Common Name	Scientific Name	Priority Status	Detections per Interval Period: Fall Migration (15 Jul – 22 Oct 2021) SM-A01 Intervals Recorded: 296	Fall Migration (15 Jul – 22 Oct 2021) SM-A02 Intervals Recorded: 302	Spring Migration (23 Apr – 27 Jun 2022) SM-A01 Intervals Recorded: 195	Spring Migration (23 Apr – 27 Jun 2022) SM-A02 Intervals Recorded: 60
Alder flycatcher	*Empidonax alnorum*		1	38	8	25
American crow	*Corvus brachyrhynchos*		8	18	24	5
American goldfinch	*Spinus tristis*		0	3	0	0
American redstart	*Setophaga ruticilla*		5	4	0	8
American robin	*Turdus migratorius*		10	37	48	18
American woodcock	*Scolopax minor*		0	0	4	1
Black-and-white warbler	*Mniotilta varia*		0	1	0	0
Black-throated green warbler	*Setophaga virens*		0	0	0	10
Black-capped chickadee	*Poecile atricapillus*		3	12	18	2
Boreal chickadee	*Poecile hudsonicus*	ACCDC: S3	0	0	0	1
Blue jay	*Cyanocitta cristata*		8	17	5	0
Brown creeper	*Certhia americana*		1	0	1	0
Canada goose	*Branta canadensis*		0	1	0	0
Chestnut-sided warbler	*Setophaga pensylvanica*		0	2	0	0
Chipping sparrow	*Spizella passerina*		0	1	2	4
Cedar waxwing	*Bombycilla cedrorum*		0	0	3	0
Common loon	*Gavia immer*	COSEWIC: NAR SARA: NS ACCDC: S1B, S4M	1	0	0	0
Common raven	*Corvus corax*		12	14	0	1
Common yellowthroat	*Geothlypis trichas*		2	2	3	17
Dark-eyed junco	*Junco hyemalis*		2	0	8	0
Double-banded upseet-type warbler call	n/a		1	6	1	0
Duck spp.	n/a		0	0	2	0
Golden-crowned kinglet	*Regulus satrapa*		4	1	0	18
Gray catbird	*Dumetella carolinensis*	ACCDC: S3B	1	0	0	0
Gull spp.	n/a		1	0	0	0
Hairy woodpecker	*Dryobates villosus*		1	0	0	0
Hermit thrush	*Catharus guttatus*		3	1	0	0
Herring gull	*Larus argentatus*	ACCDC: S2B,S5N	2	1	0	0
Killdeer	*Charadrius vociferus*	ACCDC: S2S3B	0	0	0	1
Least flycatcher	*Empidonax minimus*		0	1	0	0
Magnolia warbler	*Setophaga magnolia*		1	0	0	0
Mallard	*Anas platyrhynchos*		0	0	1	0
Mammal spp.	n/a		1	0	1	1
Mourning dove	*Zenaida macroura*		0	0	2	1
Northern flicker	*Colpates auratus*		0	0	2	0

Common Name	Scientific Name	Priority Status	Detections per Interval Period			
			Fall Migration (15 Jul – 22 Oct 2021)		Spring Migration (23 Apr – 27 Jun 2022)	
			SM-A01 Intervals Recorded: 296	SM-A02 Intervals Recorded: 302	SM-A01 Intervals Recorded: 195	SM-A02 Intervals Recorded: 60
Northern saw-whet owl	*Aegolius acadicus*		0	1	9	0
Ovenbird	*Seiurus aurocapilla*		0	0	1	0
Red-breasted nuthatch	*Sitta canadensis*		0	5	1	0
Red-eyed vireo	*Vireo olivaceous*		0	0	1	0
Red-winged blackbird	*Agelaius phoeniceus*		1	0	5	0
Rose-breasted grosbeak	*Pheucticus ludovicianus*	ACCDC: S2S3B	0	0	1	0
Ruby-crowned kinglet	*Corthylio calendula*	ACCDC: S3B	0	0	1	0
Savannah sparrow	*Passerculus sandwichensis*		4	7	8	0
Song sparrow	*Melospiza melodia*		36	32	79	22
Sparrow spp.	n/a		2	4	6	1
Swainson's thrush	*Catharus ustulatus*		1	0	0	0
Swamp sparrow	*Melospiza georgiana*		0	1	0	0
Thrush spp.	n/a		6	8	1	0
Veery	*Catharus fuscescens*	ACCDC: S3B	0	0	0	2
Warbler spp.	n/a		17	19	5	2
White-throated sparrow	*Zonotrichia albicollis*		19	30	16	15
Yellow-bellied sapsucker	*Sphyrapicus varius*		0	0	2	0
Yellow warbler	*Setophaga petechia*		0	4	0	1
Yellow-rumped warbler	*Setophaga coronata*		0	0	2	5

Notes:
NAR = Not at Risk
NS = No Status
M = Migratory Population
B = Breeding population

During the winter resident surveys, a total of 1,871 birds comprising 29 species were found to be overwintering in the Project Study Area (Table D.7 in Appendix D). The most numerous species included snow bunting (*Plectrophenaz nivalis*; 363 observations) and white-winged crossbill (*Loxia leucoptera;* 352 observations) - the latter of which is a SOCC (ACCDC Rank: S3). These species were typically observed in flocks of 20 - 100 individuals in agricultural fields or forested areas of the Project site. Wintering flocks generally travelled throughout the area at low flight heights (i.e., < 25 m).

4.2.4.3 ACOUSTIC MONITORING

Most songbirds migrate at night; therefore migration cannot be assessed using visual surveys alone. Many migrating birds are known to give calls during nighttime migration flights, and although these flight calls are relatively simple (typically just a single “chip” note), they can be distinctive enough to allow identification to species group (e.g., wood-warbler, thrush, blackbird, etc.) and, in cases, to species (Evans 2000; Evans and Rosenberg 1999; Pieplow 2017).

To supplement field surveys and better assess the risks of the Project to birds during migration, passive acoustic monitoring methods were employed during spring and fall migration periods, as recommended in EC (2007).

Acoustic Monitoring Methodology

Two SongMeter SM4 acoustic recorders (“units”; manufactured by Wildlife Acoustics Inc.) were deployed in the Project Study Area from July 15 to October 22, 2021 (fall migration) and April 23 to June 27, 2022 (spring migration). The units (SM-A01 and SM-A02) were mounted to a tree at a height of approximately 1 m, with the units facing east and the two built-in weatherproof microphones oriented to the north and south (Figure 4.5). Due to technical issues, acoustic data on one unit (SM-A02) was lost between the 23 April and 6 June, 2022, during the spring migration period.

The unit was programmed to record on a 25% duty cycle (5 minutes on, 55 minutes off) to monitor throughout the day and night. Manufacturer-recommended settings were applied during monitoring, including a sampling rate of 24 kHz, a pre-amp of 26 dB gain, and a high-pass filter of 220 kHz. Raw data were recorded as WAV files onto two 128 GB SD cards installed in the unit. The WAV files were subsampled into 1-min segments (“sampling intervals”) during data analysis. A subset of the sampling intervals was then reviewed and annotated manually using Wildlife Acoustics Inc.’s Kaleidoscope Pro (Version 5.3.8) software. For each recording unit, the subset consisted of the analysis of three 1-minute intervals per night of monitoring, including the first 1-min interval of the nearest hour after sunset (e.g., 22:00-22:01); the first 1-min interval of the nearest hour before sunrise (e.g., 5:00-5:01); and the first 1-min interval of a randomized hour throughout the night (e.g., 2:00-2:01). Sunrise and sunset times for the location were acquired for each date of the monitoring period from timeanddate.com (Time and Date AS 2022).

Species presence/absence within each 1-min sampling interval was selected as the metric for measuring relative detection frequency per species. This method allowed for a relatively unbiased comparison of species detection rates while avoiding arbitrary and potentially skewed vocalization “counts”. The number of sampling intervals in which each species was detected was then tabulated.

Spectrogram analysis was conducted with guidance from Pieplow (2017). Vocalizations were classified to the lowest possible taxonomic level or species group. It must be noted that the number of vocalizations observed cannot be considered an index of migration passage or residency rates. For instance, some species are more vocal than others and therefore may be detected at higher rates. Additionally, for monitoring occurring during the peak breeding season (June and July), individuals breeding near the unit may be detected repetitively due to frequent production of territorial singing and nest defence vocalizations. Weather conditions and other interference can also affect the rates of bird movement and flight calls and/or can mask vocalizations, thereby reducing detection rates.

During spectrogram analysis, it was noted that some of the audio recordings had moderate to high levels of noise interference from wind, precipitation, and insects. Therefore, the relative noise interference of each sampling interval was scored on an arbitrary scale of 0 - 3 (0 = none; 1 = low; 2 = medium; 3 = high). As noted above, intervals with high noise interference may have lower detection rates.

Acoustic Monitoring Results

Two sampling intervals recorded during the fall migration period and three sampling intervals during the spring migration period were lost due to file corruption potentially caused by the unit’s firmware and/or SD card (pers. comm., Wildlife Acoustics Support Team, 31 Jan 2022). Due to technical issues, acoustic data from SM-A02 was lost from the 23 April to the 6 June, 2022, during spring migration. A total of 598 viable intervals were obtained during the fall migration period and 255 during the spring migration period. Table 4.15 summarizes avian detections throughout the monitoring period. Refer to Table C.7 in Attachment C for a supplementary table summarizing species detections by week.

A total of 47 species and six species groups were detected across the spring and fall migration monitoring periods. Thirteen species (American goldfinch, black-and-white warbler, Canada goose, chestnut-sided warbler, common loon, gray catbird, hairy woodpecker, hermit thrush, herring gull, least flycatcher, magnolia warbler, Swainson's thrush, and swamp sparrow) as well as one species group (Gull spp.) were detected during fall migration that had not been detected during that spring migration monitoring period. Fifteen species (American woodcock, black-throated green warbler, boreal chickadee, cedar waxwing, killdeer, mallard, mourning dove, northern flicker, ovenbird, red-eyed vireo, rose-breasted grosbeak, ruby-crowned kinglet, veery, yellow-bellied sapsucker and yellow-rumped warbler) and one species group (Duck spp.) were detected during spring migration that were not detected during the fall migration monitoring period.

During fall migration, a total of 33 species and five species groups (i.e., thrush spp., sparrow spp., gull spp., warbler spp., and double-banded upset-type call warbler spp.) were detected during the monitoring period. Calls identified to species group showed characteristics of one or more species, which prevented identification to the species level. At least one species/species group was detected in 24% and 50% of the 1-min sampling intervals on acoustic monitors #SM-A01 and #SM-A02, respectively. Although no SAR were detected during fall acoustic monitoring, three SOCC were detected (Table 4.15).

Species diversity peaked in August, with 12 - 14 species/species groups detected per week (Figure D.2 in Appendix D). In late September to early October, a smaller peak in species diversity was noted, with 9 - 11 species/species groups detected per week. A weekly summary of species diversity during fall acoustic monitoring is presented in Table D.8 of Appendix D.

During spring migration, a total of 34 species and five species groups (i.e., duck spp., double-banded upset call warbler spp., sparrow spp., thrush spp., and warbler spp.) were detected during the monitoring period. Calls identified to species group showed characteristics of one or more species, which prevented identification to the species level. At least one species/species group was detected in 51% and 55% of the 1-min sampling intervals on acoustic monitors #SM-A01 and #SM-A02, respectively. Although no SAR were detected during spring acoustic monitoring, five SOCC were detected (Table 4.15).

Species diversity peaked in June, with 7 - 19 species/species groups detected per week (Figure D.3 in Appendix D). A weekly summary of species diversity during spring acoustic monitoring is presented in Table D.9 of Appendix D.

No migrating birds were detected in 62% of the intervals recorded during fall migration and 47% of the intervals recorded during spring migration. However, it should be noted that in 21% of the intervals during fall migration, and 35% during spring migration, relative noise interference was scored as 3 (i.e., High). Therefore, it is likely that some bird vocalizations were masked due to high noise interference, leading to false negatives in the dataset.

4.2.4.4 BIRD SPECIES AT RISK

The following describes the characteristics of the five birds with protection status under the SARA and/or COSEWIC that were detected during the 2021 - 2022 survey program (Figure 4.6).

The bank swallow is a small aerial insectivore, typically feeding on flying insects. Bank swallows nest in burrows in vertical cliffs, banks and bluffs; primarily in lowland areas along ocean coasts, rivers, streams, lakes, reservoirs and wetlands (Garrison 1999). A combination of factors including loss of nesting habitat, reduced availability of insects, and threats encountered along the winter migration route and at overwintering areas in South America are considered the primary threats to bank swallows. The Project Study Area does not contain any suitable breeding habitat for bank swallows, although they may forage in the area.

Barn swallows are insectivorous birds, typically feeding on flying insects in the air. They are associated with human habitation; constructing nests on or in buildings, bridges or other man-made structures (Brown and Brown 1999). Threats to barn swallow populations (and, indeed, most aerial insectivores) are similar to those for bank swallows. While there are no buildings in the Project footprint that may provide suitable breeding habitat, they may forage in the area.

Bobolinks nest on the ground in grasslands and pastures, maintaining a territory size of < 1 ha to 2 ha, depending on habitat quality. In the Maritimes, they are typically associated with agricultural fields (Renfrew et al., 2015). The primary threats to Bobolink are associated with incidental mortality and habitat loss and fragmentation from agricultural practices, as well as pesticide use on breeding and wintering grounds. Suitable bobolink nesting habitat is present throughout the Project Study Area.

Canada warbler is most abundant in moist, mixed forests with a well-developed shrub layer (Reitsma et al., 2009). This shrub layer provides dense cover for the nest, which is typically on or near the ground, often on slopes, knolls, in earthen banks, or rocky areas. They return to Canadian breeding grounds in mid-May or early June; typically nesting from June to early July, with fall migration beginning after that time. The cause of the species' decline is thought to be related to significant loss of wintering habitat in South America.

The lesser yellowlegs is a medium-sized shorebird that breeds in northwestern North America. In Atlantic Canada, these birds occur in greatest numbers during fall migration (peaking from early August to early September) with the occasional occurrence in the region during spring migration. During migration, lesser yellowlegs forage in an array of fresh, brackish and salt-water wetlands, including mud flats, short-grass marshes, beaches, and flooded agricultural fields. Possible causes of decline include habitat degradation, deleterious effects from pesticide use, and hunting by humans on their wintering grounds (Tibbits and Moskoff 2020). The Project Study Area contains suitable foraging habitat (e.g., cat-tail marshes), which the species may use as a stop-over site during migration.

4.2.5 BATS

Three species of bats have been confirmed to occur on PEI, including little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), and hoary bat (*Lasiurus cinereus*). The distribution, abundance, and status of bats in PEI are poorly known, but one study has indicated that little brown myotis and northern myotis are the most abundant and widespread species, while hoary bats are likely uncommon migrants to the Province (Henderson et al., 2009). An additional three species are unconfirmed in the Province, meaning that the species has been detected acoustically but cannot be confirmed due to uncertainty in acoustic species identification (McBurney and Segers 2020). These include Eastern red bat (*Lasiurus borealis*), silver-haired bat (*Lasionycteris noctivagans*), and big brown bat (*Eptesicus fuscus*). Table 4.17 provides a summary of the bat species that may occur on PEI, based on desktop review.

Table 4.17: Bat Species Potentially Occurring on PEI

Common Name (*Scientific Name*)	Conservation Status	Habitat Preference	Potential for Occurrence
Little brown myotis *(Myotis lucifugus)*	COSEWIC: Endangered SARA: Endangered ACCDC: S1 Gen Stat: S1B, SNRM	• Mainly found in forested areas, often associated with human settlement. • Forage for insects in flight, usually over water • Reproductive females may form nursing colonies of many individuals in anthropogenic structures, within tree cavities, and under loose or exfoliating bark, particularly in forested areas near water. • Males and non-reproductive females roost alone or in small groups in buildings, caves, trees, crevices, and under tree bark. • Short distance migrant • Congregate in caves or mines to hibernate (winter hibernacula)	• Likely Present • Known to occur in PEI • Suitable habitat in and near the Project Study Area
Northern myotis *(Myotis septentrionalis)*	COSEWIC: Endangered SARA: Endangered ACCDC: S1 Gen Stat: S1B, SNRM	• Considered a forest-interior species (softwood and hardwood). • Forage for insects along forest edges, over forest clearings, at tree-top level, and occasionally over ponds. • Reproductive females may form nursing colonies within tree cavities or crevices and under loose or exfoliating bark, particularly in forested areas near water. • Roosts solitarily or in small groups in tree cavities or under peeling bark. • Non-migratory • Hibernate in mines and caves.	• Likely Present • Known to occur in PEI • Suitable habitat in and near the Project Study Area
Hoary bat (*Lasiurus cinereus)*	COSEWIC: Endangered SARA: Endangered ACCDC: Status Rank Not Applicable (SNA) Gen Stat: SNA	• Forage in open areas over glades and lakes or in forests. • Roost alone, 3 - 12 m above the ground in the tree canopy, tree cavities, and under peeling bark. • Active above the forest canopy • Migratory	• Likely present • Known to occur in PEI. • Suitable habitat in and near the Project Study Area.
Eastern red bat (*Lasiurus borealis*)	ACCDC: SNA Gen Stat: SNA	• Found in forests, forest edges, and hedgerows. • Forage around streams, ponds, forest edges, and streetlamps. • Roosts in mixed hardwood forests. • Migratory	• Possibly present • Species presence is unconfirmed in PEI. • Suitable habitat in and near the Project Study Area.
Silver-haired Bat (*Lasionycteris noctivagans*)	ACCDC: SNA Gen Stat: SNA	• Found in forested areas, especially old-growth forests. • Roosts under loose bark. • Migratory	• Possibly present • Species presence is unconfirmed in PEI. • Suitable habitat in and near the Project Study Area.

Common Name (*Scientific Name*)	Conservation Status	Habitat Preference	Potential for Occurrence
Big brown bat (*Eptesicus fuscus*)	ACCDC: SNA Gen Stat: SNA	• Found in forested areas, especially deciduous forests. • Roosts individually or in smaller groups under loose bark, in rock crevices, and in anthropogenic structures. • Non-migratory • Hibernates in buildings, rock crevices, caves, or mines.	• Possibly present • Species presence is unconfirmed in PEI. • Suitable habitat in and near the Project Study Area.

Sources:
Acharya and Fenton (1999), Banfield (1974), Barbour and Davis (1969), Barclay (1984), BatCon (2006), Fenton and Barclay (1980), Foster and Kurta (1999), Griffin (1970), Hickey et al., (1996), Hickey and Fenton (1990), McBurney and Segers (2020), Menzel et al., (2005), Moseley (2007), OMNRF (2017), Reddy and Fenton (2003), van Zyll de Jong (1985).
Notes:
[1] Unconfirmed means that the species has been acoustically detected but cannot be confirmed due to uncertainty in acoustic species identification (McBurney and Segers, 2020).

In recent years, bat populations in eastern North America have been devastated by white-nose syndrome (WNS), a disease caused by the fungus *Psuedogymnoascus destructans*. WNS has led to population declines of 90% or higher in many areas, including PEI (COSEWIC 2013). The 2013-2014 season marked the first known instance of WNS in Prince County, PEI (WNS Response Team nd). In areas where WNS has caused significant population declines, the relative magnitude of other threats (e.g., habitat loss, turbine collisions) may be higher because any mortality or displacement of the few remaining individuals can significantly affect the viability and recovery of local populations (OMNRF 2017).

4.2.5.1 ACOUSTIC BAT MONITORING

Passive acoustic survey methods were used to assess presence of bats on the Project site during the spring emergence, summer breeding, and fall migratory / swarming periods. The Song Meter SM4BAT FS Ultrasonic Bat Detector with SMM-U2 Ultrasonic Microphones (manufactured by Wildlife Acoustic Inc.) was used to monitor bat activity in the Project Study Area. This device detects and analyzes inaudible, ultrasonic bat echolocation calls and records them in an audible format (.WAV) on an SD card, providing an opportunity to passively monitor bat activity without human presence or intervention.

Acoustic Bat Monitoring Methodology

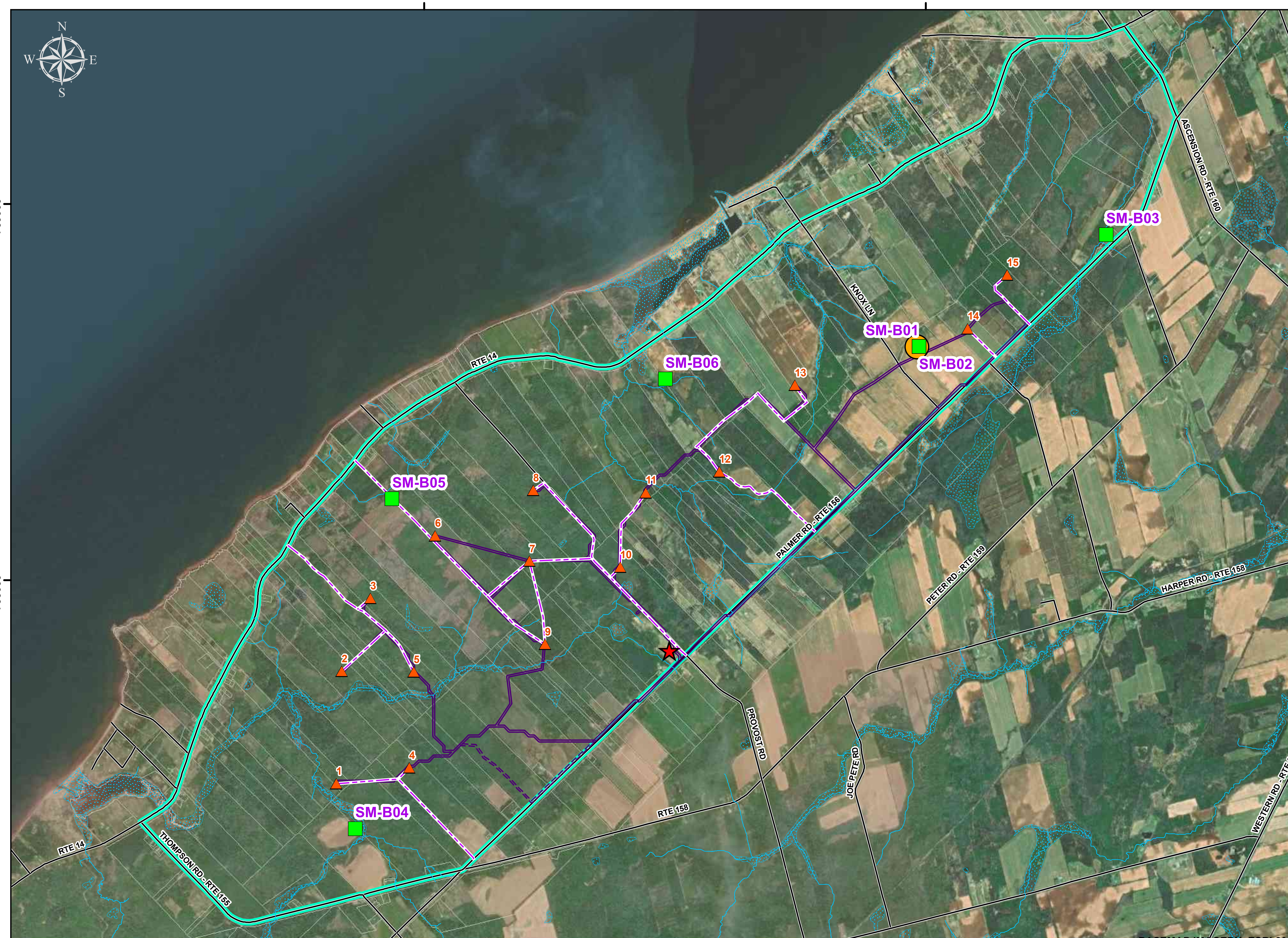
A total of six detectors were deployed at five locations across the site from early July to late October 2021 and mid-May to late June 2022. The locations of the Song Meter bat monitoring stations (SM-B) are illustrated in Figure 4.7.

Five of the detectors were mounted to a tree (four units; detector IDs: SM-B02 to SM-B06) or the onsite meteorological (MET) tower one unit as follows:

- SM-B01: MET Tower at height of 1 m with mic at 2 m;
- SM-B02: MET Tower at height of 1 m with mic at 10 m; and
- SM-B03, B04, B05 and B06: trees at height of 1 m with mic at 2 m.

To maximize detectability of bats, the detectors were sited in suitable habitat with the microphones oriented toward areas with low environmental clutter (e.g., edge of agricultural field). The detectors were programmed to record from 30 minutes before sunset to 30 minutes after sunrise, when bats are most active. The detector sensitivity was set to a manufacturer-recommended level and tested to ensure that the units were properly detecting signals. No high pass filter was applied. The detectors were periodically checked to download data, check batteries, and verify that the system was intact and functioning properly.

Experienced personnel processed the acoustic data and identified bat call sequences (i.e., groups of three or more individual bat calls in sequence) to the lowest possible level (species or genus) using Kaleidoscope Pro software (Wildlife Acoustics Inc.) and following methodology outlined in McBurney and Segers (2020). While many bat species produce distinct calls, other species (such as the two *Myotis spp.* in NS) cannot be reliably distinguished by their vocalizations (McBurney and Segers 2020) and were therefore identified conservatively as "*Myotis spp*." bats. It must also be noted that the number of call sequences does not correlate with the number of bats; one bat may produce several vocalizations over the course of an evening, and conversely, bats may pass by the detector without producing a call. However, while bat presence and activity cannot be quantified, passive acoustic monitoring does provide a useful index of relative bat activity and serves as an indicator of species presence at the Project site.



LEGEND:

- Bat Song Meter (SM-B)
- Turbine
- Point of Interconnection Option
- MET Tower
- Turbine Laneway
- Roads
- Streams/Creeks
- Wetlands (Provincial)
- Power Collection Corridor
- Alternate Power Collection Corridor
- Property Boundary
- Project Area

ALL WIND FARM INFRASTRUCTURE MAPPING WAS PROVIDED BY INVENERGY LABELLED LAYOUT 016

KEYMAP

CLIENT: Invenergy

wsp

TITLE: **BAT SURVEY LOCATIONS**

PROJECT: **SKINNERS POND WIND ENERGY CENTRE**

PROJECT NO: TE211027	DATE: MARCH 2023
REV NO: 1	DWN BY: CM
DATUM: NAD83 CSRS 2010	PROJECTION: PEI DBL STEREO

FIGURE: **FIGURE 4.7**

SCALE: 1:30,000

0 250 500 1,000
Metres

Path: Q:\PROJECTS\TE211027_Invenergy_Canada_EIA_Windfarm_PE\13 GIS\MXD\TE211027_FIGURE_4_6_Bat_SurveyLocations2021.mxd User: candace.macdonald Date: 3/28/2023

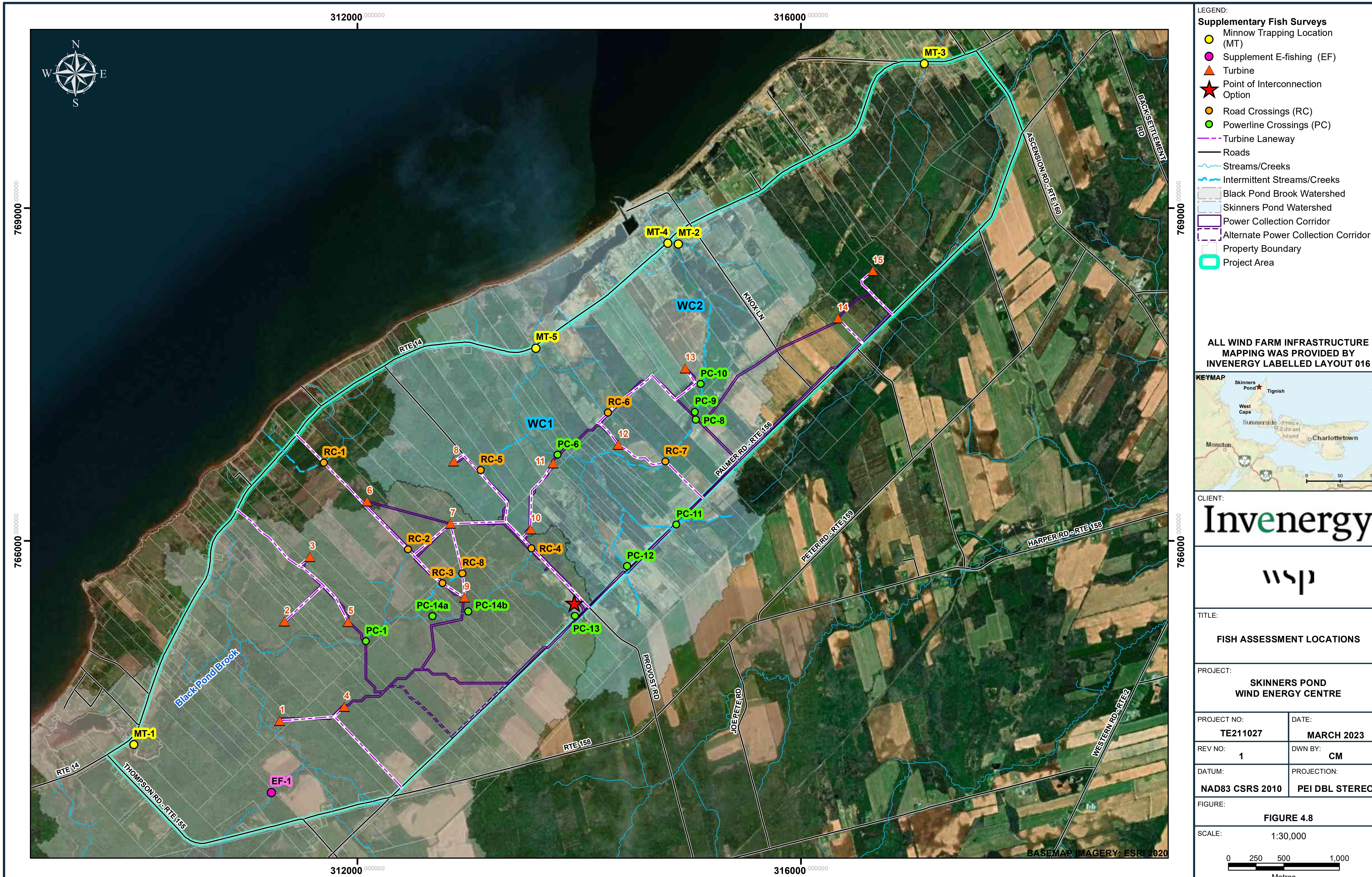
Between 2 July to 22 October 2021, and 18 May to 26 June 2022, out of a possible 906 detector nights (151 nights for 6 detectors), 56 nights were lost due to equipment issues such as battery depletion or corrupted data cards, leaving 850 detector nights of data for the Site. These data are summarized in Table E.1 in Appendix E.

Bat activity appeared relatively low in May and June, with one or two bat call sequences detected by at least one unit on approximately half the monitoring nights (average of 0.1 call sequences/detector/night). A pronounced increase in the number of bat call sequences was observed from July to September with a peak number of calls detected in August, as shown in Figure E.1 in Appendix E. The months of July and September had an average of 0.9 and 1 call sequences/detector/night, respectively, whereas August had an average of 3.2 call sequences/detector/night. In October, activity decreased to 0.7 call sequences/detector/night. The last non-migratory bat was detected on 13 October (*Myotis spp*.) and the last migratory bat was detected on 21 October (hoary bat). As shown in Figure E.2 in Appendix E, the detector with the highest number of bat call sequences was SM-B04, which was located in an agricultural field in the southwest portion of the Project Study Area (near T1). A total of 442 call sequences were recorded at SM-B04 during the monitoring period, which equates to 42% of all sequences recorded across the six detectors. Conversely, the detector with the fewest number of call sequences was SM-B01 (52 sequences; 5% of all sequences), which was located at the onsite MET tower (lower unit).

Of the 1,052 total observations, 62% were produced by *Myotis spp.* bats (little brown myotis and/or northern myotis), 24% by hoary bats, 7% by eastern red bats, and 0.4% by silver-haired bats. Some bat call sequences could not be identified to the species or genus level because they showed characteristics common to two or more species. This included 33 calls identified as *Myotis spp.* / Eastern red bat (3% of all observations); 22 as silver-haired bat/big brown bat (2%); and seven as hoary bat/silver-haired bat/big brown bat (1%). While available literature suggests that Eastern red bat, silver-haired bat, and big brown bat have not been visually confirmed on PEI, it is believed they have been detected acoustically; however, due to uncertainty in acoustic identification, these species are considered to have 'unconfirmed' presence in PEI (McBurney and Segers 2020).

4.2.6 FISH AND FISH HABITAT

Project activities will be located within the Skinners Pond and Black Pond Brook Watersheds. The Skinners Pond watershed includes 16 km of watercourse within a 10.2 km^2 area; the Black Pond Brook Watershed 26 km of watercourse within a 21.59 km^2 area (PEI EECA 2021). There are two unnamed watercourses that flow north across the northeast portion of the site into Skinners Pond. Black Pond Brook flows from the east and southwest of the Site toward Black Pond. These watercourses have multiple branching tributaries that originate within the Project Study Area, or just upstream of Palmer Road, flowing north and northwest across the Site and Route 14. The proposed layout will result in eight turbine laneway crossings (RCs) and nine RoWs for powerline crossings (PCs). A list of watercourse crossing locations are detailed in Table 4.18, illustrated in Figure 4.8, and images presented in Appendix F.



Path: Q:\PROJECTS\TE211027_Invenergy_Canada_EIA_Windfarm_PE\13 GIS\MXD\TE211027_FIGURE_4_7_FishAssessmentLocations.mxd User: candace.macdonald Date: 3/28/2023

Table 4.18: Summary of Watercourse Characteristics

Watercourse Crossing ID	UTM Coordinates		Description	Habitat at Crossing	Fish Observed
	Easting	Northing			
RC-1	411724.08	5199658.81	No channel present upstream or downstream of the crossing. Small amount of ponded water in ditch, no flow or connectivity.	n/a	n/a
RC-2	412484.55	5198877.36	Tributary of Black Pond Brook flowing southwest. Large beaver pond present at headwaters, extending approximately 40 m downstream through the turbine laneway RoW, transitioning to a channelized dead water with silt, sand, and organic substrate and low slope with an average depth of 0.5 to 0.75 m and wet width of 2.5 to 3 m. Habitat assessed; no fish community assessment was conducted as the location was unsafe to e-fish.	Marginal fish habitat, potential for small forage species.	n/a
RC-3	412794.90	5198573.39	Mapped tributary of Black Pond Brook. No channel present in shrub swamp. Evidence of ponding, characteristic of wetland habitat.	n/a	n/a
RC-4	413599.08	5198888.35	Mapped tributary of Black Pond Brook. No channel present in cattail marsh. Wetland habitat extends upstream and downstream within 40 m of the proposed turbine laneway RoW.	n/a	n/a
RC-5	413138.10	5199592.94	Mapped tributary of unnamed WC1. No channel within 40 m of the proposed turbine laneway RoW. Wetland habitat present.	n/a	n/a
RC-6	414285.59	5200110.74	Tributary of unnamed WC1, defined channel with intermittent flow downstream of the centreline of the proposed turbine laneway RoW. No defined channel upstream of the RoW, with headwaters originating in a wetland. Channel flows north towards Skinners Pond. Substrate is predominantly cobble with gravel, sand, and silt. Medium slope with no flow. Average depth 0.2 m, wet width 0.5 to 0.75 m. Assessed the intermittent pockets of water from the centreline to 50 m downstream.	Potential habitat for juvenile brook trout and small forage species.	No catch (302 seconds of electrofishing effort)
RC-7	414805.21	5199668.93	Tributary of unnamed WC1, originating from a wetland. Defined, trench-like agricultural ditch, overgrown with Dogwood and Rose sp. No defined channel or flow upstream from the proposed turbine laneway RoW. Channelizes downstream at the RoW, flowing northwest around agricultural field. Substrate is predominantly silt and sand with organic matter. The channel itself had steep banks which were unsafe to e-fish from, with low slope to the left bank and high slope to the right, bounding the agricultural field. Average depth of 0.45 m, wet width of 0.5 m.	Marginal fish habitat; intermittent agricultural ditch. Potential for small forage species.	n/a
RC-8	412973.43	5198661.81	Mapped tributary of Black Pond Brook. No channel present in shrub swamp. Evidence of ponding, characteristic of wetland habitat.	n/a	n/a
PC-1	412105.01	5198047.66	Tributary of Black Pond Brook with large beaver pond at the proposed power corridor crossing. Beaver impoundment bounded by cattail marsh. Wet width was 40 to 60 m, with and average depth of 0.5 to 1 m. The substrate was predominantly organic matter with silt and a lesser amount of sand. Low slope and no flow. Unsafe to e-fish.	Potential habitat for juvenile brook trout and small forage species.	n/a

Watercourse Crossing ID	UTM Coordinates		Description	Habitat at Crossing	Fish Observed
	Easting	Northing			
PC-6	413831.41	5199730.38	Main channel of unnamed WC1, flowing north to Skinners Pond. Large beaver pond present 40 m upstream of the proposed power corridor RoW. Dead water with an average width of 3 m and wet depth of 0.75 m. Substrate predominantly silt and organic matter with a lesser amount of sand. Low slope to the south by T11 and medium slope to the north.	Potential habitat for juvenile brook trout and small forage species.	No catch (100 seconds of electrofishing effort). One creek chub observed swimming.
PC-8	415078.24	5200047.72	Tributary of unnamed WC1, no channel present in wetland at proposed power corridor RoW, downstream to the southwest 50 m. Small pockets of standing water in wetland.	n/a	n/a
PC-9	415070.85	5200117.07	Tributary of unnamed WC2, no channel present in wetland north of the power corridor RoW.	n/a	n/a
PC-10	415120.85	5200368.21	Tributary of unnamed WC2, ill-defined, intermittent channel with no flow through a cattail marsh. Predominantly sand and silt substrate with some organic material. 0.5 to 1 m wide, 0.1 to 0.2 m deep. High slope.	Potential habitat for small forage species.	No catch (105 seconds of electrofishing effort).
PC-11	414902.45	5199100.36	Tributary of unnamed WC1 originating east of Palmer Rd. Intermittent drainage 40 m upstream. Ditch too steep to enter for e-fishing. The downstream extent to 40 m was a ditch freshly excavated by landowner. Intermittent pockets of standing water present, predominantly fine grain substrate with no flow. Approximately wet width of 1.5 m and wet depth of 0.4 m. Unsafe to e-fish.	Potential habitat for small forage species.	n/a
PC-12	414458.91	5198726.03	Agricultural drainage ditch flowing north into the unnamed WC1 at Palmer Rd. Flow present after storm event. The substrate is predominantly silt with a lesser amount of sand and organic matter. Wet width of 0.3 m and wet depth of 0.2 m. High slope present on agricultural fields bounding the stream.	Potential habitat for small forage species.	One creek chub (211 seconds of electrofishing effort).
PC-13	413989.19	5198277.19	Tributary of Black Pond Brook originating upstream, to the southeast of Palmer Rd. Upstream of Palmer Rd. to 40 m, the channel was 0.5-1 m wide with sand and silt substrate, transitioning to predominantly sand and silt with some cobble substrate to 40 m downstream of Palmer Rd, with a wet width of 3m and wet depth of 0.1 to 0.2 m. Medium slope on either bank with low flow.	Potential habitat for small forage species.	No catch (123 seconds of electrofishing effort).
PC-14a	412705.05	5198275.38	Tributary of Black Pond Brook. Series of beaver impoundments that are unsafe to e-fish. Riparian cattail marsh habitat. Substrate is sand and silt with organic matter. Wet width 1 to 1.5 m with a wet depth of 0.5 to 0.7 m. Low slope, no flow.	Potential habitat for juvenile brook trout and small forage species.	No catch (minnow trapping)
PC-14b	413026.22	5198319.48			n/a
Additional Fish Surveys					
EF-1 (Supplemental E-fishing reach)	411256.96	5196717.11	Tributary of Black Pond Brook that does not intersect with a Project crossing. Connectivity to the Study area is present. Substrate is sand and silt with organic matter. Wet width of 1 to 1.5 m and wet depth of approximately 0.5 m. No to low flow.	Potential habitat for juvenile brook trout and small forage species.	2 brook trout and 1 three spine stickleback (283 seconds of electrofishing effort)
MT-1 (Supplemental Minnow Trapping)	410012.71	5197116.51	Brackish channel upstream of Rte 14, flowing northwest to Black Pond. Fine grain substrate. Wet width approximately 50-60 m, and 1 to 2 m deep.	Potential habitat for juvenile brook trout and small forage species.	38 mummichog and 1 three spine stickleback caught (minnow trapping)

Watercourse Crossing ID	UTM Coordinates		Description	Habitat at Crossing	Fish Observed
	Easting	Northing			
MT-2	414921.87	5201630.45	Small pond to the south of the Stompin' Tom Centre on Rte 14, flowing to Skinners Pond.	Potential habitat for juvenile brook trout and small forage species.	1 three spine stickleback (minnow trapping)
MT-3	417141	5203255	Small, unnamed watercourse flowing north across Rte 14., outside of the Study Area.	Potential habitat for juvenile brook trout and small forage species.	No catch (minnow trapping)
MT-4	414834.32	5201646.78	Tributary of unnamed WC2, flowing north to Skinners Pond, downstream of the small pond by the Stompin' Tom Centre. Assessed the crossing at Rte 14. Substrate is predominantly gravel, sand, and silt with some organic matter. Wet width of 0.5 to 1 m wide and dept of 0.2 to 0.5 m. Slow flow.	Potential habitat for juvenile brook trout and small forage species.	1 brook trout (minnow trapping)
MT-5	413636	5200691	Main channel of the unnamed WC1, flowing north across Rte 14 into Skinners Pond. Predominantly sand and silt with some gravel and organic matter. Wet width approximately 0.5 m and 0.4 m deep. Right bank bounded by horse pasture.	Potential habitat for juvenile brook trout and small forage species.	2 brook trout and 18 three spine stickleback (minnow trapping)

A site visit was undertaken from the 23 - 26 August, 2021, and the 12 - 17 September, 2022, to perform freshwater habitat assessments and fish presence/absence surveys at the identified watercourses within the Project Study Area. Stream characteristics such as width, water level, velocity and substrate type and *in situ* water quality parameters (Table 4.19) were collected to as part of the habitat assessment. Other relevant observations, such as barriers to fish habitat, were recorded.

Table 4.19: Water Quality Data for Watercourse Crossings and Supplementary Fish Assessment Locations

Watercourse Crossing ID	Date	Water Temperature (°C)	Conductivity (µs/cm)	Total Dissolved Solids (ppm)	pH	Flow (m/s)
RC-1	12 Sept., 2022	n/a	n/a	n/a	n/a	n/a
RC-2	14 Sept., 2022	17.5	93	46	5.56	n/a
RC-6	15 Sept., 2022	14.9	251	125	7.07	n/a
RC-7	14 Sept., 2022	19.0	249	125	6.87	n/a
PC-1	13 Sept., 2022	17.8	233	118	6.91	n/a
PC-6	14 Sept., 2022	18.4	272	137	6.40	n/a
PC-10	15 Sept., 2022	13.8	277	140	7.11	n/a
PC-12	14 Sept., 2022	18.4	185	93	n/a	0.08
PC-13	12 Sept., 2022	12.4	365	n/a	6.07	0.13
PC-14a	12 Sept., 2022	17.8	281	n/a	7.16	n/a
PC-14b	12 Sept., 2022	18.7	289	145	7.24	n/a
EF-1	25 Aug., 2021	23.0	194	97	6.06	n/a
MT-1	25 Aug., 2021	26.1	328	164	n/a	n/a
MT-2	25 Aug., 2021	23.3	374	186	n/a	n/a
MT-4	26 Aug., 2021	29.7	358	179	n/a	n/a
MT-5	25 Aug., 2021	18.1	286	144	6.17	n/a
	26 Aug., 2021	18.0	297	153	6.76	n/a

Notes:
n/a no flow or pH not collected due to probe malfunction
RC Road Crossing
PC Powerline Corridor Crossing
MT Minnow trap location
EF Supplementary electrofishing location

Electrofishing in watercourses, where safe, was conducted using a Smith-Root LR-24 backpack electrofisher, and minnow traps (MTs, Figure 4.8) where electrofishing was not possible. Electrofishing in watercourses was conducted in accordance with the standard operational procedures from Scruton and Gibson (1995). The WSP Team initiated sampling at the downstream end of the homogenous segment and slowly worked their way upstream, covering the entire width of the streambed. An intermittent current was applied so as not to startle the fish (Scruton and Gibson 1995).

The watercourses support a variety of minnow species such as threespine stickleback (*Gasterosteus aculeatus*), mummichog (*Fundulus heteroclitus*), banded killifish (*Fundulus diaphanous*), and creek chub (*Semotilus atromaculatus*) as well as brook trout (*Salvelinus fontinalis*) parr whose location is illustrated as EF-1 on Figure 4.8 and Table 4.19. A complete list of fish species recorded is found in Appendix G, Table 1. Beaver activity is extensive throughout the length of Black Pond Brook and the unnamed WC1, which created challenges in fish community assessment. Several beaver dams present barriers to fish passage. Supplementary fishing efforts were conducted at crossings just outside the Project Study Area to compensate for the lack of ideal sampling locations at Project crossings.

Table 4.19 provides a habitat description of each of the watercourse crossings that were assessed, detailing fish community assessment efforts.

No records of aquatic priority species were listed in the ACCDC report.

4.3 SOCIO-ECONOMIC ENVIRONMENT

4.3.1 POPULATION AND DEMOGRAPHICS

Statistics Canada (StatsCan) released data from the 2021 Census Profile in August 2022 (StatsCan 2022). The Census considers each county of PEI a “census division” and further subdivides each division into census subdivisions (CSDs), which correspond to communities, townships and royalties. The Project Study Area is predominantly located within the 104.3 square kilometre (km^2) Fire District (FD) of Tignish. The nearest municipality is the Town of Tignish.

Between 2016 and 2021, the population of the FD remained the same (-0.7% change) while the overall population of PEI increased by 8% during the same time period (Table 4.20).

Table 4.20: Census Population for Study Area

Location	Area (km^2)	2016	2021	% Change
Tignish Fire District	104.3	1812	1800	-0.7
Town of Tignish	5.9	719	744	+3.5
Prince County	2006.3	43,910	46,234	+5.3
Province of PEI	5,681.2	142,907	154,331	+8.0

Notes: Statistics Canada (2021) Canadian Census

Population density for the FD is 17.2 people per km^2, which is lower than that of Prince County as a whole (23 per km^2) as well as that of the provincial average of 27.2 people per km^2. Most of the population is English first (95%) (StatsCan 2022).

The total number of occupied private dwellings in the Project Study Area is 695. Most homes are single-detached houses (655) with an average number of persons per household of 2.6, which is similar to the Provincial average of 2.3 (StatsCan 2022).

The average age of the population is 42.3 years. The employment rate of 59.6% is just slightly lower than the Provincial rate 62.82%. The median after-tax earnings for full time employees in 2020 (2021 data not yet available) was $35,200, similar to the Provincial average ($34,400).

4.3.2 INDIGENOUS COMMUNITIES

There are two First Nations on PEI; the Mi’kmaq communities of Lennox Island First Nation (L’nui Mnikuk) and the Abegweit First Nation (Epekwitk) (Mi’kmaq Confederacy of PEI 2022). The Abegweit Mi’kmaq First Nation is composed of three communities: Scotchfort, Rocky Point, and Morell. The nearest First Nation to the Site, Lennox Island, is located approximately 42 km to the southeast.

4.3.3 LOCAL ECONOMY

The Study Area is bounded by Thompson Road, Palmer Road, Ascension Road and Route 14 which included the unincorporated communities of Waterford, Skinners Pond, and Palmer Road. Nail Pond and Pleasant View are nearby, but outside the footprint.

A review of the 2016 Lot 1 labour force by occupation reveals that agriculture / forestry / fishing / hunting is the largest with 33% of the work force (the 2021 data not yet available). That is followed by construction (9%), manufacturing (8%), and educational services (8%). No local businesses were noted in the PEI Business Directory, however the Stompin' Tom Centre is located on Route 14 in Skinners Pond. It is a museum, restaurant, and events centre. A Fisheries and Oceans (DFO) Small Craft Harbour (SCH) is located in Skinners Pond. It is a core fishing harbour (Harbour number 2071) which means it is critical to fishing and aquaculture industries managed by a Harbour Authority (Government of Canada 2021b).

According to the 2022 assessment performed by WSP Golder, it was estimated that the development, construction and decommissioning of the Skinners Pond Wind Energy Centre could generate approximately $24.9 million in Gross Domestic Product (GDP) contribution, 311 Full Time Equivalent (FTE) person years of employment and $0.6 million in partial government tax revenues for PEI. For direct jobs only, it is suggested that roughly 143 direct FTE jobs are expected to be sustained annually during the construction period of the Project. Finally, total operational impacts could equate to approximately $51.5 million in GDP contributions, 150 FTE person years of employment and 15.1 million in partial government tax revenues (Appendix H).

WSP Golder also found that through the Company's community benefit fund (CBF), Invenergy will contribute up to $49,500 annually (based on a 99 MW Project nameplate), or $1.49 million over the operation of the wind farm to various community initiatives and programs throughout PEI and West Prince (Appendix H).

4.3.4 LOCAL GOVERNANCE, COMMUNITY SERVICES, AND INFRASTRUCTURE

Transportation Infrastructure

Route 14 is a coastal road that begins around Nail Pond and proceeds south along the western coast of PEI and then around West Point coast. As noted in Section 4.3.3 the Site is bounded by Route 14 and three other secondary roads. A dirt road, Knox Lane, traverses the site in a southeast-northwest orientation. The turbines are located on turbine laneways that egress off both Route 14 and Palmer Road.

The nearest airport, Summerside Airport, is located 60 km south-southwest of the Project Study Area (Figure 4.1) in Slemon Park where services are limited to private, corporate, charter, and military clients as well as Slemon Park's aerospace, manufacturing, and training tenants (Slemon Park 2022).

The nearest full-service airport is the Charlottetown Airport, located approximately 100 km southeast of the Project Study Area. It is a public airport featuring two runways (7000 ft and 5000 ft in length), an airline terminal and an adjacent business park with 43 serviced lots. Airlines offering service include Air Canada, WestJet, Swoop, and Flair Airlines (Charlottetown Airport Authority 2022).

Electricity

PEI has the highest percentage of wind-generated electricity of all Canadian provinces at twenty-five percent (25%) of their supply being generated by Island wind farms. The balance is purchased from MECL who imports electricity through a 17 km submarine cable from NB.

Since PEI has such advantageous wind resources, utility-scale wind projects are a viable option for generating additional renewable capacity and energy that can be used both domestically and by exporting it. The additional wind capacity will assist in supporting PEI's increasing electrical load and help the Island reach their 10-year energy strategy goals and objectives (Appendix H).

Cultural/Institutional

There are several churches in Tignish of various denominations. Education is administered by two school districts: the Public Schools Branch and La Commission scolaire de langue française. The nearest schools are Tignish Elementary and Ecole Pierre-Chiasson, and St. Louis Elementary School in St. Louis (Government of Prince Edward Island 2021). The West Prince Holland College Campus is located in nearby Alberton. The University of PEI, Atlantic Veterinary College, Maritime Christian College and other Holland College specialized campuses are located in Charlottetown (Government of Prince Edward Island 2018).

Communication and Radar Systems

The Radio Advisory Board of Canada (RABC) / Canadian Wind Energy Association (CanWEA) Guidelines are used to determine a consultation zone around various types of radio communication and radar systems that may be affected by the proposed wind turbines. Should a consultation zone overlap with the proposed turbine footprint, a consultation process is initiated with the system operator. Additionally, these guidelines provide a mandatory contact list for coordination with agencies responsible for weather radar, navigational radar, national defense, and public safety radio systems.

RABC recommends that wind turbines be located at least 50 km from ECCC Weather Radars (RABC 2020). The nearest weather radars are in Chipman, NB; Marion Bridge, NS; and Halifax, NS which are all well outside this radius (ECCC 2022b).

The RABC also recommends that consultation with the Department of National Defence (DND) and ECCC take place early in the development of a wind farm. Wind farms that lie within the direct "line of sight" to radar systems can create various forms of interference. Though all tall structures can interfere with radar, wind turbines are of unique concern as their rotating blades can mimic that of an aircraft, with the potential to create clutter for a radar system. Predictive modeling is consequently based upon the coverage footprints and sensitivities of the individual system(s) that is being analysed, whether e.g., DND radar or Air Traffic Control (ATC) radar. An additional consideration in this analysis is that wind turbines can rotate 360° to accommodate wind direction, changing the radar cross section (RCS) accordingly (RABC 2020).

The Project is located far enough from any private or public airport (60 km from Slemon Park) that it is not anticipated to affect air traffic systems where a 10 km consultation radius is recommended (RABC 2020). ECCC Guidelines suggest that a distance of more than 50 km is generally not observed in radar data but can be visible in some conditions and that proponents should notify ECCC (ECCC 2022c).

For general communication, the Study Area has Long Term Evolution (LTE) technology coverage for mobile and internet capabilities typical of the Maritime provinces.

Frontier Power Systems has completed an assessment of potential impact on radio communication and radar systems. This assessment was conducted using the guidelines prepared by the RABC and the Wind Energy Association of Canada, in the document: Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems (RABC 2018).

The RABC/CanWEA Guidelines are used to determine a consultation zone around various types of radio communication and radar systems that may be affected by the proposed wind turbines. If a consultation zone overlaps with the proposed turbine layout, a consultation process is initiated with the system operator. Additionally, these guidelines provide a mandatory contact list for coordination with agencies responsible for weather radar, navigational radar, national defense, and public safety radio systems.

No concerns were found for cellular, public radio broadcasting, television broadcasting, or most known point-to-point radio communications. No negative impacts are anticipated for any point-to-point radio systems outside wireless internet services. Additionally, no negative impacts are anticipated for broadcast transmitters, over-the-air reception, cellular and land mobile radio systems and public radio systems, public safety radio broadcasting, or Environment Canada weather radars.

From survey responses to date, no negative impacts are expected on other radar and communication systems. There are still outstanding responses from mandatory contact list and additional information received will be updated. A survey of local satellite systems was undertaken during the Nov 10-11, 2022 surveys. Impacts on satellite television systems were evaluated and there are no expected negative impacts of the Project on these systems for users of satellite television.

Surveys conducted on November 10-11, 2022, identified wireless rural internet subscribers within the project Study Area whose wireless internet connection could be impacted. Providers of wireless internet services in the area are Bell and Xplore (formerly Xplornet). Both companies maintain broadcast towers within 5.5 km of turbines. The study has concluded that multiple internet subscribers within the local area could theoretically be impacted by the installation of turbines and consequently the two providers were notified. As of the date of this report Bell has not responded with formal recommendations, although they have acknowledged the inquiries made. Xplore had no recommendation to provide. Generally, potential impacts of wind turbines on wireless internet services have not been investigated by the wireless internet industry.

Since it is possible that wind turbines may cause adverse impacts on wireless internet subscribers in the Project Study Area, and in the absence of input from area internet providers, Invenergy will take seriously any received complaints about signal issues that arise for local residents and investigate to ensure any adverse impacts on this critical modern service that are attributable to the Project are mitigated for the local population.

The Assessment of Potential Impact on Radiocommunication & Radar Systems for this Project was provided by Frontier Power Systems (Appendix I).

Health and Emergency Services

The Study Area is covered by a province-wide 911 service. Medical services in the area are provided by the Western Hospital, located 20 km south of the Site. It is a 27-bed community hospital in Alberton that provides emergency, inpatient, ambulatory and palliative care service. The Prince County Hospital in Summerside is the second largest acute care hospital in the Province. The 110-bed facility provides emergency, inpatient and ambulatory care services (Health PEI 2022).

The Tignish volunteer fire department serves the region around the Site (PEIDJPS 2022). Policing of the area is under the jurisdiction of the Royal Canadian Mounted Police (RCMP) detachment located on Route 2 in Rosebank (RCMP 2022), approximately 25 km southwest of the Site.

The Veteran Farmer located in Waterford (Figure 4.1) is a community wellness clinic that provides mental health services, including cannabis prescriptions, to veterans of PEI (The Veteran Farmer nd).

4.3.5 LAND USE

The Project is predominantly located within 104.3 square kilometers (km^2) Fire District (FD) of Tignish. The Project Study Area is bounded by existing roads (Thompson Road, Palmer Road, Ascension Road and Route 14) lined with residential homes and a few commercial properties. One unpaved road, Knox Lane, traverses the project Study Area itself with one home; this road will not be used for access to the Project footprint. An old logging road(now privately-owned) that crosses the project Study Area, John O'Haron Road, will be incorporated as a turbine laneway as part of the Project footprint. Its entrance from Palmer Road marks the site of connection to the main power grid (Figure 4.1). Most of the area is shrubby and forested with agricultural fields centrally concentrated around Knox Lane and lining the roads. Stompin' Tom Road is used to access the Skinners Pond DFO SCH from Route 14, outside the Project Study Area's perimeter. Current land use is primarily agriculture, forestry, and the enjoyment and personal recreation of the owners. With the exception of the small area occupied by turbines, the turbine laneways, and the area around the substation, no change of land use for landowners is anticipated or required.

Land uses on the lands that the Project will be sited on are not anticipated to change or be affected by the Project. Agricultural operators will continue to use the land to farm produce such as potatoes. Residents and recreational land users may experience some nuisance effects from noise or traffic during Project construction and potentially during operations from noise or shadows created by the turbine blades.

4.3.6 VISUAL LANDSCAPE

The terrain of PEI is a predominantly flat to moderately undulating plain, best described as gently rolling (Agriculture Canada 2006). The Project Study Area mostly consists of shrubby and forested terrain with agricultural fields concentrated near Knox Lane and lining the roads. The current land use is primarily agriculture, forestry, and recreational usage by landowners. A representation of the potential impacts to the visual landscape for this Project was provided by Frontier Power Systems (Appendix J).

4.3.7 PUBLIC SAFETY

There are several potential safety issues for both the public and onsite workers. The potential hazards from the construction and decommissioning phases are limited to the contractors, as the public will be prevented from accessing the Site. The exception to this would involve the transportation of materials to and from the Site which extends the spatial boundaries to include other public roads. Any special permits required for the delivery of turbine components using overweight or non-compliant trucking configurations will be obtained.

The potential hazards from the operation phase include maintenance activities, the potential formation of ice on the turbine blades (ice shedding), and the potential for breakage of turbines or turbine blades. Maintenance hazards are limited to workers, but the other scenarios pose a risk to anyone that may be near the Site. Structural failure of the turbines and rotors is a rare event but can be caused by material fatigue, rotor over-speed, poor maintenance or lightning strikes. There are also potential issues regarding human health, such as shadow flicker and excessive noise levels.

As prescribed in provincial regulations, the distance from turbine locations to nearest residences is generally greater than 4x turbine height which will provide an appropriate setback from residential infrastructure and the potential for interaction with the public is minimal. Two residents will be within the 4x height setback objective and have provided their agreement to the proposed turbine locations. The nearest distance to any habitation or public road is greater than 600 m.

4.3.7.1 SHADOW FLICKER

Shadow flicker is the term used to describe the moving shadow cast by the moving rotors which causes a flickering effect. The rotating blades cause an abrupt change between light and dark which can occur at different frequencies depending on the speed of the rotation. Rotation speed is a function of the wind speed and the size and type of the rotors. If this shadow is cast on occupied buildings, the people inside can be disturbed (Gipe 1995; in BLM 2004). For shadow flicker to occur, the sky must be clear, the turbine must be operating, and the turbine rotor must be located with an unobstructed line of sight from the receptor to the sun. The occurrence depends both on the location of the observer relative to the turbine and on the time of day or of the year. Shadow flicker is only present at distances of less than 1400 m from the turbine (Massachusetts Department of Environmental Protection 2012).

While most people are unaffected by shadow flicker, there have been reports of people being negatively affected, including the development of psychological problems. These reports are mainly from Europe, where people live close to wind farms, and wind turbines have been in operation for a long time. In addition, a more recent report (Massachusetts Department of Environmental Protection 2012) states that there is limited scientific evidence to suggest an association between annoyance from prolonged shadow flicker and potential mental and physical health effects. Early wind turbines were generally smaller, and some models had only two blades. Both features can result in very rapid shadow flicker. Modern wind turbines such as those proposed for the Project use slower turning three wing rotors with very low blade-passing frequencies.

Shadow flicker is considered an important issue in Europe, but not the US. One reason for this is the geographical location (latitude). The American Wind Energy Association (AWEA 2010) states, that shadow flicker is not a problem for the US for most of the year, except for Alaska, where the sun is low in the sky for most of the year.

While there are no legal limits to the exposure to shadow flicker, a judge in Germany responded to a complaint about the “nuisance” with setting 30 hours of exposure to shadow flicker per year as an acceptable limit. Considering that shadow flicker only occurs when there is both bright sunlight and wind, the probability for shadow flicker is much reduced. There are various mitigation measures that may be employed if shadow flicker presents a nuisance. The measures are tailored to the specific situation and may include different means to block the line of sight to the turbines causing flicker. Under exceptional circumstances, it may be appropriate to contemplate alternative measures pertaining to operations carried out during the episodes, such as "curtailment" which is shutting down turbines at strategic times to reduce shadow flicker at a receptor. Considering the few hours of exposure analyzed in the study, the chances of having to resort to this type of measurement remain very low.

4.3.7.2 ELECTRIC AND MAGNETIC FIELDS

There has been public concern expressed in the past over potential health implications from electromagnetic fields (EMFs) from electrical power transmission and distribution lines. Health Canada has issued an opinion on the subject (Health Canada 2008). It is the opinion of Health Canada that health risks to the public from exposures to power-frequency EMFs have not been established, and a warning to the public to avoid living near or spending time in proximity to power lines is not required (Health Canada 2008).

4.3.8 HERITAGE AND ARCHAEOLOGICAL RESOURCES

The objectives of an Archaeological Impact Assessment (AIA) are to identify, inventory, and evaluate all sites of archaeological, historical, and architectural significance within the Project impact area and to assess the potential impact on these archaeological and heritage resources. The Project Study Area will include the site clearing areas, turbine foundations, collector lines, turbine laneways, turning radii and crane pads. The objectives of an AIA are accomplished via a four-phase process:

- Phase 1: Background desktop review (documentary research, Regulator consultation).
- Phase 2: Field examination (visual surface survey, informational interviews).
- Phase 3: Field evaluation (archaeological field survey).
- Phase 4: Significance determination, impact assessment, mitigation, and contingency plan.

This four-phase process is approached sequentially and involves decision points along the way. While these steps are initially addressed in a linear fashion, they are iterative as circumstances commonly arise during the course of investigations that may require previous phases to be revisited. The methodology used for each phase is determined based upon the results obtained in the preceding phase.

4.3.8.1 PHASE 1 BACKGROUND DESKTOP REVIEW

Phase 1 background research was undertaken for the proposed Project Study Area in order to assess the potential for heritage resources. The documentary research included the following:

- Reviewing present-day and historic aerial photographs and topographic maps;
- Reviewing previous archaeological surveys conducted in the area;
- Reviewing documentation on existing identified heritage sites in the vicinity;
- Conducting a literature review of archaeological literature sources;
- Consulting with the Provincial Archaeology Regulator (Lori St. Onge, acting Director, Indigenous Relations Secretariat (PEIIRS) & Colleen Curran, Reconciliation Coordinator, PEIIRS);
- Identifying any National or Provincial historic sites or designations in the area; and

- Conducting a literature review of available historical literature sources.

Potential Indigenous Archaeological Resources

A review of previous archaeological investigations offers insight into the lifeways of past populations. Human occupation of the Maritime provinces dates back as far as 9,000 to 11,000 years ago. There are no registered precontact sites within the Project Study Area. However, the lack of registered sites may simply reflect a shortage of archaeological research rather than the absence of archaeological resources. In 1984, an archaeological survey of Prince County was conducted by Anna Sawicki of the University of Prince Edward Island. The survey focused primarily on coastal areas and included limited subsurface testing at Skinners Pond and Black Pond. No archaeological resources were identified at either location. However, the survey report concluded that "more attention to interior regions" is required to provide a better "representative inventory of archaeological sites in West Prince County" (Sawicki 1984: 19).

Lithic remains (stone tools) associated with this Palaeoindian culture have been found at a number of sites in northeastern PEI, including the Jones site (CcCq-3), Basin Head (CcCm-6), and Greenwich (CcCp-7) (Deal 2006; Keenlyside 1982; Maloney 1973).

Coastal erosion and rising sea levels over subsequent millennia mean that the oldest shoreline encampment sites in many parts of the Province have long since been submerged. However, surviving precontact coastal shell midden sites provide important information on past diet and subsistence regimes. For example, excavations at the 2,000-year-old Pitawelkek site (CdCw-5) in Malpeque Bay unearthed a variety of mammal (terrestrial and marine), fish, and bird bones, as well as charred seeds, preserved among the mounds of discarded shellfish remains (Kristmanson 2019). Beaver incisors, some of which show evidence of having been modified to use as tools, have been recovered at the precontact Pitawelkek, South Lake (CcCm-12), Greenwich (CcCp-7), and Rustico Island (CcCt-1) sites, among other locations (Curley et al., 2019). Their presence demonstrates that people were accessing resources from wetland environments.

The high density of archaeological sites along the north shore of the Island also highlights the significance of marine resources in the precontact period (Keenlyside and Kristmanson 2016). An analysis of the faunal material from Pitawelkek revealed that the site’s occupants hunted marine mammals, including harbour seal, grey seal, harp seal, and walrus (Kristmanson 2019). Walrus were abundant in the southern Gulf of St. Lawrence before they were hunted to extirpation by the end of the eighteenth century (Hogan 1986). Another shellfish midden, at the Rustico Island site, contained a walrus jawbone with evidence of butchering marks (Leonard 1996). Closer to the Project Study Area, the northwest coast of PEI is known to have been an important seal and walrus hunting area. In particular, Seacow Pond (10 km to the northeast) has been described as one of the three major walrus hunting grounds in PEI (Hoffman 1955).

The preservation of Mi’kmaw placenames reflects their longstanding presence in PEI. The Island itself is known as Epekwitk, meaning “Cradled above water,”or Menigu meaning “The Island” (Sable and Francis 2012; Mi'gmaq-Mi'kmaq Online [MMO] 2019). The Mi’kmaw name for the Tignish River, approximately 6 km east, is Mta'qanejk or “paddle place” (MCPEI 2020). In 2020, Mta'qanejk was among nine places around PEI to receive official signage in the Mi’kmaw language in recognition of the area’s “historic significance to the Mi’kmaq” (Jenkins 2020). Miminegash, approximately 7 km south of the Project Study Area, is known in Mi'kmaw as Elminikej, meaning 'Let us carry something animate on our shoulders' (MCPEI 2020).

Documentary evidence attests to Mi'kmaq living in the vicinity of the Project Study Area in the late-eighteenth century. Nineteenth-century parish records, from the Mission of St. Simon and St. Jude, make reference to an "Indian settlement" called Mtagunechk on the northwestern shore of the Island at that time (MacDonald 2007).

The physiography of an area is also useful in determining archaeological potential. Coastal locations, rivers, lakes, and wetlands provided access to valuable food and other resources, while habitation sites would have required a nearby potable water source. Watercourses, including Black Pond Brook and Little Miminegash River, also served as transportation routes in the past. As such, marine shorelines, riverbanks, and areas in proximity to wetlands are considered to exhibit high potential for heritage and archaeological resources from precontact through historic time periods. Furthermore, surviving trails and roads may correspond with precontact portage routes and historic habitation sites (Keenlyside and Kristmanson 2016). Elevated terraces, strategic vistas, and plateaus also hold potential for Indigenous archaeological resources, as they may have been used during precontact times as look-out sites for travel, hunting, and monitoring animal migrations. Finally, potential indicators of past shorelines must be considered, since changing sea levels over the past 11,000 years mean that coastal early Holocene sites dating to the Palaeoindian (ca. 12,000–9,000 years before present (BP)) and Archaic (ca. 9,000–3,000 BP) Periods will not align with present-day coastlines.

Based on the background review of previous archaeological work, placename evidence, historical accounts, and maps depicting the local physical environment, the Project Study Area has been determined to exhibit elevated potential for Indigenous archaeological resources in areas situated in proximity to Black Pond Brook, other watercourses, and wetlands.

Potential Historic Heritage/Archaeological Resources

Early French attempts to settle PEI proved relatively unsuccessful prior to the eighteenth century. Christened Île Saint-Jean, by Samuel de Champlain in 1604, the Island was first granted to Nicholas Denys in the mid-1600s (Harvey 1926). In 1663, Île Saint-Jean was re-granted to Sieur Doublet, a captain in the French navy (Campbell 1875; Harvey 1926). Despite these efforts, the Island saw only sporadic visits by fisherman and traders throughout the sixteenth and seventeenth centuries (de Jong 1973). In 1719, Île Saint-Jean was regranted to the Comte de Saint Pierre, First Equerry to the Duchess of Orleans, and the Island's first permanent settlement was founded at Port la Joye (present-day Charlottetown) (Harvey 1926). A 1735 census recorded eight Acadian settlements on Île Saint-Jean, with the westernmost located at Malpeque Bay (Warburton 1923). By 1752, the Malpeque community comprised more than thirty-two households with over two hundred inhabitants (Belmont Women's Institute 1973).

In 1758, during the Seven Years' War, the British gained control of PEI and began deporting many of the original Acadian inhabitants. Although its remote location on the west side of the Island reportedly spared Malpeque from the worst of the Expulsion, most of its families likely fled the Island by the fall of 1758 (Lockerby 1998). The 1763 Treaty of Paris officially ceded the Island to the British Crown and initiated the process of redistributing the land among British landowners (PEIECO 2019). From 1764 to 1766, Captain Samuel Holland, Surveyor General of British North America, surveyed the Island and divided it into 67 numbered lots (Boylan 1973). These lots were then granted to influential English landowners (Acadian-Cajun Genealogy & History 2012). The Project Study Area is located in Lot 1, which occupies the northwest tip of the PEI. In July 1767, the entirety of Lot 1 was granted to Phillip Stevens, Esq., Secretary to the Lords of Admiralty (Island Register 2022).

Although the 1763 Treaty included provisions for the return of displaced Acadian families, a 1768 census listed only ten Acadian families living at Malpeque (Lockerby 1998). Furthermore, British settlers began moving into the area. In 1771, Chief Justice John Duport reported the arrival of approximately 70 new settlers at Malpeque (Warburton 1923). Tensions with the British newcomers, combined with high rents imposed by absentee English landlords, served to push many Acadian families out of the area (Cyr 1989).

In 1799, eight Acadian families left Malpeque to establish a new community at Tignish (Porter 1990). The settlement occupied an area east of present-day Tignish, which is now a registered historic site known as The Green. In 1801, an additional seven Acadian families arrived from Malpeque (Porter 1990). The Acadian settlement represented the first Euro-Canadian community in this part of PEI. The northwest part of the Island had previously been considered too remote for settlement and was described as such by Samuel Holland during his 1764 survey of the area (Cran 2000).

Settlement of Lot 1 continued with the arrival of the Irish in 1811. With the Acadian families firmly established around The Green, the first Irish settlers occupied the Nail Pond area, approximately 5 km north of the Project Study Area (Island Narratives Program 2022). The influx of Irish persisted over the decades that followed, reaching approximately 34 families around Nail Pond, Tignish, and Waterford (O'Grady 2004). By 1830, the settlement at Tignish consisted of two areas of scattered homesteads distributed near the shore and loosely connected by a primitive road, while travel to other parts of PEI was accomplished primarily by boat (Cran 2000).

The early Acadian and Irish settlers around Tignish did not own the land on which they lived. Although the proprietorship of Lot 1 changed several times, ownership rights continued to rest in the hands of absentee landlords. The area's isolated location, combined with a prolonged landownership dispute between the families of Sir Samuel Cunard and James Bardin Palmer, hindered the collection and enforcement of rent from area residents (Robertson 2020). In 1840, however, the Great Western Road (modern Route 2) reached the Tignish area, making it more accessible to the rest of PEI (Murray 2008). The following year, an agreement was struck between Edward Cunard and the Palmer family to divide the ownership of Lot 1 equally between them (Robertson 2020). Edward and Charles Palmer retained the western portion of Lot 1, which includes the Project Study Area. Present-day Palmer Road (Route 156), along the east boundary of the Project Study Area, as well as the community of Palmer Road were named after the Palmer family (Island Register 2022).

A review of historic maps provides insight into the development history of the Project Study Area and its environs. Ball's 1853 map identifies the property boundaries and landowners of all the properties within the Project Study Area. The map also depicts an unnamed road that corresponds with modern Palmer Road, indicating that it was in place at that time. However, there is no road shown along the shore, and no structures are depicted on any of the properties. By 1863 however, Lake's map not only depicts the shore road, but also identifies several structures along both the shore road and Palmer Road. There is no settlement or development identified within interior portions of the Project Study Area, with the exception of a sawmill along Black Pond Brook, located outside of any proposed Project impacts. Meacham's 1880 map also identifies structures along Palmer Road and the shore road which it identifies as Horse Head Road; the sawmill on Black Pond Brook still identified. Based on an overlay of the Project Study Area on the Meacham map, none of the proposed impacts intersect with a potential feature, although there are several structures depicted along Palmer Road that may be located within the proposed power collector corridor.

Based on the background review, the Project Study Area was determined to exhibit elevated potential for historic archaeological resources in areas situated in proximity to historic roads, including Palmer Road and what is now known as Route 14.

Five registered Historic Places are located within 5.0 km of the Project Study Area (Parks Canada 2020):

- Immaculate Conception Roman Catholic Church;
- Gaudet Lodge;
- The Government of Canada Building;
- St. Simon and St. Jude Roman Catholic Church; and
- The Convent of Notre Dame-des-Anges.

The Immaculate Conception Roman Catholic Church is located across Palmer Road from the southeastern corner of the Project Study Area, at 986 Palmer Road. The church is a French Gothic Revival style structure on well maintained grounds. It was built in the late Victorian period (1891-1893) by Dunstan Martin. The historic place designation, which includes the footprint of the building and the associated parish grounds, recognises the church as a fine example of the French Gothic style of architecture in PEI and is significant as a symbol and centre of the community's religious life.

Gaudet Lodge is located approximately 5 km east of the Project Study Area, at 197 Dalton Avenue, Tignish. The 2.5-storey house, with Cottage and Queen Anne Revival style elements, was built shortly after the 1896 Great Fire of Tignish for Senator/Doctor Patrick Charles Murphy. The historic place designation, which encompasses the footprint of the building, recognises the site's significance as one of the few surviving residences designed by PEI architect William Critchlow Harris (1854-1913). In 1927, the house was owned by the first Acadian Lt. Governor, Joseph A. Bernard (1945-1950). In the late 1950s, the building was operated as a rooming house and restaurant.

The Government of Canada Building is located approximately 5 km east of the Project Study Area, at 289 Church Street, Tignish. The French-Romanesque-style structure was designed by David Ewart, Chief Dominion Architect, built between 1911 and 1912. The historic place designation recognises the building's architectural style, contribution to the streetscape, and use as a post office. Built following the destruction of the original post office in the Great Fire of 1896, the new post office's brick construction and French-Romanesque style, with distinctive corner clock tower, were characteristic of Ewart's designs and intended to enhance the visual impact of the Canadian government in a small community such as Tignish. This well-preserved structure continues to function as a post office and remains the only Ewart-designed French Romanesque building in PEI.

The St. Simon and St. Jude Roman Catholic Church is located approximately 5 km east of the Project Study Area, at 208 Maple Street, Tignish. The church was built between 1859 and 1860, under the direction of Father Peter McIntyre, following a design by famed New York ecclesiastical architect Patrick Charles Keely (1816-1896). The historic place designation recognises the building's High-Gothic architectural style, its association with Keely, and its contribution to the Town of Tignish. This substantial edifice, constructed using over 500,000 bricks, replaced a wooden church built by community members at The Green in the late 1820s.

The Convent of Notre Dame-des-Anges is located approximately 5 km east of the Project Study Area, at 206 Maple Street, Tignish. The 3.5-storey structure opened in October 1868 as a convent and girls' school operated by the Sisters of the Congregation de Notre Dame of Montreal. The Historic Place designation encompasses the footprint of the building and recognises the Georgian architecture and its association with the religious heritage of Tignish. The school, which later admitted boys as well, remained in use until January 1966, while the convent operated until 1991. More recently, the building has been restored and opened as the Tignish Heritage Inn.

4.3.8.2 PHASE 2 FIELD EXAMINATION

The objective of the field examination (visual surface survey) is to obtain first-hand exposure to the physical geography of the Project Study Area to aid in the early identification of potential heritage resource locations. The archaeological visual survey involves a close examination of the surface of the impact area and vicinity, paying particular attention to subsurface exposures, watercourse erosional faces, forest clearings, historic roads and other areas indicated as having elevated potential from Phase 1 investigations and archaeological modeling. For this Project, areas of particular interest included historic roads, watercourses and forest clearings.

Proposed Project Impact Areas were surveyed over several days between the 12 September and 6 October, 2022, by WSP's Archaeological Field Team (Lisa Atkinson, Darcy Dignam, Russell Dignam and Julie Smith) under the direction of permit holder, Darryl Kelman. Field tablet computers equipped with GPS were used to collect tracklog and waypoint information. Satellite reception was variable, but sufficient to conduct the visual survey. No unregistered archaeological sites were found within the Project Study Area. Five areas with elevated potential for archaeological or heritage resources were identified during the field examination (Figure 4.9). The areas were identified as High Potential Areas (HPA) 1 through 5; photographs are available in Appendix K.

HPA1 is located along the northwest bank of the watercourse identified on historic maps as Black Pond Brook, which empties into Black Pond along the coast. Although the watercourse has been influenced and modified by beaver activity within the Project Study Area, the bank on the northwest side features a gently-sloped terrace that would have been suitable for both short- and long-term occupation (Photograph 1, Appendix K). As a result, the area is considered to exhibit high archaeological potential for precontact resources.

HPA2 is located along the south bank of the watercourse identified on historic maps as Black Pond Brook, which empties into Black Pond along the coast. The area is currently being used for a modern camp. Although the watercourse has been influenced and modified by beaver activity within the Project Study Area, the bank on the southside features an extended level terrace that would been suitable for both short- and long-term occupation (Photograph 2). As a result, the area is considered to exhibit high archaeological potential for precontact resources.

HPA3 is located in a field along Palmer Road (Route 156). Historic mapping indicated the possible presence of a building in this area (Allen 1880). Field reconnaissance identified a subtle depression in the field in the approximate location of the historic structure shown on Meacham's map (Photograph 3). There was no observable evidence of extensive post-occupation disturbance, such as ploughing or infilling. As a result, the area around the depression is considered to exhibit high archaeological potential for historic resources.

HPA4 is located along the northeast bank of an unnamed watercourse that drains a wetland. The area consists of a relatively-level terrace adjacent to the watercourse, which would have been suitable for both short- and long-term occupation (Photograph 4). As a result, the area is considered to exhibit high archaeological potential for precontact resources.

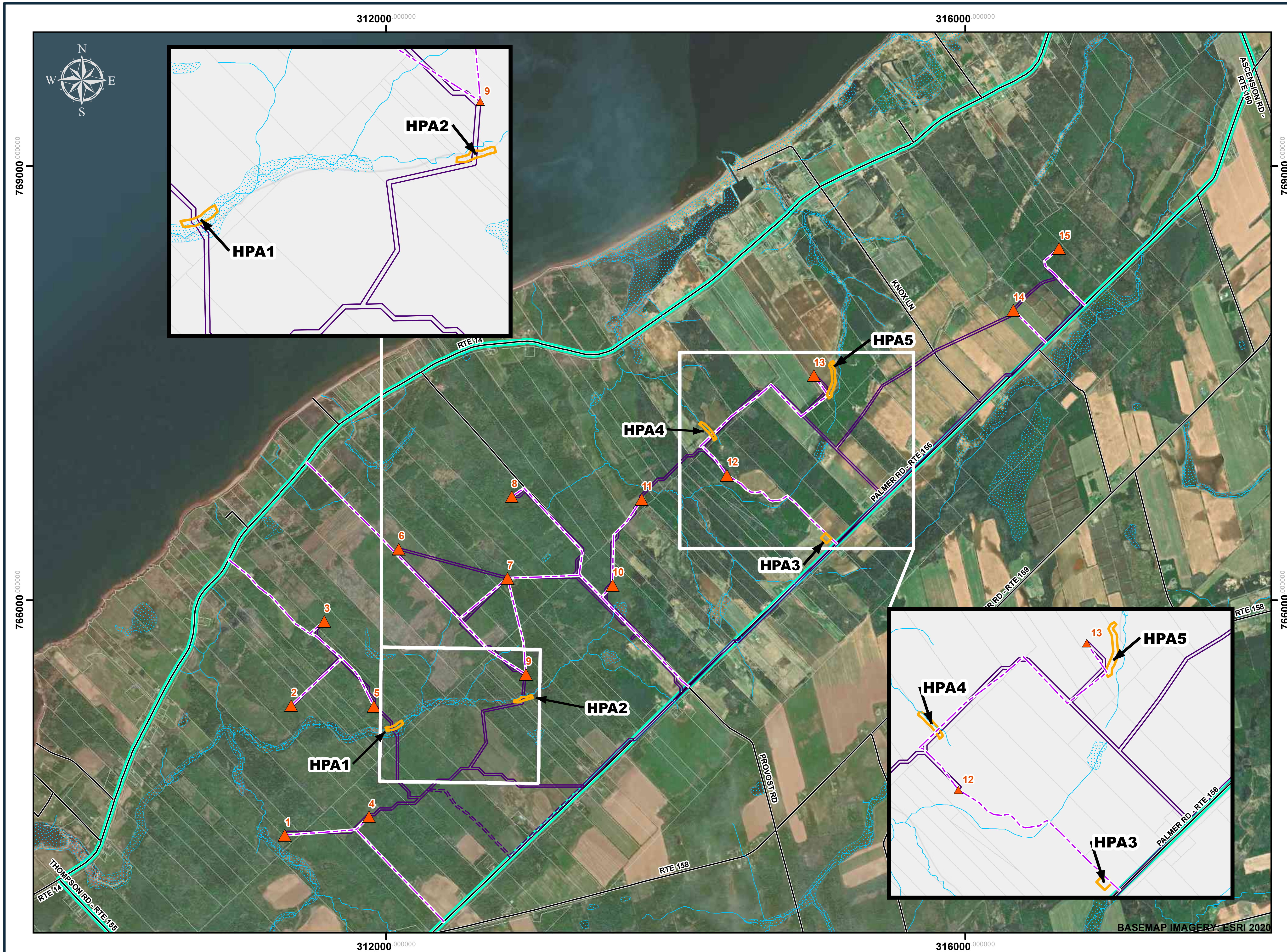
HPA5 is located along an elevated ridge adjacent to a shallow valley with a small watercourse running along the base. Based on the shape and depth of the valley, it is possible that a more significant watercourse ran through the valley at some point in the past (Photograph 5). As such, the level area is considered to exhibit high archaeological potential for precontact resources.

Ground disturbance within any of the above-listed HPAs should be preceded by a program of archaeological shovel testing to determine whether archaeological resources are present.

The remainder of the Project Impact Area is considered to exhibit low potential for archaeological or heritage resources. Proposed power collector and turbine laneways pass through a variety of environments including forests, former clear cuts, and wetlands as well as relict and active fields. Forested areas featured abundant deadfall and tree throws. Where safe, tree throws were investigated for cultural resources. No archaeological artifacts or materials were observed. Signs of past tree cutting were noted, including stumps, wood piles, and skidder trails. A number of small watercourses were also observed. Despite noticeable beaver activity which may have obscured some of the original channels, most of the watercourses appeared to have been non-navigable and unsuitable for past occupation sites. Other wetland areas were determined to have been too low and wet to have been used for campsites or settlements. Previous field-clearing activities were evidenced by overgrown dry-stone boundary walls. The remains of fences, including barbed wire, were also observed. Several modern camps and refuse piles were noted during field reconnaissance. In addition, a few small borrow pits were located along the edges of roads and trails, which were likely used to provide material for modern road repairs.

The locations of structures depicted on the 1880 Meacham map, along modern Shore Road (Route 14) and Palmer Road, were investigated during the field survey. In some instances, the original building was still standing, while in others a later replacement structure occupied the same footprint. Where no building remained, a detailed field examination was undertaken. With the exception of HPA3, the former house locations were situated in fields that were either actively being farmed or had recently been used for agriculture. The previously existing structures were most likely removed, and any cellars infilled, when preparing the field for agricultural use. At one location where the historic map showed a structure, the remains of a concrete cellar, partially infilled with other debris, was observed. According to the local landowner, the cellar had been built in the 1950s, along with a contemporary house, on the site of the original historic dwelling. The mid-century home was torn down in 2021, and the cellar was slated to be fully infilled. This individual owns several properties in the area and informed the survey team that he was unaware of any other old cellars, wells, or historic features in the area. No archaeologically-significant features or deposits were observed within any of the low potential areas during the field examination.

As mentioned in Section 2.1, a portion of the proposed footprint was not field surveyed at the adjusted locations of Turbines T14 and T15, and along the proposed alternative electrical collector corridor adjacent to Palmer Road. No site-specific information is known about the potential for archaeological high potential areas to be present in these locations and this will need to be established with field surveys in May/June of 2023 and provided in an addendum report.



LEGEND:

- Turbine
- Turbine Laneway
- Roads
- Wetlands (Provincial)
- Archaeological High Potential Areas (HPA)
- Power Collection Corridor
- Alternate Power Collection Corridor
- Property Boundary
- Project Area

ALL WIND FARM INFRASTRUCTURE MAPPING WAS PROVIDED BY INVENERGY LABELLED LAYOUT 016

CLIENT:

Invenergy

wsp

TITLE:

ARCHAEOLOGICAL RESOURCES

PROJECT:

SKINNERS POND WIND ENERGY CENTRE

PROJECT NO: TE211027	DATE: MARCH 2023
REV NO: 1	DWN BY: CM
DATUM: NAD83 CSRS 2010	PROJECTION: PEI DBL STEREO

FIGURE:

FIGURE 4.9

SCALE: 1:25,000

0 250 500 1,000

Metres

Path: Q:\PROJECTS\TE211027_Invenergy_Canada_EIA_Windfarm_PE\13 GIS\MXD\TE211027_FIGURE_4_8_Archaeology.mxd User: candace.macdonald Date: 3/28/2023

5 EFFECTS ASSESSMENT

5.1 PROJECT ENVIRONMENT INTERACTIONS

The planning, construction, operation, maintenance, and decommissioning phases of the proposed Project will have the potential to affect the geophysical, biological, and atmospheric environments. This section will describe potential interactions between the Project and the environmental components. The EIA was conducted in the following stepwise fashion:

- Identification of VCs and potential interactions with Project activities;
- Prediction and assessment of Project-related environmental impacts;
- Identification of mitigation measures (avoidance, mitigation, offsetting); and,
- Determination of the residual effects and their level of impact/significance after the implementation of mitigation measures.

This process, detailed in Section 3 was followed to ensure that interactions between the Project components and the environment were adequately described, that the likely environmental effects are identified and properly assessed, and that the significance of any residual effect is determined.

The analysis of the identified valued components (VCs) within the Study Area's spatial and temporal bounds are presented in Table 5.1. VCs were identified based on potential public concerns related to environmental, social, cultural, economic, or aesthetic values as well as the scientific concerns of the professional community. These VCs and pathways were further analysed against potential interactions with Project components resulting in a summary of potential environmental impacts and those VCs that underwent detailed assessment.

Table 5.1: Valued Components (VCs)

Environmental Resources	Environmental Components of Concern (ECC)	Potential Interaction	Included as VC	Rational
Atmospheric Environment	Ambient Air Quality	• Formation of dust and exhaust fumes • Dust created from soil depleted of vegetation and from gravel turbine laneways • Formation of dust and exhaust fumes	Yes	Protected by regulation Potential impacts on Greenhouse gas emissions (positive and negative)
	Acoustic Environment (Noise)	• Temporary increase in ambient noise during construction	Yes	Potential negative impacts on sensitive receptors
Hydrology	Groundwater	• Impacts on local residential wells • Reduced availability of local groundwater supply	Yes	Protected by regulation
	Surface Water	• Impacts to water flow and drainage within local watershed boundaries • Degradation of water quality • Impacts to potable water supply • Changes to the water regime by erosion and runoff	Yes	Protected by regulation

Environmental Resources	Environmental Components of Concern (ECC)	Potential Interaction	Included as VC	Rational
		• Potential hydrocarbon contamination of water		
Biological Environment	Species at Risk	• Noise, visual impacts, and the presence of humans (workers in the area) • Habitat loss by clearing and grubbing, excavation, equipment (silt run-off, infilling; fuel spills) • Collisions with turbines • Lights • Barrier effect • Toxic leaks and spills • Habitat destruction	Yes	Protected by regulation
	Terrestrial Wildlife	• Killing of individuals during land clearing activity • Loss, fragmentation, or degradation of breeding, feeding, and resting habitat • Respiratory health effects from dust • Habitat degradation by invasive species • Exposure to toxic chemicals • Reduction of quality and quantity of habitat • Reduced species diversity • Potential adverse effects to fauna as a result of exposure to toxic substances • Damage or injury because of traffic accidents	Yes	Protected by regulation
	Terrestrial Flora	• Potential adverse effects to flora as a result of exposure to toxic substances • Habitat degradation by invasive species • Reduction of quality and quantity of habitat • Reduced species diversity	Yes	Potential negative impacts on terrestrial habitat
	Wetlands	• Reduced species diversity • Degradation of water quality and watershed health • Impacts to water flow and drainage within local watershed boundaries • Changes to the water regime by erosion and runoff • Habitat degradation by invasive species • Impacts to water flow and drainage • Toxic effects from chemicals substances	Yes	Protected by regulation
	Avifauna	• Mortality due to vehicle collisions • Avoidance and changes to movement caused by noise, visual impacts, and human presence • Disturbance of normal behaviour during foraging and breeding • Habitat degradation from invasive species • Potential mortality of adults, young and eggs from collisions, or nest destruction • Killing of individuals during land clearing activity	Yes	Protected by regulation

Environmental Resources	Environmental Components of Concern (ECC)	Potential Interaction	Included as VC	Rational
		• Avoidance and changes to migratory movement caused by noise, visual impacts, and human presence • Loss, fragmentation, or degradation of breeding, feeding, and resting habitat • Respiratory health effects from dust • Habitat degradation by invasive species • Exposure to toxic chemicals • Reduced species diversity • Damage or injury as a result of traffic accidents		
	Bats	• Mortality due to vehicle collisions • Avoidance and changes to movement caused by noise, visual impacts, and human presence • Disturbance of normal behaviour during foraging and breeding • Habitat degradation from invasive species • Potential mortality of adults and young from collisions, or nest destruction • Killing of individuals during land clearing activity • Avoidance and changes to migratory movement caused by noise, visual impacts, and human presence • Loss, fragmentation, or degradation of breeding, feeding, and resting habitat • Respiratory health effects from dust • Habitat degradation by invasive species • Exposure to toxic chemicals • Reduced species diversity • Damage or injury as a result of traffic accidents • Damage or injury due to collisions with the turbines • Possible barotrauma • Sensitivities to magnetic fields	Yes	Protected by regulation
	Fish	• Impacts to water flow and drainage within local watershed boundaries • Loss of fish habitat • Reduced species diversity • Degradation of water quality and watershed health • Reduction of quality and quantity of habitat • Loss, fragmentation, or degradation of breeding, feeding, and resting habitat • Changes to the water regime by erosion and runoff • Habitat degradation by invasive species • Impacts to water flow and drainage • Reduced species diversity	Yes	Protected by regulation

Environmental Resources	Environmental Components of Concern (ECC)	Potential Interaction	Included as VC	Rational
		• Toxic effects from chemicals substances • Potential hydrocarbon contamination of water		
Socio-Economic Setting	Indigenous Land use and Resources	• Potential for Indigenous archeological resources	Yes	Protected by regulation
	Land Use and Economy	• Loss of private land use due to construction and operation • Local spending and increased demand for services • Increased local employment and taxation revenue	Yes	Potential impacts on local economy (positive and negative)
	Visual Landscape	• Contrasting visuals to that of a natural landscape • Glare from shiny surfaces • Negative visuals (i.e., still blades, missing parts, garbage, etc.)	Yes	Changes in local viewscape
	Public Safety	• Ice shedding • Shadow flicker • Increased traffic including possible damage to roads and interference with traffic flows Damage or injury as a result of traffic accidents	Yes	Potential harm to third parties and property
Site History	Heritage and Archaeological Resources	• Construction activities leading to the loss of irreplaceable cultural and archaeological resources/knowledge	Yes	Protected by regulation

5.2 DETERMINATION OF VCS

See Table 5.1 for determination of VCs.

5.2.1 AIR QUALITY

5.2.1.1 SIGNIFICANCE DETERMINATION

A significant adverse effect on air quality is defined as a condition where regulatory objectives are routinely exceeded. Contaminants of concern include TSP, NO_2, SO_2 and CO as regulated under the PEI *Air Quality Regulations* and the Canada Wide Standard for $PM_{2.5}$.

Currently there is no provincial or federal standard approach available to assess greenhouse gas (GHG) emissions and the impacts these projects have on climate change. In the absence of a regulatory approach to assess industrial project GHGs, practical guidance has been adopted based on literature and from regulatory agencies together with specific practitioners working on industrial projects for use when assessing GHGs in an EIA (Murphy and Gillam 2013). Using guidelines summarized in Section 4.1.3.2 (Table 4.5), above, a significant GHG emission would be a total production >100,000 tonnes CO_2e per year.

5.2.1.2 POTENTIAL INTERACTIONS AND EFFECTS

The construction of the wind farm will require the construction of unpaved site roads, the grading of the site where the wind turbines will be constructed, the installation of concrete foundations for each turbine, the transport of the turbine materials and installation of the turbines on the concrete foundations. The concrete foundations will require a temporary batch concrete plant to be installed at the southeast boundary of the site toward the middle of the property along Palmer Road (Route 156). It is conservatively assumed the concrete batch plant will be powered by an onsite mobile generator, although the existing power grid may be used instead if site services are available. It is also conservatively assumed to be operated for 16 weeks in the fall (September to January), from 6 am to 6 pm every day of the week. The plant will generate 900 m^3 of concrete per day. Concrete ready-mix trucks will make an estimated 30 to 40 trips back and forth (approximately 3 trips per hour) from the concrete plant to areas on site where the concrete foundations are being constructed.

Table 5.2 summarizes the types of emissions that will be generated during the construction activity.

Table 5.2: Expected Emissions from Wind Turbine Construction

Activity	Emission Generated	Significance
Road Construction and site preparation	Dust (TSP and PM_{10}) from heavy-duty equipment performing material handling activities. Exhaust emissions (NO_2, SO_2, CO, $PM_{2.5}$, diesel particulate) from the operation of heavy-duty equipment.	Low
Concrete Plant Operation	Dust (TSP and PM_{10}) from heavy-duty equipment performing material handling activities from wind erosion of stockpiles. Exhaust emissions (NO_2, SO_2, CO, $PM_{2.5}$, diesel particulate) from the onsite mobile generator and operation of heavy-duty equipment including payloaders and concrete ready-mix trucks.	Moderate
Concrete transport with ready mix trucks	Dust (TSP and PM_{10}) from concrete ready-mix trucks driving on unpaved roads to and from the concrete foundation construction areas. Exhaust emissions (NO_2, SO_2, CO, $PM_{2.5}$, diesel particulate) from the operation of the concrete ready-mix trucks.	Low
Transport of wind turbine materials	Dust (TSP and PM_{10}) from transport trucks driving on unpaved roads to and from the concrete foundation construction areas. Exhaust emissions (NO_2, SO_2, CO, $PM_{2.5}$, diesel particulate) from the operation of the transport trucks.	Low
Wind turbine installation on concrete foundations	Dust (TSP and PM_{10}) from crane(s) driving on unpaved roads to and from the concrete foundation construction areas. Exhaust emissions (NO_2, SO_2, CO, $PM_{2.5}$, diesel particulate) from the operation of the crane(s).	Low
Use of light duty trucks to perform supervision and inspection services during the construction of the wind turbines	Dust (TSP and PM_{10}) from light duty trucks driving on unpaved roads to and from the concrete foundation construction areas. Exhaust emissions (NO_2, SO_2, CO, and $PM_{2.5}$) from the operation of the light duty.	Low
Use of light duty trucks during operation for routine maintenance activities	Dust (TSP and PM_{10}) from light duty trucks driving on unpaved roads to and from the concrete foundation construction areas. Exhaust emissions (NO_2, SO_2, CO, and $PM_{2.5}$) from the operation of the light duty.	Negligible (on an annual basis)

Based on a review of the expected emissions from the wind farm project, most of the activities are of short duration; are located a distance from sensitive receptors (residences); and are small in magnitude with respect to generating emissions. However, the concrete batch plant and concrete transport using ready-mix trucks has the potential to generate noticeable dust (moderate significance) and exhaust emissions. There are several residences located within a few hundred metres of the concrete batch plant location.

A typical concrete batch plant mixes water, cement, fine aggregate (i.e., sand) and coarse aggregate (i.e., gravel) and small amounts of supplemental materials in a very large drum to create concrete. The site will have stockpiles of sand and gravel and there will be conveyor belts that will move this material to a central mixing area. Dust (particulate emissions) can be generated from the transfer to cement and additive materials to silos; from the transfer of sand and aggregate; from truck and mixer loading; and from sand and aggregate blowing from stockpiles. The driveway of the plant property, typically unpaved, would also contribute to the overall dust associated with a plant. Dust from cement and additives may also have metals associated with it. In addition to dust, exhaust emissions are generated from the mobile 100 kW diesel generator to power the plant, and from payloaders and concrete ready-mix trucks internal combustion engines. Often heavy equipment uses diesel to operate engines up to 1000 hp. Diesel exhaust emissions consist of CO, NO_2, SO_2, VOC, $PM_{2.5}$, and diesel particulate. Other sources of exhaust emissions include the idling of trucks trying to access the facility waiting to load or unload.

In summary, the main impacts of significance will be from the dust (TSP and PM_{10}) generated from the materials handling of stockpiles; manufacturing of concrete; and the driving of large heavy-duty vehicles over unpaved roads. Dust emissions can be mitigated to minimize impacts to the airshed to below ambient air standards. Refer to the section on mitigation below for further information. Other impacts to the airshed will occur from the exhaust from the plant mobile generator and heavy-duty equipment fueled with diesel. It is expected the impact to the airshed will be minimal and the following sections Criteria Air Contaminants and Greenhouse Gases provide supporting information.

Criteria Air Contaminants

Table 5.3 provides a summary of the annual air emissions estimated to be produced by the operation of the batch plant and ready-mix trucks over the 4-month period. It was conservatively assumed that the mobile generator operates 12 hours per day and 7 days per week.

Table 5.3: Estimate of Criteria Air Contaminant Emissions for Batch Plant and Ready-Mix Trucks

Equipment	NO_2	SO_2	CO	VOC	$PM_{2.5}$
100 kW Diesel Fired Generator	2.53	0.17	0.55	0.2	0.18
Front End Loader	0.193	0.0007	0.135	0.033	0.007
Ready Mix Trucks	0.749	0.003	0.704	0.177	0.027
Total (tonnes):	3.472	0.174	1.39	0.41	0.214
Total 2020 PEI CACs (tonnes per year):	3,302	271	20,300	5,016	3,472

Note:
1.USEPA AP-42 (Table 3.3-1) provides an emission factor for PM10 and this is being used as an estimate for PM2.5 in this table.
2.Fugitive dust emissions were not included since these emissions will be controlled using mitigation measures

CAC emissions were estimated using the following guidance documents:

- United States Environmental Protection Agency AP-42 Emission Factors. Table 3.3-1. Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines. 10/96.
- California Air Resources Board. Mobile Source Emissions Inventory – Off Road Diesel Vehicles. SCAB Fleet Average Emission Factors (Diesel), 2022 for the front-end loader and offsite concrete trucks.

It is estimated that the operation of the proposed Project will produce 1.39 tonnes of carbon monoxide, 3.472 tonnes for NO_2, 0.214 tonnes of $PM_{2.5}$, 0.174 tonnes of SO_2, and 0.41 tonnes of VOC per year (concentrated mainly during the 4-month period of concrete batch plant operation).

A comparison of total CAC emissions in the Province with estimated emissions from the proposed Project determined that the operation would increase provincial emissions of CO by 0.007%, NO_2 by 0.105%, $PM_{2.5}$ by 0.006%, SO_2 by 0.064%, and VOCs by 0.008%.

The estimated contribution of CACs to the provincial annual levels is considered very low and since the activity will only last 4 months, this is a one-time contribution to the airshed.

Greenhouse Gases

Table 5.4 provides a summary of greenhouse gas emissions for the proposed wind farm.

Table 5.4: Estimate of Greenhouse Gas Emissions for Batch Plant and Ready-Mix Trucks

Equipment	CO_2
100 kW Diesel Generator	94
Front End Loader	65
Ready Mix Trucks	357
Total	516
Total 2020 Prince Edward Island GHGs	1,760,000

GHG emissions were estimated using the following guidance documents:

- California Air Resources Board. Mobile Source Emissions Inventory – Off Road Diesel Vehicles. SCAB Fleet Average Emission Factors (Diesel), 2022 for the front-end loader and offsite concrete trucks.

In 2020 the estimated GHG emissions generated in Prince Edward Island was 1760 kt CO_2e. The Project is expected to generate an estimated 0.516 kt of carbon dioxide, which would result in an increase in carbon dioxide emissions of approximately 0.03% to the Provincial levels.

The estimated contribution of CACs to the provincial annual levels is considered very low and since the activity will only last 4 months, this is a one-time contribution to the airshed. A comparison of the estimated tonnes of GHG over the 4-month period with the Murphy Table 4.5 (Section 4.1.3.2) indicates the impacts are nominal with no further assessment with respect to GHGs for this project and climate change required.

5.2.1.3 MITIGATION MEASURES

Construction Phase

The use of equipment to construct the site will result in temporary, short-term emissions of air pollutants that will be restricted to the 4-month construction period for onsite road construction and concrete foundation construction and will terminate once construction has been completed. Provided the above mitigation measures are used along with best management practices for fugitive dust control measures, these emissions will likely not result in significant adverse impacts to the air quality within the vicinity of the Project Study Area. Best management practices for controlling fugitive dust include the application of water or other approved dust suppressants on storage pile; unpaved areas and haul roads; covering of haul trucks; use of paved roads to the extent possible; limiting onsite vehicle speed; limiting track-out onto paved sections; and stabilizing disturbed areas. Once the concrete plant is no longer required, the plant will be removed and the site will be reinstated to its original condition which will include revegetating to prevent wind erosion of recently disturbed areas.

The following mitigation measures will be implemented when feasible to minimize potential adverse effects on the airshed during construction of the wind farm:

- Establishing a buffer zone between roadways and neighbors.
- Designing the site to account for prevailing winds (from the SW/W/NW directions for the fall).
- Enforce speed limits for onsite vehicles during construction;
- Stabilize exposed erodible material;
- Ensure proper truck loading and tarping when appropriate;
- Minimize drop height for material transfer points;
- Apply water for dust suppression (watering of roadways and misting of stockpiles);
- Ensure vehicles and equipment are maintained as per manufacturer specifications;
- Minimize truck/heavy-duty equipment idling; and
- The exits of the construction sites will be equipped with effective dirt traps.

Operation Phase

It is expected the impact on air quality from the operation of the Skinners Pond Wind Energy Centre will be minimal. The wind turbines themselves do not generate any air contaminant emissions while operating. Very minimal impacts can be expected from the use of light duty vehicles to perform maintenance duties on the turbines. Emissions will consist of dust from unpaved roads and exhaust emissions from the vehicle(s). The impacts would be the same as any that would be generated from any other personal vehicle in the community.

Mitigation presented for the construction phase will be appropriate for the operation phase of the project.

5.2.1.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

Impacts on air quality from the construction and operation of the wind farm will occur on a localized basis resulting from emissions from gas and diesel fired vehicles and dust from temporary concrete batch plant operations. As a result, additional impacts (including greenhouse gases) to the local airshed from the Project are predicted to be moderate during the construction phase and minimal during the operation phase.

5.2.2 ACOUSTIC ENVIRONMENT

5.2.2.1 SIGNIFICANCE DETERMINATION

In general, the more a new sound exceeds the previously existing ambient noise level, the less acceptable the new sound will be judged to be by those hearing it. A new source of sound will be judged to be more aggravating in a quiet area than it would be in an area with more ambient background sound. The following empirical relationships can be helpful in understanding the quantitative changes in noise levels (Cowan 1994):

- Change of only 1 dB in sound level cannot be perceived (no impact).
- 3 dB change is considered a "just-noticeable" difference (low impact).
- Change in level of at least 5 dB is required before any community response would be expected (impact).
- 10 dB change is subjectively heard as approximately a doubling in loudness and may cause an adverse community response (significant impact).

These relationships take place in part as a result of the logarithmic nature of sound and the decibel system; two noise sources do not combine in a simple additive fashion, but rather logarithmically. For example, if two identical noise sources each produce noise levels of 50 dB, the combined sound level would be 53 dB, not 100 dB.

5.2.2.2 POTENTIAL INTERACTIONS AND EFFECTS

Construction is usually performed in a series of steps or phases, and noise associated with different phases can vary greatly. However, similarities in noise sources allow typical construction equipment to be placed into one of three categories: heavy equipment, stationary equipment, or impact equipment. In order to estimate the construction noise level, it is necessary to know the type of equipment and its acoustic specifications. At this early stage of Project development this information is unavailable; therefore, quantitative assessment of construction noise is not possible. However, given the low existing ambient noise levels, it can be assumed that construction activities will result in a temporary increase in existing noise levels.

A Noise Impact Assessment was conducted by Frontier Power Systems for the proposed Skinners Pond Wind Project and is provided in Appendix L. The Project has been assessed by modeling the noise propagation from the wind turbines and comparing the predicted noise levels to an established noise limit. The noise limit used for this assessment was 45 dB(A). The predicted noise levels do not exceed 45 dB(A) at any of the receptor locations surrounding the Project Study Area and no adverse impact related to noise is expected during normal operation of the proposed wind farm.

5.2.2.3 MITIGATION MEASURES

Construction Phase

The following mitigation measures will be implemented to minimize potential noise-related adverse effects on receptors during construction of the Wind Turbines:

- Regular inspection and maintenance of construction vehicles and equipment to ensure that quality mufflers are installed and worn parts are replaced.
- Restrict noise pollution by specifying and enforcing construction noise limits.
- Reduce power operation – use only necessary size and power.
- Enforce vehicle speed limits.
- Use quieter methods and equipment when possible.
- Turn equipment off when not in use if practicable.
- Schedule noisy operations during daytime hours.

- Specify stringent noise emission limits, including shielding and installation of quality mufflers on construction and fixed equipment.
- Maintain project roads to reduce noise associated with vibration and vehicle noise.
- Enclose noisy equipment, and use baffles to reduce transmission of noise beyond the construction site.
- Locate stationary equipment, such as compressors and generators, away from the noise receptors to the extent practicable.
- Replace or repair parts generating excessive noise.
- Educate truck drivers and mobile equipment operators about the characteristics of diesel engines (i.e., that the flat torque characteristic allows ascending an incline in a higher gear, which is a less noisy operation).

Operation Phase

Noise produced by the wind turbines is a frequent concern with people living close to wind farms. Health Canada has released a study that explored the relationship between wind turbine noise and the extent of health effects reported by, and objectively measured in, those living near wind power developments. The results indicate no serious health effects in correlation to wind turbine noise levels (Michaud et al., 2013), other than an annoyance of wind turbine features. Massachusetts (Massachusetts Department of Environmental Protection and Massachusetts Department of Public Health 2012) has completed a study which reviewed the potential effects of noise generated from wind farms. The report concluded that there is no evidence to suggest an association between the noise generated from wind turbines and mental and/or physical health.

Noise results from the conversion of wind energy into sound when interacting with the rotors. Other project activities could also result in noise. Sound is measured in decibels (dB). Audible sound range is from 0 dB (the threshold of hearing) to 140 dB (the pain threshold) (BLM 2004). Human hearing normally detects frequencies between 20 Hz and 30 kHz but the ear does not respond equally to all frequencies and we are much more sensitive to sounds in the frequency range about 1 kHz to 4 kHz (1000 to 4000 vibrations per second) than to very low or high frequency sounds. For this reason, sound meters are usually fitted with a filter whose response to frequency is a bit like that of the human ear. The "A weighting filter" is commonly used for environmental noise and is expressed as dB(A). This scale is thought to be more reflective of human hearing, as it filters out lower frequencies, which are less damaging.

The Project Study Area is in a rural setting with low anthropogenic noise levels. The Government of PEI has regulations for siting wind turbines at least four times (4X) their height from any existing habitable building (*Planning Act*, Section 54.1(2) of the Subdivision and Development Regulations). This is a significant increase over the three times height setback (3X) in place during much of the Project's development . At this setback distance, ambient noise levels are expected to significantly reduce the amount of audible noise from the turbines. Ambient noise includes everyday sounds such as passing cars, birds singing, rustling leaves, and wind blowing through trees and vegetation.

The impact of the noise created by Project activities depends on several factors, most of which influence sound propagation: distance from the source, height of the source, atmospheric conditions (especially humidity), intervening topography or structures, vegetation cover, wind speed, wind direction, turbulence (Beranek and Ver 1992 in BLM 2004), as well as background noise levels. Any sound level created by a point source such as a wind turbine generator (WTG) will drop by 6 dB with each doubling of the distance, while noise from a line source, such as highways or powerlines, decreases by about 3 dB per doubling of distance (BLM 2004). These decreases can be enhanced by the presence of vegetation, such as shrubs, topography, etc. As sound is carried on the wind, sound impacts will not only be larger downwind of the source than upwind, but they will be carried further. To what degree the sounds originating from Project activities are actually noticed by the receptors (people) also depends on the amount of background noise at the receptor's location, as well as on the amount of sound produced by the wind itself. Wind alone, due to the interaction with vegetation or structures, can actually be quite noisy, for example, 32-45 dB during moderately high winds of 10 m/s (Sea Breeze 2004).

Noise impacts on people fall into three categories: 1) annoyance or nuisance - a subjective effect; 2) interference with speech, sleep, learning, etc.; and 3) physical effects such as hearing loss or anxiety. Generally, sound levels associated with environmental effects are low, therefore resulting in effects in category 1 and 2, but not category 3 (BLM 2004).

Whether noise is considered annoying depends largely on the sensitivity of the listener. However, the type of noise (constant, impulsive, low frequency, tonal, etc.), circumstances and the difference from previously existing noise, all influence the perception. Tonal noise (containing discrete tones) stands out much more against background noise. While changes in noise levels of 3 dB are less noticeable, a 5 dB change is likely to result in comments, and a 10 dB change (perceived as a doubling in sound level) is highly likely to result in adverse reactions from the people impacted (BLM 2004).

Noise levels associated with regular maintenance activities, such as visits to the turbines and power lines, are expected to result in a low level of noise, since light vehicles are used and they will be driven slowly. There is potential for short periods of increased noise levels when repairs to the roads are necessary, or when there are major repairs to the turbines, including exchange of nacelles or rotors. In both cases heavy equipment would be brought in, resulting in increased noise.

Based on the distance between the Project Study Area and residential areas, impacts on residents are not expected from the use of regular sized vehicles. Also, heavy equipment use will be very infrequent and at considerable distance from the receptors, resulting in non-significant and short-term impacts. Mitigation measures are not necessary.

During the operational phase, noise can originate from the wind turbines. The noise may have effects on humans and wildlife.

Noise produced by the wind turbines is a frequent concern with people living close to wind farms. Wind turbines produce both mechanical and aerodynamic noise (BLM 2004). While modern wind turbines are designed and built to produce much quieter sound "side-effects" than earlier models, there still is a gentle "swishing" sound associated with the rotor movement, which becomes louder as the wind speed increases. This aerodynamic noise has broad-band character (BLM 2004). It can be reduced through blade design but cannot be avoided. As sound is carried with the wind, locations downwind from the turbines will experience a higher noise level than those upwind, and locations further downwind will detect more noise than those at similar distances upwind.

A noise analysis was conducted by Frontier Power Systems to determine if noise produced by the wind turbines would negatively impact nearby residences. The completed assessment is attached as Appendix L.

During the operation phase, noise may be associated with the presence and rotation of the turbine blades, the substation and the vehicles used for the regular visits to turbines and power lines for monitoring and maintenance activities.

The fact that the turbines are generally set back at least 800 m from the nearest residence reduces the amount of Project noise audible in those areas. Nearby residents should be informed in advance when particularly noisy construction activities will be performed. Using engine brakes should be discouraged.

As avoidance is the best mitigation, the wind farm layout was designed with a setback distance of at least four times the height of the turbine between any turbine and the nearest residence, with two exceptions (approximately 630 m and 675 m) respectively). In accordance with the Planning Act, Section 54.1(4) of the Subdivision and Development Regulations, written approval of the proposed turbine locations has been obtained from the owners of the two affected residences. It is also recommended that the wind farm operator establish a noise complaint mitigation protocol to receive, assess, and respond to potential noise complaints. An adaptive management approach may also be appropriate. This could include upgrades to houses for improved noise impedance or installation of noise screens to provide additional noise attenuation. This could also include noise-reduced operation (reduced power output) of certain turbines under certain conditions if they are identified as problematic.

5.2.2.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

The effects of noise in the Project Study Area caused by the construction, operation and maintenance of the wind turbines are not expected to be significant.

5.2.3 GROUNDWATER

5.2.3.1 SIGNIFICANCE DETERMINATION

The significance of effects on groundwater resources is evaluated by considering potential for Project-related activities to reduce groundwater quantity in a way that negatively effects existing users or downgradient surface water bodies or impacts groundwater quality in a way that exceeds regulatory guidelines or is noticeable to local users. Groundwater quality is protected by regulation.

5.2.3.2 POTENTIAL INTERACTIONS AND EFFECTS

As described in Section 4.1.6.1, groundwater resources are relatively shallow and can have high connectivity over large areas. There is a potential for planned temporary groundwater withdrawals to effect groundwater quantity during construction to provide fresh water for the temporary concrete batch plant. There is also a general low risk of accidental spills of fuel or stored chemicals during construction, operation, and decommissioning which could impact local groundwater quality. The potential effects of groundwater withdrawal and accidental spills are described further, below.

Water Withdrawal

The location of the temporary concrete batch plant would be within the laydown area of the proposed Project footprint shown in Figure 4.1, within the westernmost edge of Prince Edward Island. It is understood that groundwater is proposed to be extracted from a well (or wells) located in the vicinity of the red star shown on

Figure 4.1. To meet the demand of concrete production, the daily water usage is estimated at 315,000 liters (315 m^3) for a 12-hour work-day. The concrete batch plant will be required for a period of 16 weeks between September 2024 and September 2025. During that time, it is estimated that the total water usage will be 5,500,000 litres (5,500 m^3).

Based on the available information, it is highly probable that the required water usage can be available via a groundwater well(s) constructed within the project footprint. However, it is also highly probable that interference with existing wells would occur. Preliminary calculations of a capture zone for pumping at a rate of 26 m^3 per hour (315,000 Litres during a 12 hour period) show a potential capture zone width ranging from 1 km to 5 km, depending on field conditions. The corresponding drawdown (lowering of the water table) within that capture zone will decrease with distance away from the well, however, it may be sufficient to impact other existing users. The cumulative effect on the water table from this new user, even though temporary, could have a lasting and negative effect on existing resources.

The review of features on Figure 4.1 reveals the following potential receptors that could be impacted by the operation of a well as described above:

- Several residences likely operate their individual well water supply system.
- The coastline is approximately 2 km from the proposed well location, which could induce sea water intrusion within the capture zone of the well.
- The presence of at least three surface water courses within 1 km of the proposed well location – the well may intercept groundwater that would normally discharge into those streams as baseflow.

The desktop review for this overview assessment was based on existing knowledge from areas outside the Study Area, but with similar geology. Substantial field verification will be necessary within the Study Area and proximity to assess the potential for a successful extraction of the desired water and also to quantify potential impacts to existing groundwater and surface water resources in the vicinity of the proposed well location. Any local water withdrawal would be subject to a provincial water withdrawal approval and would include conditions of approval the proponent would have to comply with.

Should the detailed groundwater modelling indicate that significant impacts are likely, then alternative freshwater sources will be identified. These options would require regulatory approval but are practical alternatives.

Accidental Spills

Un-controlled liquid wastes generated during construction activities include the generation of construction wastewater (concrete wash water, equipment wash water, etc.). All liquid wastes are considered hazardous and are to be collected and disposed of in accordance with applicable local and provincial requirements.

Un-controlled liquid wastes generated during construction activities include the generation of construction wastewater (concrete wash water, equipment wash water, etc.). All liquid wastes are considered hazardous and are to be collected and disposed of in accordance with applicable local and provincial requirements.

During construction and operation of the wind facility, all liquid wastes have a potential to enter the groundwater or surface water bodies due to accidental spills or use of improper storage and handling practices. Impacts could include exceedances of regulatory guidelines for hazardous materials including fuel and cleaning agents. Mitigation is identified below to minimize or eliminate potential accidental spills.

5.2.3.3 MITIGATION MEASURES

Construction Phase

- Collect and retain all construction wastewater and solids in leak proof containers.
- Recycle collected construction wastewater and solids.
- Never discharge wash water directly to storm drains or receiving waters.
- No POL storage will occur in sensitive areas (e.g., near watercourses or wells) or associated buffer zone.
- The Contractor will, with the prior approval of the Site Supervisor, designate and use areas for the transfer and limited temporary storage of hazardous materials and special wastes. These sites will be properly labeled and appropriately controlled.
- WHMIS program to be implemented.
- Hazardous materials to be used only by personnel trained and qualified in the handling of these materials and only in accordance with manufacturers' instruction and applicable regulations.
- A complete inventory of hazardous materials will be maintained onsite according to WHMIS regulations and will be made available.
- Material Safety Data Sheets (MSDS) are to be readily available for all hazardous materials in use or stored on-site.
- Transportation of hazardous materials to be in compliance with Transportation of Dangerous Goods Act.
- The number and volume of hazardous materials on site will be minimized to the extent possible.
- All containers are to bear labels that identify their contents.
- All containers are to be lined or constructed of materials that are compatible with the waste being stored.
- All containers are to be in good condition, free from corrosion, leaks or ruptures.
- Lids are to be kept on containers at all times when not in use.
- All hazardous materials are to be stored in a designated location to be determined by Construction Manager.
- Hazardous materials including petroleum products may not be stored within 30 m of a watercourse or wetland, including small containers.
- All hazardous materials are to be stored on an impermeable surface.
- All hazardous materials are to be collected and disposed of in accordance with applicable local and provincial requirements.
- Appropriate spill response equipment must be maintained in a readily accessible location and in sufficient quantity for the relative amount of petroleum product on-site.
- All large machinery shall have a spill kit on-board.
- All spills and releases shall be promptly contained, cleaned up and reported.
- Inspect storage containers, vehicles and equipment regularly for leakage.
- Maintain equipment in good repair to avoid leakage of hydraulic, fuel, cooling and system fluids.
- Do not cut, puncture or weld on fuel storage containers.

- Keep fuel and waste oils away from heat, sparks, open flames and any other sources of ignition.
- Refuelling and maintenance (including lubrication and oil change) of equipment must take place off-site or in designated areas only. These designated areas are to be determined by the Construction Manager.
- Designated refuelling areas (if used) are to be on level terrain, a minimum of 30 m away from any surface water, wetland and potable water supply well, on a prepared impermeable surface with collection system to contain oil, gasoline and hydraulic fluids.
- All containers, hoses and nozzles shall be free of leaks.
- All fuel nozzles shall be equipped with automatic shut-offs.
- During fuel dispensing, operators must be present at all times.
- Petroleum contaminated wastes, waste rags, spill clean-up materials, etc. are to be collected in an approved container (sealed and contaminant-proof) for pickup and disposal by an approved contaminated material disposal company or recycling firm.

Operation Phase

There is no applicable mitigation for water withdrawal related to the temporary concrete batch plant.

Mitigation for accidental spills during Operation would be identical to that described for the Construction Phase.

5.2.3.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

Prior to commencement of the Project, a detailed groundwater impact assessment modelling exercise will be conducted for the proposed onsite water withdrawal during construction. Should the study indicate that significant impacts are likely, then the alternative fresh water sources shall be used instead. The alternative sources would have no associated environmental impacts as these would be subject to a separate regulatory approval.

Accidental spills are expected to be fully mitigated with no residual impacts, following the application of the recommended best management practices.

5.2.4 SURFACE WATER

5.2.4.1 SIGNIFICANCE DETERMINATION

The significance of effects on surface water resources is evaluated by considering potential effects of Project-related activities on surface water quantity and quality. A significant impact on surface water quantity would be a reduction in flow that potentially impacts the maintenance of downstream aquatic habitat and sustainable use by other downstream stakeholders. A significant impact on surface water quality would be a project related exceedance of regulatory guidelines in discharges. Surface water quality is protected by regulation.

5.2.4.2 POTENTIAL INTERACTIONS AND EFFECTS

As described in Section 4.1.6.2, there are multiple turbine laneway watercourse crossings and electrical corridor watercourse crossings. All turbine laneway watercourse crossings are at relatively small tributaries that will be spanned by single span bridges where feasible or culverts shall be installed. Electrical power line crossings are to be done with horizontal directional drilling and no instream activity or bank disturbance is expected. Potential impacts to surface water relate to structural habitat effects and disturbance of erodible material in or adjacent to the watercourse resulting from Project activities in or near riparian wetlands and watercourses. Where culverts are installed, they will be sized and designed by a qualified engineer to ensure that appropriate flow volumes are allowed, and that fish passage is maintained (where applicable). Watercourse alterations will be subject to a separate detailed approval process, including regulatory design review and approval.

Surface runoff from disturbed areas can transport eroded soils into a watercourse. The soil may then deposit, and thereby affect aquatic resources. The erosion of soil from the site footprint and disturbed areas can potentially harm fish inhabiting adjacent watercourses. Suspended solids are carried in the water column and can adversely affect fish and benthic invertebrate populations. Potential impacts on fish and fish habitat are discussed further in Section 5.1.10, below.

The proposed wind farm is situated inland. Clearing along turbine laneways will generally be 25 m total width (to allow for oversized truck loads) but clearing shall be minimized to the extent possible at watercourse crossings. Clearing measures employed to protect riparian wetlands and watercourses will address potential surface water issues.

Surface water quality is also vulnerable to impacts from the accidental spill of liquid waste or hazardous materials, including fuel.

Operational activities would be similar to construction but smaller in scale. Maintenance of turbine laneways and watercourse crossings, and vegetation management will be required in proximity to riparian wetlands and watercourses. Turbine maintenance may also require periodic construction type activities.

5.2.4.3 MITIGATION MEASURES

Construction Phase

- Mitigation for effects on Groundwater (above) are generally applicable to surface water resources, including the prevention of accidental spills of waste fluids and hazardous materials.
- Environmentally sensitive areas (i.e., watercourses) will be staked out prior to work operations so that the areas are protected.
- A 15 m buffer zone will be maintained on each side of a watercourse.
- The Construction Manager will limit activity within watercourse buffer zones, as well as within areas where rare species are noted to occur.
- Work conducted in the vicinity of watercourses will be conducted in a manner which ensures that erosion and sedimentation of watercourses is minimized.
- Appropriate erosion control measures will be installed prior to conducting the work. Work will be completed as soon as possible and will be suspended during and immediately after intense rainstorms and during periods of high runoff.
- Equipment travel will be limited to roads during rainfall events.
- In areas where extensive erosion occurs (e.g., along steep slopes) or in environmentally sensitive areas, an active re-vegetation program will be implemented as soon as possible following disturbance to ensure rapid re-vegetation.

- Materials cleared from the sites (brush, logs, soil, etc.) should not be dumped into otherwise unaffected land and are not permitted within any watercourse buffer zone.
- Slash will be piled outside the buffer zone of a watercourse (i.e., greater than 15 m from a watercourse) for subsequent chipping and disposal in an approved facility.
- Construction equipment will not enter buffer zones of watercourses or environmentally sensitive areas, except within the Project footprint and under direct supervision of the Site Supervisor or Environmental Inspector.
- Erosion control measures will be monitored during construction activities within the RoW and any areas associated with Project construction activities. Where damage to these erosion control measures is observed, they will be promptly repaired to prevent siltation of watercourses or other environmentally sensitive areas.
- Where a vegetation buffer between erodible slopes and water bodies is less than 15 m, or where construction areas are immediately upgradient of adjacent properties, an engineered silt fence will be constructed to control silt runoff and placed along the down gradient perimeter of the construction area.
- Sediment-laden water resulting from dust control measures will be collected by erosion control measures in place on-site such as sediment control fences and check dams.
- Silt or sediment control fences will consist of woven synthetic fibre fabric attached to wooden posts.
- In extremely erodible areas, straw mulch will be used as required for protection.
- Silt fences will not be used to control sedimentation within a ditch or watercourse.
- Where erosion control within a drainage ditch is required, geotextile wrapped straw bales will be installed to provide a check dam and prevent downstream sedimentation. Some rockfill or rip rap may be installed on the downstream side of the check dam to secure the structure during heavy rainfall events.
- The Contractor will maintain the erosion control structures in a functional condition as long as necessary to contain sediment from run-off, from time of installation until a sufficient vegetative cover growth (>90% cover) has been established.
- All erosion control structures and sediment control fences will be inspected before, during and following each rainfall event and at least daily during periods of prolonged rainfall. Any damage arising from major storm events will be repaired as soon as possible to the satisfaction of the Site Supervisor.
- Retained sediment will be removed when it has accumulated to a level of half the height of the fence/barrier and disposed at least 15 m away from any watercourse in a manner that prevents it from entering a watercourse.
- If siltation of the nearby watercourses is observed, the Construction Manager will be notified and will identify the source of the siltation. Siltation indicates preventative measures have been ineffective.
- Construction operations contributing to the problem will be suspended.
- The source of the problem will be isolated, contained and controlled using measures such as straw bales or brush mats. Erosion control structures will be fixed immediately.
- If the release has affected, or has the potential to affect, a sensitive area (i.e., a watercourse), the Site Supervisor will contact and consult with the appropriate regulatory authorities (e.g., PEIDEWCC, DFO) as required for notification and planning.

- To ensure that erosion and sediment control measures are in effective working order, their condition will be monitored periodically and prior to, during, and following storm events.
- Accumulated sediment will be removed once it reaches a depth of one-half the effective height of the control measure or a depth of 300 mm immediately upstream of the control measure.
- For all erosion control measures, accumulated sediment will be removed as necessary to perform maintenance repairs.
- Accumulated sediment will be removed immediately prior to the removal of control measures.
- The sediment removed will be deposited in an area that is approved by the Construction Manager and will not result in erosion and runoff into a watercourse.
- No waste or debris will be permitted to enter any watercourse.
- Run-off from a disposal/storage area will not be allowed to enter a watercourse.
- The on-site POL storage container shall be located on level terrain, at least 100 m from any water body.
- No POL storage will occur in sensitive areas (e.g., near watercourses or wells) or associated buffer zone.
- Fuelling must be done at least 30 m from a waterbody.
- Servicing of equipment will not be allowed within 100 m of a watercourse or drainage ditch.
- The Contractor will, with the prior approval of the Site Supervisor, designate and use areas for the transfer and limited temporary storage of hazardous materials and special wastes. These sites will be properly labeled and appropriately controlled and will be located a minimum of 15 m from a watercourse.
- On-site temporary disposal areas for surplus material will be designated and will be located a minimum of 15 m from a watercourse.

Operation Phase

Mitigation for operational project activities would be identical to those for construction, above.

Mitigation for accidental spills during Operation would be identical to that described for the Construction Phase.

5.2.4.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

No significant residual effects are expected for construction and operation activities on surface water quantity and quality due to vegetation clearing, site ground disturbance and wetland/watercourse crossings. Proposed mitigation measures should reduce potential effects to negligible risk.

Accidental spills are expected to be fully mitigated with no residual impacts, following the application of the recommended best management practices.

5.2.5 TERRESTRIAL WILDLIFE

5.2.5.1 SIGNIFICANCE DETERMINATION

A significant adverse effect on wildlife would be one which results in contravention of the Prince Edward Island *Wildlife Conservation Act* or SARA provisions, or for non-SARA or non-PEIWCA listed priority species, one which causes a decline in abundance and/or a change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its pre-project level within several (three to five) generations. An adverse effect that does not cause such declines or changes is not considered to be significant.

5.2.5.2 POTENTIAL INTERACTIONS AND EFFECTS

Impacts to fauna (excluding avian species) include temporary disturbance of normal behaviour during foraging and breeding due to noise, visual impacts and the presence of humans (workers in the area) as well as injury or mortality with vehicle collisions. Generally, effects are limited to the duration of activity and typically do not present problems outside the immediate construction area.

5.2.5.3 MITIGATION MEASURES

Construction Phase

- All clearing, grubbing and trimming activities will be scheduled to avoid sensitive breeding, nesting and brooding periods (typically May 1st to August 31st) of avian species (birds and bats) as much as possible. All other construction activities will be scheduled between May 1 and the end of the construction period for that calendar year.
- Limit removal of tall trees and snags to areas absolutely necessary for construction, including trees of 15 cm diameter or greater.
- For clearing activities, the following measures will be implemented:
  - Clearing activities will be scheduled in consideration of critical habitat features (e.g., wetland areas) identified during the pre-construction field survey.
  - The proponent will instruct the management team and contractors on the MBCA and the importance of habitat.
- If there is soil (not rock) in the lay-down areas used for assembly of turbine parts adjacent to the turbine foundations, the soil will be aerated and loosened after use to counteract the compaction caused by the equipment. The vegetation will be allowed to return to a natural state.
- When grassed areas are encountered during grading, every effort will be made to leave such grassed areas intact.
- Native plant regeneration will be promoted in any areas that are cleared but not built upon (i.e., roadside ditches, temporary laydown areas, etc.).
- Use native plants or no vegetation at all around turbines, avoid Mountain Ash trees.
- Avoid mowed lawn.
- Imported equipment will be thoroughly cleaned before it arrives on PEI in order to prevent the introduction of exotic species.
- Food waste will be stored in a manner that ensures wildlife will not be attracted and will be removed from the Site on a daily basis.
- All personnel will report the presence of wildlife to the Construction Manager.

- When wildlife sightings are reported to the Construction Manager, the Construction Manager will initiate any reasonable action to reduce the chance of disruption or injury. Should disruption or injury to the wildlife occur, the Construction Manager will contact the on-call Provincial Conservation Officer.
- In the case of wildlife encounters in sensitive areas, and for consultation on appropriate action to be taken for any encounter, the Construction Manager will contact the on-call Provincial Conservation Officer. However, in general:
  - No attempt to harass wildlife will be made by any person at the work site; and
  - Equipment and vehicles will yield the RoW to wildlife.
- If dead animals are encountered, they will be removed and disposed of, as soon as possible, in consultation with the local Provincial Conservation Officer (or, in the case of a pet, the PEI Humane Society). All handling of bird carcasses will be in accordance with the MBCA salvage permit. If SARA species carcasses are found, they will be sent to the Sackville CWS office with suitable permitting as advised by the CWS.
- In the case of encounters with injured or diseased wildlife at the work site, the Construction Manager will contact the on-call Provincial Conservation Officer. No attempt will be made to harass the animal, and no person at the work site will come into direct contact with the animal.

Operation Phase

The noise of the turbines may have an effect on the wildlife in the area. An impact assessment will be done if deemed necessary.

5.2.5.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

With the successful implementation of the mitigation measures described above, Project activities related to construction, operation and maintenance of Project components are not likely to result in significant adverse residual effects on terrestrial fauna, including priority species.

5.2.6 TERRESTRIAL FLORA

5.2.6.1 SIGNIFICANCE DETERMINATION

A significant adverse effect on terrestrial habitat and vegetation would be one which results in contravention of SARA or PEIWCA provisions, or for non-SARA or non-PEIWCA listed priority species, a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its pre-project level within several (three to five) generations. A significant adverse effect on sensitive/critical habitat would be a permanent net loss of habitat function. A positive effect is one that may enhance the quality of habitat, increase species diversity, or increase the area of valued habitat.

5.2.6.2 POTENTIAL INTERACTIONS AND EFFECTS

Spills or exposure to toxic substances, either directly or indirectly via contaminated soil or water, has the potential to lead to negative impacts on flora, including the 7 (seven) plant Species of Concern that were found in the project footprint. Physical disturbances are also probable during the span of the Project.

As mentioned in Section 2.1, a portion of the proposed footprint was not field surveyed at the adjusted locations of Turbines T14 and T15, and along the proposed alternative electrical collector corridor adjacent to Palmer Road. Based on available desktop information, it is considered these areas do not have high potential for species at risk to occur, so potential interaction is unlikely, but this will need to be confirmed with field surveys in May/June of 2023 and submitted in an addendum report, including an updated effects assessment.

5.2.6.3 MITIGATION MEASURES

Construction Phase

- Sensitive flora populations in close proximity to the Project footprint will be flagged and avoided.
- A minimum 10 m buffer zone will be maintained or greater if possible.
- On-site personnel induction training will include an environmental component including basic recognition of identified floral Species of Concern and protective buffer areas.
- The Construction Manager will limit activity within buffer areas and make minor adjustments (10 m or less) to project floral Species of Concern.
- Work conducted in the vicinity of floral Species of Concern will be conducted in a manner which ensures that erosion and sedimentation of sensitive habitat is minimized.
- Should impacts on flagged Species of Concern locations occur or be required, regulators will be contacted immediately to discuss appropriate additional mitigation requirements.

Operation Phase

Implement follow-up monitoring of RoW priority species outside footprint.

- Sedimentation
  - Limit removal of riparian zone vegetation.
  - Adhere to federal and provincial approval conditions.
- Contamination
  - Use mechanical vegetation control where possible. Herbicides can be used only under the guidance of TIR's IRVM program. No pesticides used.
  - Mitigation measures pertaining to air emissions pollution control as outlined in Section 6.2.3 will also protect common lichen species sensitive to air quality.
  - Inclusion of operator environmental awareness training.

5.2.6.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

With the implementation of the recommended mitigation measures, Project activities are not likely to result in significant adverse residual effects on flora (including priority species) and terrestrial habitats.

5.2.7 WETLANDS

5.2.7.1 SIGNIFICANCE DETERMINATION

A significant adverse effect from the Project on wetlands is defined as an effect that is likely to cause a permanent net loss of wetland area (i.e., infilling) or reduced wetland function caused by vegetation clearing or changes in hydrology.

5.2.7.2 POTENTIAL INTERACTIONS AND EFFECTS

As described in Section 4.2.3, there are twenty-three (23) wetlands identified in close proximity to the Project footprint, as outlined in Table 5.5. Based on the current project footprint, 21 wetlands are crossed (WL15 and WL20 are avoided). Four wetland areas (WL2, WL14a & b, WL23) will be crossed with power collector line only using horizontal directional drilling to avoid impacts on these wetlands and their associated watercourses. All remaining 18 wetland crossings are co-located turbine laneways and adjacent power collector buried cables (installed by open-cut trench). A vegetation clearing zone will extend beyond the physical footprint of the turbine laneway and buried cable corridor, to allow passage of oversized turbine parts that may overhang beyond the edge of the turbine laneways. Clearing will be minimized to the extent possible during construction, but for the purpose of assessing wetland impacts it is conservatively assumed that a clearing width of 25 m will be used. During operation, the permanent physical turbine laneway width will be closer to 6 m wide and the power collector line corridor will be approximately 5 m wide. Based on this project layout, there will be direct impacts (vegetation clearing/infilling) of approximately 5.66 ha of wetland area.

Table 5.5: Wetland Impact Area

Wetland	Type	Size (ha)	Impact Area (ha)
WL1	Forested Seepage Swamp	3.86	0.97
WL2	Shrub Seepage Swamp	0.98	None (HDD Xing)
WL3	Forested Channel Swamp	4.18	1.11
WL4	Forested Seepage Swamp	2.26	0.14
WL5	Forested Seepage Swamp	0.40	0.07
WL6	Forested Seepage Swamp	0.44	0.19
WL7	Forested Seepage Swamp	0.92	0.14
WL8	Forested Seepage Swamp	0.72	0.04
WL9	Sloped Forested Seepage Swamp	0.17	0.04
WL10	Forested Seepage Swamp	0.25	0.11
WL11	Forested Seepage Swamp w/ Beaver Pond	7.25	0.59
WL12	Forested Seepage Swamp w/ Beaver Pond	5.74	1.26
WL13	Shrub Seepage Swamp	1.82	0.33
WL14a	Riverine Swamp w/ Beaver Pond	3.11	None (HDD Xing)
WL14b	Riverine Swamp w/ Beaver Pond	0.65	None (HDD Xing)
WL15	Forested Seepage Swamp	0.52	None (Avoided)
WL16	Forested Seepage Swamp w/regen clearcuts	2.12	0.33
WL17	Forested Seepage Swamp	0.16	0.04
WL18	Regen Shrub Seepage Swamp	0.06	0.01
WL19	Shrub Seepage Swamp	1.80	0.17
WL20	Shrub Seepage Swamp	0.51	None (Avoided)
WL21	Shrub Seepage Swamp	0.79	0.02
WL22	Forested Riverine Swamp	0.41	0.10
WL23	Shrub Riverine Swamp w/Beaver Pond	0.99	None (HDD Xing)
		Total Impact Area (ha):	**5.66**

Where work will be done in a wetland or within 15 m of the boundary, a provincial Watercourse, Wetland and Buffer Zone Activity Permit (WWABZAP) approval will be obtained. The conditions attached to the issued permit will become part of the site-specific environmental protection plan and will be adhered to.

In addition to direct impacts, there is a potential for site run-off and dust during construction, or accidental spills to enter wetlands, and the accidental introduction of invasive species. Settling of dust on wetland vegetation and erosion/sedimentation issues could result in the suppression of vegetation growth or exceedance of local water quality guidelines during construction, which may last several weeks. Standard mitigation for control of site erosion and sedimentation, including dust control, will be used. Such measures may include erecting silt fence along the Project boundary, dust control using water only, and stabilization of all disturbed soils as soon as possible following construction, and prior to any severe precipitation events. Invasive species, such as the alien race of common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), and Japanese knotweed (*Reynoutria japonica*) are known to severely degrade wetland diversity by producing dense monocultures, which displace the range of naturally occurring vegetation species. These species may be introduced through seeds, roots or "root-able" fragments stuck to construction/maintenance equipment and shoes of workers. Special care will be taken to avoid known populations of Japanese knotweed which is abundant along roads in the local area. Such populations may be flagged temporarily during construction to prevent equipment and personnel from accidentally entering them.

As mentioned in Section 2.1, a portion of the proposed footprint was not field surveyed at the adjusted locations of Turbines T14 and T15, and along the proposed alternative electrical collector corridor adjacent to Palmer Road. Based on available desktop information, it is considered these areas do not have high potential for wetlands to occur, so potential interaction is unlikely, but this will need to be confirmed with field surveys in June of 2023 and submitted in an addendum report, including an updated effects assessment.

5.2.7.3 MITIGATION MEASURES

Construction Phase

- Environmentally sensitive areas (i.e., wetlands) will be staked out prior to work operations so that these areas are protected.
- A 15 m buffer zone from wetland boundaries will be maintained to the extent feasible during construction. Care will be taken to avoid unnecessary impacts.
- The Construction Manager will limit activity within wetland buffer zones.
- Work conducted in the vicinity of wetlands will be conducted in a manner which ensures that erosion and sedimentation of wetlands is minimized.
- Where material is excavated from a wetland and backfilled (buried power cable), wetland topsoil will be conserved separately from subsoil and returned to the upper horizon.
- Where wetland surfaces are disturbed and restored, care will be taken to ensure the post construction surface elevation matches the elevation of the surrounding wetland so that it does not form a ridge or a depression.
- The natural drainage pattern in disturbed wetlands shall be maintained to the extent possible by the installation of appropriate cross-drains and culverts (at watercourses).

- Restored wetland areas should not be treated with conventional seed-mix or hay mulch, or with chemicals, but allowed to regenerate by natural recolonization. This process will be supported by the successful conservation and placement of original wetland topsoil.
- During horizontal direction drilling under wetlands, continuous monitoring shall be conducted to detect "frac-outs" where drilling fluid may come to the surface in the wetland area. Small frac-outs will be contained using straw bail barriers and if severe will be addressed by operational controls (modified drilling practices) and/or suction truck.
- Appropriate erosion control measures will be installed prior to conducting the work. Work will be completed as soon as possible and will be suspended during and immediately after intense rainstorms and during periods of high runoff.
- Equipment travel will be limited to turbine laneways during rainfall events.
- In areas where extensive erosion occurs (e.g., along steep slopes) or in environmentally sensitive areas, an active re-vegetation program will be implemented as soon as possible following disturbance to ensure rapid re-vegetation.
- Materials cleared from the sites (brush, logs, soil, etc.) should not be dumped into otherwise unaffected land and are not permitted within any wetland buffer zone.
- Slash will be piled outside the buffer zone of a wetland (i.e., greater than 15 m from a wetland) for subsequent chipping and disposal in an approved facility.
- Construction equipment will not enter buffer zones of wetlands or environmentally sensitive areas, except within the Project footprint and under direct supervision of the Site Supervisor or Environmental Inspector.
- Erosion control measures will be monitored during construction activities within the RoW and in any areas associated with Project construction activities. Where damage to these erosion control measures is observed, they will be promptly repaired to prevent siltation of wetlands or other environmentally sensitive areas.
- Where a vegetation buffer between erodible slopes and water bodies is less than 15 m, or where construction areas are immediately upgradient of adjacent properties, an engineered silt fence will be constructed to control silt runoff and placed along the down gradient perimeter of the construction area.
- Sediment-laden water resulting from dust control measures will be collected by erosion control measures in place on-site such as sediment control fences and check dams.
- Silt or sediment control fences will consist of woven synthetic fibre fabric attached to wooden posts.
- In extremely erodible areas, straw mulch will be used as required for protection.
- Where erosion control within a drainage ditch is required, geotextile wrapped straw bales will be installed to provide a check dam and prevent downstream sedimentation. Some rockfill or rip rap may be installed on the downstream side of the check dam to secure the structure during heavy rainfall events.
- The Contractor will maintain the erosion control structures in a functional condition as long as necessary to contain sediment from run-off, from time of installation until a sufficient vegetative cover growth (>90% cover) has been established.

- All erosion control structures and sediment control fences will be inspected before, during and following each rainfall event and at least daily during periods of prolonged rainfall. Any damage arising from major storm events will be repaired as soon as possible to the satisfaction of the Site Supervisor.
- Retained sediment will be removed when it has accumulated to a level of half the height of the fence/barrier and disposed at least 15 m away from any wetland in a manner that prevents it from entering a wetland.
- Suspend any construction operations contributing to the problem.
- Isolate, contain, and control the source using measures such as straw bales or brush mats. Erosion control structures will be fixed immediately.
- If the release has affected, or has the potential to affect, a sensitive area (i.e., a wetland), the Site Supervisor will contact and consult with the appropriate regulatory authorities (e.g., PEI EECA, DFO) as required for notification and planning.
- To ensure that erosion and sediment control measures are in effective working order, their condition will be monitored periodically and prior to, during, and following storm events.
- Accumulated sediment will be removed once it reaches a depth of one-half the effective height of the control measure or a depth of 300 mm immediately upstream of the control measure.
- For all erosion control measures, accumulated sediment will be removed as necessary to perform maintenance repairs.
- Accumulated sediment will be removed immediately prior to the removal of control measures.
- The on-site fuel storage container shall be located on level terrain, at least 100 m from any wetland.
- No fuel storage will occur in sensitive areas (e.g., near wetlands) or associated buffer zone.
- Fueling must be done at least 30 m from a wetland.
- Servicing of equipment will not be allowed within 100 m of a wetland.
- The Contractor will, with the prior approval of the Site Supervisor, designate and use areas for the transfer and limited temporary storage of hazardous materials and special wastes. These sites will be properly labeled and appropriately controlled and will be located a minimum of 15 m from a wetland.
- On-site temporary disposal areas for surplus material will be designated and will be located a minimum of 15 m from a wetland.

Operation Phase

- Limit removal of riparian zone vegetation.
- Adhere to federal and provincial approval conditions for sedimentation.
- Use mechanical vegetation control and avoid use of herbicides. No pesticides can be used.

5.2.7.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

The project will result in a maximum total loss of 5.66 ha of wetland habitat (predominantly forested swamp). This loss of wetland function will need to be offset by the development of a wetland compensation area somewhere else. This will be accomplished by establishing an agreement with an approved wetland construction organization, such as Ducks Unlimited, to provide an area of created or restored wetland sufficiently large to compensate for the wetland area loss and reduced functions impacted by the Project. A wetland offsetting plan will be developed as part of the WWABZAP approval process, subject to regulatory review and approval. With the successful implementation of recommended mitigation measures and final offsetting of any permanent loss of wetland function by creation of compensation wetland areas, the significance of Project residual effects on wetlands will be negligible.

5.2.8 AVIFAUNA

5.2.8.1 SIGNIFICANCE DETERMINATION

A significant adverse effect on avifauna (birds) would be one which results in contravention of MBCA, SARA or PEIWCA provisions, or for non-SARA or non-PEIWCA listed priority species, a decline in abundance and/or a change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its pre-Project level within several (three to five) generations.

5.2.8.2 POTENTIAL INTERACTIONS AND EFFECTS

The main impacts to bird species during clearing, grubbing and excavation activities includes: direct injury or death of adult birds, nestlings or eggs through collisions or the destruction of nests; temporary disturbance of birds due to noise, visual impacts and the presence of humans (workers in the area); and intermittent or permanent loss, fragmentation, alteration or degradation of breeding, feeding and resting habitat. Habitat degradation can result from fugitive dust for the construction and movement of construction equipment, negative changes to water quality due to erosion and run-off, and introduction and spread of invasive vegetation.

The sight and sound of humans and vehicles and other engines are known to disturb birds. The disturbance can result in interruption of the regular behaviour, such as feeding, migrating and breeding. Birds tend to avoid areas where they are disturbed. If birds are displaced to avoid disturbance, this effectively means a loss in suitable habitat. Disturbance effects are species, season, and site-specific (Langston and Pullan 2003). There are few studies on disturbance effects, and often there are no conclusive results (Langston and Pullan 2003). Some species may habituate to these new conditions, but others do not appear to be able to do this (Langston and Pullan 2003).

The greatest impact to birds during the construction of the wind farm will be lost, altered, and fragmented habitat (BLM 2004). Land that will be lost includes: new permanent turbine laneways and wind turbine “footprints”. This impact is considered to be moderate as the total amount of habitat that will be displaced is small compared to the total available in the Study Area.

The altered areas should return to native vegetation upon the end of construction. The impact on these areas will consist of a short-term loss of habitat for one or a limited number of years until the vegetation has recovered. Bird use of this land for feeding and resting will only be impacted for the duration of construction work itself, i.e., a few weeks at each location. However, since the habitat will be altered until it has recovered, the composition of the bird species using a particular area may change to reflect their different feeding habits.

5.2.8.3 MITIGATION MEASURES

Construction Phase

- All clearing, grubbing, and trimming activities will be scheduled to avoid sensitive breeding, nesting and brooding periods (typically May 1st to August 31st) of avian species (birds and bats) as much as possible. All other construction activities will be scheduled between May 1 and the end of the construction period for that calendar year.
- Limit removal of tall trees and snags to areas absolutely necessary for construction, including trees of 15 cm diameter or greater.
- For clearing activities, the following measures will be implemented:
  - Clearing activities will be scheduled in consideration of critical habitat features identified during the pre-construction field survey.
  - The proponent will instruct the management team and contractors on the MBCA, the importance of habitat, the significance of the nesting period, and measures to be implemented to minimize any disturbance to birds/nests.
  - A bird nest survey of the area will be conducted by a professional biologist/ornithologist/birder prior to clearing activities. The bird species recorded during the survey will be used as an indicator regarding the potential nesting habitat in the area.
  - The typical nesting habitat for these species would be investigated for potential nests.
  - Nest trees will be felled prior to or after the nesting season.
  - The occurrence of all identified nests will be documented.
- If dead animals are encountered, they will be removed and disposed of, as soon as possible, in consultation with the local Provincial Conservation Officer (or, in the case of a pet, the PEI Humane Society). All handling of bird carcasses will be in accordance with the MBCA salvage permit. If SARA species carcasses are found, they will be sent to the Sackville CWS office with suitable permitting as advised by the CWS.
- In the case of encounters with injured or diseased avifauna at the work site (including bats), the Construction Manager will contact the on-call Provincial Conservation Officer. No attempt will be made to harass the animal, and no person at the work site will come into direct contact with the animal. Injured birds will be transported to the Atlantic Veterinary College in Charlottetown, PEI where they will be received by a certified wildlife rehabilitator.
- If an injured or dead bird or bat is encountered, the following information will be recorded: date and time it was found, injury sustained (if identifiable), cause of injury (if known), and species. This information will be kept on file for incorporation into the post-construction bird and bat monitoring program.
- If there is soil (not rock) in the lay-down areas used for assembly of turbine parts adjacent to the turbine foundations, the soil will be aerated and loosened after use to counteract the compaction caused by the equipment. The vegetation will be allowed to return to a natural state.
- When grassed areas are encountered during grading, every effort will be made to leave such grassed areas intact.

- Native plant regeneration will be promoted in any areas that are cleared but not built upon (i.e., roadside ditches, temporary laydown areas, etc.).
- Use native plants or no vegetation at all around turbines, avoid Mountain Ash trees.
- Avoid mowed lawn.
- Imported equipment will be thoroughly cleaned before it arrives on PEI in order to prevent the introduction of exotic species.

Operation Phase

Birds have long been a concern for wind turbine generators, particularly due to the potential for collisions with the turbines. The impact best known to the public is the potential for direct bird mortality due to collisions with turbines, but other potential impacts are mortality from collisions with guy wires, power lines, loss or degradation of habitat, disturbance, barrier effect, interference with normal behaviour (such as feeding, breeding), etc. These effects can be caused by activities associated with construction, operation and decommissioning of the wind farm.

Any bird using the wind farm area may be impacted by associated structures and activities. Field surveys were conducted throughout 2021-22 to determine if there are breeding birds, resident non-breeding birds, migratory birds or wintering birds which use the Project Study Area at different times of the year.

The sensitivity to disturbance varies from species to species and may also vary with the type of behaviour that is influenced. Studies in the Netherlands demonstrated that breeding bird density near roads was less than the density away from roads (BLM, 2004). Monitoring studies of wind farms showed that, in a given species, breeding birds were much less sensitive to turbine presences than migrating, resting birds (German Wind Energy Association 2005). Sounds produced by the turbine may also disturb birds, but many birds adapt to the presence over time and progressively move closer to the turbines – a behaviour known as “habituation”. Since disturbance and avoidance vary from species to species and may also vary depending on the status of the bird (breeding, floating, migrating), the impact assessment will be completed for separate species groups, where necessary and where literature data are available. Impacts will be more important for SAR, or protected species such as migrating birds. Impacts would also be larger for previously undisturbed areas.

Effects of wind turbine developments on birds fall mainly into two categories: indirect effects due to habitat loss and disturbance, among others, as well as the direct effect of injury or mortality through collisions.

In consultation with regulators, a environmental effects monitoring program may be developed to verify predictions of the assessment.

5.2.8.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

With the successful implementation of the mitigation measures described above, Project activities related to construction, operation and maintenance of Project components are not likely to result in significant adverse residual adverse effects on migratory birds and raptors, including priority species.

5.2.9 BATS

5.2.9.1 SIGNIFICANCE DETERMINATION

A significant adverse effect on wildlife would be one which results in contravention of the *PEI Wildlife Conservation Act* or SARA provisions; for non-SARA or non-PEIWCA listed priority species, one which causes a decline in abundance and/or a change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its pre-project level within several (three to five) generations. An adverse effect that does not cause such declines or changes is not considered to be significant.

5.2.9.2 POTENTIAL INTERACTIONS AND EFFECTS

Impacts on bats could result from direct effects such as death of individuals during the land clearing activity, or indirect impacts due to loss and/or alteration of habitat as well as disturbance and noise. Many of the impacts to birds can be extrapolated to bats. Whether an impact is significant depends on the number of bats impacted and the vulnerability of the species.

Worldwide, habitat loss has been identified as the main cause of declines in bat populations (Mickleburgh et al., 2002). Bats need several types of habitat to survive: foraging areas, summer roosting areas, and hibernation areas. Loss or alteration of any of these habitat types can have impacts on bats. Wind power developments can potentially impact these crucial habitats in a variety of ways.

Tree clearing activities remove or alter foraging and roosting sites and are detrimental to local bat populations (Waldien et al., 2000a, 2000b; Hayes 2003; Humphrey 1982). This can also affect bat species which hibernate in hollow trees or on the ground. In particular, removal of large diameter snags and/or hollow trees can be detrimental to maternity colonies and local populations (Bringham et al., 1997; Waldien et al. 2000a and 2000b). Alteration or degradation of riparian areas could also affect foraging habitats. Replacement of mature forest areas with younger regenerating forest can also affect bats. Broders and Forbes (2004) noted that in NB, roost selection by male little brown bats appeared highly dependent on the number of snags (dead trees) in the area.

During the operational phase, bats could be affected by collisions with turbines or infrastructure such as buildings, power lines, etc., or by noise from the turbines if it interferes with foraging. They could also be attracted to, or repelled by, the turbine noise. Turbines may also affect the distribution of insect prey.

<u>Bat Collisions</u>

During the operational phase, there is a potential risk to bats from collisions with turbines or ancillary structures. Bats have been shown to be killed by the collision with the turning rotor blades of turbines (Horn et al., 2004). The mechanism is unclear since bats are thought to detect moving objects better than stationary ones (Jen and McCarty 1978). While bats have been shown to fly and feed in close proximity to the wind turbines (Ahlen 2003; Horn et al., 2004) via radar, echolocation is relatively ineffective at distances greater than 10 m for most bat species, so bats foraging around turbines may fail to predict rotor velocity or to detect the large rapidly moving turbine blades (Ahlen 2003). There is nothing in a bat's natural habitat comparable to a turbine, so they may not recognize it as a threat.

It has been postulated that land clearing for construction of turbine laneways, turbine foundations, and power transmission lines might attract bats by mimicking natural linear landscape features, such as natural forest edges, along which foraging and commuting bats may regularly travel (Kunz et al., 2007; Verboom and Spoelstra 1999). Several authors have suggested that tree-roosting bats may mistake the turbine monopoles for roost trees and fly into the rotor blades (Ahlen 2003; von Hensen 2004, cited in Baerwald et al., 2008). Cryan (2008) suggested that tree bats collide with turbines while engaging in mating behaviours that centre on the tallest trees in the landscape (in this case, the turbines).

It is noted that hoary bats, which were detected at the Project Site, are considered potential breeders in PEI based on recent studies (Curley et al., 2019), appear to be more attracted to turbines than myotis bats (Foo et al., 2017; Cryan et al., 2014). The reasons for this attraction are not entirely clear but appear to be related to increased foraging opportunities around turbines (Rydell et al., 2016; Foo et al., 2017).

Many other hypotheses involve the attraction of insects. Turbines are often situated at the highest points in the landscape, where some flying insects tend to gather in an activity known as ‘‘hilltopping,” potentially attracting foraging bats. Published studies in North America reveal a surprising lack of correlation between local landscape features and fatalities at wind energy sites. An example is the relatively high fatality rates of bats reported from sites in open, treeless, relatively unmodified landscapes (e.g., Alberta, Canada—Baerwald 2010). Other authors have suggested that insects may be attracted to aviation lights, warmth or colour of turbines - in turn drawing in hungry bats (Kunz et al., 2007). It has also been suggested that the clearing of treed areas around turbine sites creates habitat conducive to the aerial insects which most bats feed upon (Grindal and Brigham 1998; Baerwald et al., 2008), thereby indirectly attracting foraging bats.

The risk for resident bats (little brown bat and northern long-eared bats) is different from the risk to migrating bats such as the hoary bat. Though there is a risk of fatal collisions with turbines when bats are present, most published reports show that mortality of resident bats is generally low; numbers may vary, however, with the location of the wind farm. Erickson et al., (2002) states that the collision risk for resident breeding bats is virtually nil, resulting in no apparent impact on resident breeding bats. In addition, the risk to bats is somewhat correlated with the number of passes a bat makes across wind turbines (one mortality for every 70 passes) (Johnson et al., 2002, in Erickson et al., 2002). Collision risk is low because bats generally forage below 25 m height. The lowest blade height for the turbine model chosen for the Project is approximately 25-34 m. Bats will only infrequently fly within the blade height, particularly since the trees in the area are short. Broders et al., (2003) have found that little brown bats and Northern long-eared bats are typically caught near ground level. At maximum activity at the Project Site, an average of 3.2 call sequences were recorded per unit per night in August and an average of 0.9 call sequences in early September.

Migrating bats are known to be at a higher risk from collisions with turbines than resident bats (Keeley et al., 2001; Erickson et al., 2002) - possibly because they may rely on sight more than echolocation while migrating (Keeley et al., 2001). In addition, long distance migrants such as hoary or red bats (*Lasiurus* spp) may be more likely to fly through open areas, and to fly at heights that would bring them into contact with turbine blades or cables used for anchoring turbines or communication towers than short distance migrants such as *Myotis* sp. (Keeley et al., 2001). Again, the risk is positively correlated with the number of bats passing through the turbine area. Recent surveys indicate the Project Study Area is an important migratory route for bats. However, Project impacts on migratory bats are considered to be minimal to nonexistent.

Barotrauma

An additional threat unique to bats is caused by fluctuating air pressure near an active turbine. It has long been recognized that spinning turbine blades create vortices at the turbine blade tips, causing rapid changes in atmospheric pressure as the rotor blades rotate downward. The decompression hypothesis suggests that bats are killed by lung injuries (barotrauma) due to the rapid reductions in air pressure near the moving turbine blades. Evidence for this effect comes from the fact that some bats killed at wind turbines show no sign of external injury, but necropsies have shown signs of internal organ damage consistent with decompression. Baerwald et al., (2009) provided the first evidence that barotrauma is the cause of death in a high proportion of bat deaths around a wind turbine. Their study found that 90% of all bat fatalities (nearly half of which showed no external injury) at a wind turbine in Alberta involved internal hemorrhaging consistent with barotrauma, and that direct collision with turbine blades accounted for 50% of fatalities. The faster a turbine blade is spinning, the greater the pressure drop in the vortex.

Noise Impacts

During the operational phase, bats could also be impacted by noises emitted by the turbines. As bats use ultrasound (20 kilohertz (kHz) and up) for echolocation of prey, there could potentially be interference with foraging activities, if the sounds from the turbine cover the frequencies that bats use for echolocation. The frequencies and volume of sound in the 20 to 60 kHz range are of particular interest. Sounds emanating from wind farms could potentially result in bats avoiding the area or, conversely, may attract bats to the turbines (Keeley et al., 2001; Schmidt and Joermann 1986), potentially increasing the risk of collisions. However, since bats were found to forage at distances as close as 1 m from a moving turbine blade, it appears unlikely that bats would avoid a wind farm because of noise. They have been shown via thermal imaging to fly and feed in close proximity to the wind turbines (Ahlen 2003, Horn et al., 2004). Erickson et al., (2002) stated there is no impact of turbine noise on echolocation, as bats are generally able to avoid moving turbine blades, because only few resident bats collide with the turbines, even if there is a high level of bat activity around turbines. Therefore, sound emissions from turbines are not expected to adversely affect foraging activities or lead to displacement of bats.

Other Impacts

Since some bats are known to be sensitive to magnetic fields, (Buchler and Wasilewski 1985; Holland et al., 2006), it is possible that the complex electromagnetic fields produced by turbines around nacelles may interfere with perception in these species. Further research is required to determine the extent of this effect, if any, though such research is beyond the scope of this Project.

5.2.9.3 MITIGATION MEASURES

Construction Phase

- All clearing, grubbing and trimming activities will be scheduled to avoid sensitive brooding periods (April 15th to August 31st) of bats as much as possible.
- Limit removal of tall trees and snags to areas absolutely necessary for construction, including trees of 15 cm diameter or greater.
- The working limits of the Project footprint will be clearly defined to prevent trespassing. The Contract Manager will ensure all activities are contained with the defined Project footprint.

- Equipment and vehicles will only operate on cleared RoWs or areas designated for construction activities in the Plans/Drawings.
- For clearing activities, the following measures will be implemented:
  - Clearing activities will be scheduled in consideration of critical habitat features (e.g., wetland areas) identified during the pre-construction field survey.
  - The proponent will instruct the management team and contractors on the SARA, the importance of habitat, the significance of the brooding period, and measures to be implemented to minimize any disturbances.
- All personnel will report the presence of wildlife to the Construction Manager.
- When wildlife sightings are reported to the Construction Manager, the Construction Manager will initiate any reasonable action to reduce the chance of disruption or injury. Should disruption or injury to the wildlife occur, the Construction Manager will contact the on-call Provincial Conservation Officer.
- In the case of wildlife encounters in sensitive areas, and for consultation on appropriate action to be taken for any encounter, the Construction Manager will contact the on-call Provincial Conservation Officer.
- In the case of encounters with injured or diseased bats at the work site, the Construction Manager will:
  - Contact the Provincial Conservation Officer. No attempt will be made to harass the animal, and no person at the work site will come into direct contact with the animal.
  - A photograph will be taken, and the following information will be recorded: date and time it was found, injury sustained (if identifiable), cause of injury (if known), and species. This information will be kept on file for incorporation into the post-construction bird and bat monitoring program.

Operation Phase

- All personnel will report notable wildlife sightings (dangerous, injured, dead, or SAR) to the Construction Manager
- The Construction Manager will initiate any reasonable action to reduce the chance of disruption or injury to reported wildlife
- Should disruption or injury to wildlife occur, the Construction Manager will contact the on-call Conservation Officer in Wellington at (902) 854-7250
- If encountered, dead animals will be removed and disposed of as soon as possible
- If found, carcasses of SARA-listed species will be sent to the Sackville CWS office with suitable permitting as advised by CWS
- Provide environmental awareness training
- Report all incidents of injured or dead wildlife to the on-call Conservation Officer in Wellington at (902) 854-7250
- Bat impact surveys may need to be conducted during the Operation phase of the project

5.2.9.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

With the successful implementation of the mitigation measures described above, Project activities related to construction, operation and maintenance of Project components are not likely to result in significant residual adverse effects on migratory birds and raptors, including priority species.

5.2.10 FISH

5.2.10.1 SIGNIFICANCE DETERMINATION

The Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2007) recommend the following:

- TSS concentration in surface waters should not increase by more than 25 mg/L for any short-term exposure (i.e., 24-hour period) with a maximum average increase of 25 mg/L from background levels for longer term exposures (i.e., inputs lasting between 24 hours and 30 days).
- TSS concentration in surface waters should not increase by more than 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. When background levels are greater than or equal to 250 mg/L, TSS concentration should not increase more than 10% of background levels.

The legislative authority for the management and conservation of fish and fish habitat in Canada is provided by the federal *Fisheries Act*. Section 2(1) of the *Fisheries Act* defines fish habitat as: "water 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."

The main provision of the *Fisheries Act* regarding the protection of fish habitat is Section 35(1) which states, "No person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat."

Furthermore, Section 36(3) states, "No person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water."

The SARA states, "The Act aims to prevent wildlife species from becoming extirpated or extinct, to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity, and to manage species of special concern to prevent them from becoming endangered or threatened." If a species is listed under Schedule 1 of SARA as extirpated, endangered or threatened, it is an offence to kill, harm, harass, capture or take an individual (s. 32[1]), and that species has legal protection related to the species' residence and critical habitat as specified in SARA (s. 56, 58[1]) (ECCC 2016).

Based on the above, a significant adverse residual environmental effect on the aquatic environment is defined as a Project-related environmental effect that:

- Results in the harmful alteration, disruption or destruction of fish habitat (as defined by the *Fisheries Act*), that occur as a result of Project activities without federal approval and/or without required implement approval conditions (e.g., offsetting plan) after mitigation measures are implemented.

- Project-related activities that, after the implementation of mitigation measures, result in the harmful alteration, disruption or destruction of fish habitat and cannot be remedied with an appropriate offsetting plan.
- Results in the deposition of a deleterious substance (under Section 36(3) of the *Fisheries Act*) into the aquatic environment
- Results in the exceedance of water quality guidelines outlined in the conditions of approval.
- Results in the death, harm harassment or capture of a species listed as extirpated, endangered, or threatened under Schedule 1 of SARA, after mitigation measures are implemented.

A positive effect is one that enhances the quality or area of habitat or increases species diversity.

5.2.10.2 POTENTIAL INTERACTIONS AND EFFECTS

Project activities will include several watercourse crossings by turbine laneways. The crossings will be designed as either single span bridges or culverts. Both options will include clearing of riparian vegetation and some potential for disturbance of the bed and banks of a watercourse during Construction and from regular maintenance during Operation. Impacts may include direct disturbance of the bed and banks of a watercourse, and degraded water quality from uncontrolled releases of site runoff into a watercourse or wetland.

Disturbance of the stream bed within a fish-bearing watercourse or direct impacts on fish during culvert installations would require a DFO Fisheries Authorization, including development of an off-set plan to compensate for a loss of fish habitat. Therefore, watercourse crossings will be designed to minimize or eliminate direct impacts on aquatic habitat.

Riparian vegetation stabilizes banks, moderates water temperature by shading, and provides cover for fish. Failure to encourage re-growth of vegetation along watercourse banks following a disturbance may lead to elevated or diminished water temperatures, increased sediment, and loss of refuge for many fish species.

Surface runoff from disturbed areas can transport eroded soils into a watercourse. The soil may then deposit, and thereby affect aquatic resources. The erosion of soil from the site footprint and unstabilized areas can potentially harm fish inhabiting adjacent watercourses. Suspended solids are carried in the water column and can adversely affect fish and benthic invertebrate populations. Potential effects on fish include the elimination of spawning habitat by sediment infilling; clogging of gills; reduction of light and changes in predator-prey interactions by increased turbidity.

Sublethal effects have been reported for a variety of fish species in waters with TSS concentrations of approximately 650 mg/L or greater, when fish are continually exposed for a period of several days (Appleby and Scarratt 1989). Physiological effects are related to the concentrations and durations of exposure (Anderson et al., 1996). Fish mortality can result from exposure to high concentrations of TSS for a short duration, or a long exposure to suspended solids of low concentration. There are also differences in sensitivity between species. While levels of 100 mg/L are frequently cited as harmful, lethal levels (LC10) of TSS for a number of fish species are above 580 mg/L in static bioassays (Sherk et al., 1974). Mortality of fish eggs or alevins within the stream substrate may also be caused by the deposition of previously suspended fine material. The size and shape of the suspended particles also has a bearing on the TSS concentration that causes fish mortality (Anderson et al., 1996).

Fish habitat also includes fish food organisms. Benthic macroinvertebrates make up the majority of fish food organisms in north temperate streams. These organisms are adversely affected by increased levels of TSS, either through direct mortality, displacement to another area, or loss of habitat. Sedimentation events have been shown to result in decreases in invertebrate density, biomass, and species diversity (Gammon 1970). Benthic invertebrates may become buried under high sediment loads and suffer other ill-effects such as clogged gills, decreased food supply as well as habitat loss. While behavioural effects such as predator-prey interactions are easily reversed (Newcombe 1994), the physiological damage caused by sediment on aquatic organisms can be fatal.

5.2.10.3 MITIGATION MEASURES

Construction Phase

- Environmentally sensitive areas (i.e., wetlands and watercourses) will be staked out prior to work operations so that these areas are protected.
- A 15 m buffer zone will be maintained on each side of a wetland/watercourse.
- The Construction Manager will limit activity within watercourse and wetland buffer zones, as well as within areas where rare species are noted to occur.
- Work conducted in the vicinity of wetlands/watercourses will be conducted in a manner which ensures that erosion and sedimentation of wetlands/watercourses is minimized.
- Appropriate erosion control measures will be installed prior to conducting the work. Work will be completed as soon as possible and will be suspended during and immediately after intense rainstorms and during periods of high runoff.
- Equipment travel will be limited to roads during rainfall events.
- In areas where extensive erosion occurs (e.g., along steep slopes) or in environmentally sensitive areas, an active re-vegetation program will be implemented as soon as possible following disturbance to ensure rapid re-vegetation.
- Materials cleared from the sites (brush, logs, soil, etc.) should not be dumped into otherwise unaffected land and are not permitted within any watercourse/wetland buffer zone.
- Slash will be piled outside the buffer zone of a wetland or watercourse (i.e., greater than 15 m from a wetland or watercourse) for subsequent chipping and disposal in an approved facility.
- Construction equipment will not enter buffer zones of wetlands/watercourses or environmentally sensitive areas, except within the Project footprint and under direct supervision of the Site Supervisor or Environmental Inspector.
- Erosion control measures will be monitored during construction activities within the RoW and any areas associated with Project construction activities. Where damage to these erosion control measures is observed, they will be promptly repaired to prevent siltation of wetlands/watercourses or other environmentally sensitive areas.
- Where a vegetation buffer between erodible slopes and water bodies is less than 15 m, or where construction areas are immediately upgradient of adjacent properties, an engineered silt fence will be constructed to control silt runoff and placed along the down gradient perimeter of the construction area.

- Sediment-laden water resulting from dust control measures will be collected by erosion control measures in place on-site such as sediment control fences and check dams.
- Silt or sediment control fences will consist of woven synthetic fibre fabric attached to wooden posts.
- In extremely erodible areas, straw mulch will be used as required for protection.
- Silt fences will not be used to control sedimentation within a ditch or watercourse.
- Where erosion control within a drainage ditch is required, geotextile wrapped straw bales will be installed to provide a check dam and prevent downstream sedimentation. Some rockfill or rip rap may be installed on the downstream side of the check dam to secure the structure during heavy rainfall events.
- The Contractor will maintain the erosion control structures in a functional condition as long as necessary to contain sediment from run-off, from time of installation until a sufficient vegetative cover growth (>90% cover) has been established.
- All erosion control structures and sediment control fences will be inspected before, during and following each rainfall event and at least daily during periods of prolonged rainfall. Any damage arising from major storm events will be repaired as soon as possible to the satisfaction of the Site Supervisor.
- Retained sediment will be removed when it has accumulated to a level of half the height of the fence/barrier and disposed at least 15 m away from any wetland or watercourse in a manner that prevents it from entering a wetland or watercourse.
- If siltation of the nearby watercourses is observed, notify the Construction Manager and identify the source of the siltation. Siltation indicates preventative measures have been ineffective.
- Suspend any construction operations contributing to the problem.
- Isolate, contain, and control the source using measures such as straw bales or brush mats. Erosion control structures will be fixed immediately.
- If the release has affected, or has the potential to affect, a sensitive area (i.e., a wetland or watercourse), the Site Supervisor will contact and consult with the appropriate regulatory authorities (e.g., PEIDEWCC, DFO) as required for notification and planning.
- To ensure that erosion and sediment control measures are in effective working order, their condition will be monitored periodically and prior to, during, and following storm events.
- Accumulated sediment will be removed once it reaches a depth of one-half the effective height of the control measure or a depth of 300 mm immediately upstream of the control measure.
- For all erosion control measures, accumulated sediment will be removed as necessary to perform maintenance repairs.
- Accumulated sediment will be removed immediately prior to the removal of control measures.
- The sediment removed will be deposited in an area that is approved by the Construction Manager and will not result in erosion and runoff into a watercourse.
- No waste or debris will be permitted to enter any watercourse.
- Run-off from a disposal/storage area will not be allowed to enter a watercourse.

- The on-site POL storage container shall be located on level terrain, at least 100 m from any water body or wetland.
- No POL storage will occur in sensitive areas (e.g., near wetlands, watercourses or wells) or associated buffer zone.
- Fueling must be done at least 30 m from a wetland or waterbody.
- Servicing of equipment will not be allowed within 100 m of a wetland, watercourse or drainage ditch.
- The Contractor will, with the prior approval of the Site Supervisor, designate and use areas for the transfer and limited temporary storage of hazardous materials and special wastes. These sites will be properly labeled and appropriately controlled and will be located a minimum of 15 m from a wetland or watercourse.
- On-site temporary disposal areas for surplus material will be designated and will be located a minimum of 15 m from a wetland or watercourse.
- Culvert installation and disturbance of the bed or banks of a watercourse will be planned during the mid-late summer low flow period to the extent possible.
- Prior to any watercourse crossing installation, a Watercourse, Wetland and Buffer Zone Activity Permit will be obtained and the conditions of the approval shall be complied with.
- Work within a watercourse or wetland shall be designed in accordance with the Watercourse, Wetland and Buffer Zone Activity Guidelines (Version 3).
- Instream construction will be conducted in-the-dry, such that flowing water is diverted around the construction site.
- Prior to any instream activities in a fish-bearing watercourse, a fish rescue will be conducted to remove fish from the construction area. Fish removals shall be conducted under the authority of a DFO permit.

Operation Phase

- Sensitive features (i.e., watercourses) identified during construction will be protected during maintenance activities.
- All waste generated in the removal of damaged and deteriorated components will be collected for proper disposal.
- All necessary precautions will be taken to prevent discharge or loss of any harmful material or substance into a watercourse.
- Minimizing the Project footprint and implement erosion control and dust abatement.

5.2.10.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

It is anticipated that the residual adverse effects of the Project on the environment will be minimal after the mitigation measures in the sections listed above are implemented.

5.2.11 INDIGENOUS LAND USE AND RESOURCES

5.2.11.1 SIGNIFICANCE DETERMINATION

A significant adverse effect on traditional use of land and resources is defined as one which results in a detrimental long-term change in current use of the land and resources for traditional purposes by the Mi'kmaw of Prince Edward Island by the Project.

5.2.11.2 POTENTIAL INTERACTIONS AND EFFECTS

Based on the background review of the Project Study Area, the wind farm placement has been determined to exhibit elevated potential for Indigenous archaeological resources in areas situated in proximity to Black Pond Brook, other watercourses, and wetlands. The closest present-day Indigenous community is located 42 km away and therefore will not be directly impacted by the Project.

5.2.11.3 MITIGATION MEASURES

Construction Phase

Standard mitigation for potential impacts on archaeological resources of all types are detailed in Section 5.2.15.3. Any discoveries of potential Indigenous archeological finds will be discussed with the Mi'kmaw of Prince Edward Island as Invenergy is committed to informational exchange relationships with the Indigenous community.

Operation Phase

Standard mitigation for potential impacts on archaeological resources of all types are detailed in Section 5.2.15.3. Due to possible effects of the Project, the Company will continue to consult with the Mi'kmaw of Prince Edward Island.

5.2.11.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

There are no anticipated significant adverse effects on traditional use of land and resources.

5.2.12 LAND USE AND ECONOMY

5.2.12.1 SIGNIFICANCE DETERMINATION

A significant effect on existing and planned land uses outside of the RoW of the proposed wind farm is one that results in a permanent change in current use of land or future opportunities to develop land, or a permanent loss of existing recreational opportunities.

5.2.12.2 POTENTIAL INTERACTIONS AND EFFECTS

The main impacts to the environment will occur during land preparation (clearing, grubbing and excavation) for access routes and temporary workspaces as well as during collector line implementation and turbine assembly. There should be no economic impact during this time.

5.2.12.3 MITIGATION MEASURES

Construction Phase

- Property boundaries will be identified, where possible, prior to commencing work activities. This may include staking out private property prior to work operations.
- The Contractor will ensure landowners and the public are notified of the schedule of construction activities taking place.
- All site activities will be carefully planned and performed in such a manner that noise is minimized.
- The frequency and/or duration of noise producing activities will be minimized wherever possible.
- All heavy construction equipment will be maintained in accordance with the manufacturer's specifications and equipped with appropriate mufflers and other noise control equipment to minimize noise where appropriate.
- Vehicle traffic, construction activities, and heavy equipment operation on-site will be limited to normal working hours.
- The Contractor will ensure idling of construction vehicles is limited.
- The routing of truck traffic through residential areas will be controlled during the maximum period of activity.
- Equipment and vehicles will only operate on cleared rights-of-way or areas designated for construction activities in the Plans/Drawings.
- The area of disturbance will be limited to that which is absolutely necessary to conduct the work.
- Clearing will be minimized to that necessary to construct and operate the turbines and the electrical substation, install single phase line, collector lines and transmission lines and implement turbine laneways.
- Soil compaction will be avoided by limiting the traffic flow on turbine laneways.
- Because soil admixing can also result from excessive rutting of turbine laneways, travel on the turbine laneways will be limited following periods of heavy rain.
- The potential for soil admixing to occur will be mitigated through the stripping of topsoil from any area which requires grading and the storage of the topsoil separately from the subsoil for reuse during rehabilitation of the site.
- Stoniness will be avoided by removing any noticeable stone concentration to an approved location.
- During the excavation for the foundation, any shallow soft rock that may be encountered will not be mixed with the topsoil. Topsoil and excavated overburden and bedrock will be stored in separate stockpiles for later use during rehabilitation.
- Excavated materials will largely be used on original clearing sites, where appropriate.
- All sand, aggregate, soil, or other materials in place or in stockpiles must be contained to prevent materials from producing dusty conditions and from cross contamination, as determined necessary by the Site Supervisor or Construction Manager.
- All borrow material pits will be inspected for invasive species prior to importing the material to site.
- Sand and soil stockpiles will be bermed and sloped (and seeded with non-invasive, herbaceous, native species, if abandoned) to minimize runoff. If stockpiles are not needed immediately, temporary erosion and sediment control devices will be installed and regularly maintained.

- Only material approved by the Project Manager and the Site Supervisor will be disposed of or reused onsite (e.g., clean fill materials).
- Mobile fuelling trucks will be used to minimize the requirements for on-site storage of petroleum, oils or lubricants (POLs).
- The transport of fuel will be conducted in compliance with the Transportation of Dangerous Goods Act.
- Diesel fuel and gasoline may be stored on-site in limited quantities. Drums as required for one day's use will be on-site, and drums will be delivered on a daily basis. Fuel drums will be stored upright on a deck with drip trays for the collection of spilled substances.
- Where possible, vehicle maintenance will be performed off-site, at a nearby commercial fuelling station, in order to minimize the amount of lubricants and oils stored on-site. Some heavy equipment, such as the cranes, will be maintained on-site due to the challenges involved in moving the equipment.
- The Contractor will make daily inspections of hydraulic and fuel systems on machinery and leaks will be repaired immediately. All leaks will be reported to the Canadian Coast Guard at 1-800-565-1633. Regarding transmission line, leaks will be reported in compliance with MECL Spill Agreement for Line Construction.
- On-site Petroleum, Oil, and lubricants (POL) storage will be in a ventilated, lockable steel container. The container will be equipped with galvanized steel drip trays for the collection of spilled substances.
- Spill decks will be used for transferring products to smaller containers.
- Fire extinguishers and spill kits will be located near POL storage areas.
- POL storage areas will be identified by signs, and "No Smoking" signs will be displayed at all POL storage sites and refuelling areas.
- Smoking will not be permitted within 50 m of any POL storage area. On-site signage will indicate the location of smoking areas.
- When refueling equipment, operators will:
  - Use designated fuelling locations.
  - Use drips trays.
  - Use leak free containers and reinforced rip and puncture proof hoses and nozzles.
  - Be in attendance for the duration of the procedure.
  - Seal all storage container outlets except the outlet currently in use.
- Fuelling attendants will be trained in the requirements under a Fuel and Hazardous Material Spills Contingency Plan.
- Waste POLs will be stored in a ventilated, lockable steel container. The container will be equipped with galvanized steel drip trays for the collection of spilled substances.
- Waste solvents and oils will be stored separately.
- All used oil and petroleum products will be removed from the Site and disposed of in an acceptable manner in accordance with government regulations, and requirements. Waste oil will be collected separately and offered for recycling or stored for collection by an appropriate special waste collection and disposal company.

- Greasy or oily rags or materials subject to spontaneous combustion will be deposited, and kept, in an appropriate receptacle. This material will be removed from the work Site on a regular basis and will be disposed of in an approved existing waste disposal facility.
- POL waste disposal will be the responsibility of the Contractor.
- Waste produced during the Project construction will be sorted as per the requirements of the PEI Waste Watch Program.
- During the initial stages of site development and where it is not feasible to install sewage treatment facilities, portable and/or temporary toilets and washcars will be developed with holding tanks.
- The holding tanks will be pumped and emptied at as required and disposed of by the sanitation contractor at an approved facility.
- Domestic waste from temporary office quarters will be gathered on a regular basis and stored in closed containers until recycled or disposed of as per the requirements of the PEI Waste Watch Program.
- All surplus materials, rubbish, waste materials, and construction debris will be removed from the Site upon completion of construction of the Project.
- All waste will be handled in accordance with relevant provincial and federal requirements.
- Waste material will not be dumped on-site. In such case as waste materials are inadvertently dumped, the Construction Manager (or designate) will immediately act to have the dumped material cleaned up and removed.
- Firefighting equipment, sufficient to suit on-site fire hazards, will be maintained in proper condition and to the manufacturer’s standards.
- On-site personnel will take immediate steps to extinguish the fire using appropriate equipment.
- If the fire cannot be contained, contact the Fire Department at 9-1-1. Notify nearby personnel, the Project Manager and Construction Manager.
- In case of related medical emergencies, emergency medical assistance will be requested from 9-1-1.

Operation Phase

A portion of privately owed land will be used for the life of the project. Land use agreements will be in place for the duration of the Project.

5.2.12.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

There are no anticipated direct adverse effects on existing and planned land uses. A positive residual effect is expected due to a local power source and jobs being created.

5.2.13 VISUAL LANDSCAPE

5.2.13.1 SIGNIFICANCE DETERMINATION

The US Bureau of Land Management (BLM) defines visual impacts as the contrast perceived by observers between existing landscapes and proposed projects and activities (BLM 2004).

5.2.13.2 POTENTIAL INTERACTIONS AND EFFECTS

Adverse visual impacts can be grouped into three major types: unnatural intrusion of man-made appearance or disfigurement; partial degradation, reduction or impairment of the existing level of visual quality, and complete loss of the visual resources. The amount of visual contrast from the turbines will influence the degree to which a structure or "activity intrudes on, degrades or reduces the visual quality of a landscape" (BLM 2004).

Factors that contribute to negative impressions are: lattice towers, shiny surfaces, colour contrast to the surroundings, artificial, industrial appearance contrasting the natural environment, presence of logos or advertising signs, location of turbines at prominent landscape features, arrangement of turbines, etc. Glare from shiny surfaces and shadow flicker contribute to the visual impacts, as may lighting requirements. Strong, steady lighting may cause "skyglow" (BLM 2004). Also, "untidy" arrangement of turbines may increase the negative impression. Garbage, traces of leaks from the nacelles, and otherwise dirty turbines will also result in a more negative impression on the viewer, as do "idle" turbines or turbines with parts missing (BLM 2004).

5.2.13.3 MITIGATION MEASURES

Construction Phase

Visual impacts of turbines cannot be avoided without abandoning the Project, however there are a number of mitigation measures that will reduce the potential for negative impacts (BLM 2004). Many have been considered by the turbine manufacturer and during the planning of the wind farm layout. These include:

- Tubular towers.
- Aesthetic balance in the design.
- Light grey colour, non-reflective, non-shiny steel.
- Turbine model identical for all turbines.
- Turbines arranged in clusters where possible (no disorder).
- No long lines of turbines.
- Turbines not located on elevated land points.
- Visual simulations of the Site landscape including Project turbines available to the public.

Operation Phase

- Minimizing the lighting on the turbines to what is required for air safety.
- Minimizing the Project footprint
- Implementation of erosion control and dust abatement.
- Repair turbines immediately and remove obsolete turbines instead of just switching them off, in order to prevent the impression of idle turbines.
- Clean the turbines, particularly traces of spills from the nacelle.
- Remove excess materials and any 'fugitive' litter from the Project Study Area.
- Avoid posting commercial signs.

5.2.13.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

Wind turbines will be visible in the skyline. No significant adverse effects are anticipated on the visual landscape.

5.2.14 PUBLIC SAFETY

5.2.14.1 SIGNIFICANCE DETERMINATION

A significant adverse impact on public safety is considered to be any Project related effect which causes harm to third parties or damage to public or private property. The study boundaries for these impacts are considered to be within the Project footprint and 4-times turbine height set-back (approximately 800 m), and on public roads used for Project related material transportation, and within the potential shadow-flicker view-shed.

Potential impacts from air emissions and noise are considered separately in Sections 5.2.1 and 5.2.2 respectively.

5.2.14.2 POTENTIAL INTERACTIONS AND EFFECTS

There are several potential safety issues for the public. This would involve the transportation of materials to and from the Site which extends the spatial boundaries to include other public roads.

The potential hazards from the operation phase include the potential formation of ice on the turbine blades (ice-throw), and the potential for breakage of turbines or turbine blades. Structural failure of the turbines and rotors is a rare event but can be caused by material fatigue, rotor over-speed, poor maintenance or lightning strikes. There are also potential issues regarding human health, such as shadow flicker and excessive noise levels.

Shadow flicker from the proposed Skinners Pond Wind Project has been assessed by Frontier Power Systems using a shadow flicker model to determine the flicker possible at each receptor location. Wind speed data and long-term sunshine data were used to determine representative, worst-case value for shadow flicker hours at each receptor.

The realistic maximum shadow flicker is predicted to be greater than 30 hours per year at 16 receptor locations with a maximum of 48 hours per year at receptor 41.

The modelling used conservative assumptions so it is likely that site specific conditions will reduce the amount of shadow flicker observed throughout the year. Site specific conditions that may mitigate shadow flicker impact include trees or buildings that block the line of sight to the proposed turbine locations, seasonal or intermittent use, or the absence of windows facing the direction of the wind farm.

Preliminary results of the assessment indicated that shadow flicker from the proposed wind turbines could have the potential to cause annoyance for a subset of receptors. Therefore, the Proponent elected to implement a curtailment scheme to four of the turbines (T1, T2, T3, and T6) that will reduce for 16 effected residences the annual shadow flicker to under 30 hours. These residences are clustered along the western edge of the project. Additional mitigation measures may be employed if necessary. Mitigation measures include the installation of window blinds or awnings.

The full assessment of the potential for shadow flicker impacts for this Project conducted by Frontier Power Systems is provided as Appendix M.

5.2.14.3 MITIGATION MEASURES

Construction Phase

Any special permits required for the delivery of turbine components using overweight or non-compliant trucking configurations will be obtained. The public will be made aware of the construction zone and advised to stay out of the area. Other mitigation measures include:

- The Contractor will ensure landowners and the public are notified of the schedule of construction activities taking place.
- All site activities will be carefully planned and performed in such a manner that noise is minimized.
- The frequency and/or duration of noise producing activities will be minimized wherever possible.
- All heavy construction equipment will be maintained in accordance with the manufacturer's specifications and equipped with appropriate mufflers and other noise control equipment to minimize noise where appropriate.
- Vehicle traffic, construction activities, and heavy equipment operation on-site will be limited to normal working hours.
- The Contractor will ensure idling of construction vehicles is limited.
- The routing of truck traffic through residential areas will be controlled during the maximum period of activity.
- Equipment and vehicles will only operate on cleared rights-of-way or areas designated for construction activities in the Plans/Drawings.
- The area of disturbance will be limited to that which is absolutely necessary to conduct the work.
- Clearing will be minimized to that necessary to construct and operate the turbines and the electrical substation, install single phase line, collector lines and transmission lines and implement turbine laneways.
- In case of related medical emergencies, emergency medical assistance will be requested from 9-1-1.

Operation Phase

The Project Study Area has an appropriate setback from any residential infrastructure and the potential for interaction with the public is minimal. The public will be advised to avoid the turbines.

5.2.14.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

There are no anticipated significant adverse residual effects to the public concerning safety if all safety measures are followed.

5.2.15 HERITAGE AND ARCHAEOLOGICAL RESOURCES

5.2.15.1 SIGNIFICANCE DETERMINATION

A significant adverse effect on heritage and archaeological resources is defined as one which results in a permanent disturbance or destruction of an archaeological or heritage resource considered by provincial heritage regulators or the First Nation of Prince Edward Island to be of major importance where this effect is not mitigated or compensated.

5.2.15.2 POTENTIAL INTERACTIONS AND EFFECTS

Ground disturbing activities associated with construction of this Project could have significant adverse effects on archaeological resources. If unmitigated, activities such as grubbing, grading, and excavation could result in the permanent loss of irreplaceable cultural and archaeological resources and the knowledge that can be gained from them.

As mentioned in Section 2.1, a portion of the proposed footprint was not field surveyed at the adjusted locations of Turbines T14 and T15, and along the proposed alternative electrical collector corridor adjacent to Palmer Road. No site-specific information is known about the presence of archaeological high potential areas at these locations, and this will need to be established with field surveys in May/June of 2023 and submitted in an addendum report, including an updated effects assessment.

5.2.15.3 MITIGATION MEASURES

Construction Phase

With the exception of the 5 HPA sites identified within the planned wind farm area, the rest of the site is considered to have low archeological or heritage potential. In consultation with regulators, a testing program will be designed to verify the presence of archaeological features. Where HPA’s are confirmed, further mitigation is required. Should a significant feature be discovered, regulators and Indigenous communities will be consulted to determine an appropriate approach to mitigation. Significant features will be avoided by adjusting the Project footprint. Within verified HPA’s where artifacts are not observed by a testing program, ground disturbing activities shall be monitored by a qualified archaeologist.

As cultural and archaeological features are non-renewable resources and any impact is permanent, clearly defined mitigative measures are necessary to avoid a significant residual environmental effect. Despite efforts to identify and avoid areas of high potential for archaeological resources, there always remains some potential to accidentally encounter buried archaeological features. Therefore, during ground disturbing activities (e.g., clearing, grubbing, removal of overburden) additional mitigation is required:

- Site personnel will be made aware of the potential for archaeological resources within the Project footprint.
- During any ground disturbing activities, if potential archaeological resources are discovered, the following accidental discovery protocols shall be followed:
  - Secure the Area.
  - Contact Site Supervisor.
- Site Supervisor shall stop work in the immediate vicinity of the find, visually examine the find, take photographs (if possible), and record the following information:
  - A description of the possible archaeological resource.
  - The location of the activity and construction activity being conducted.
  - If possible, the approximate depth at which the materials were identified.
- Site Supervisor shall contact a qualified archaeologist and provide the information. If possible, email the photographs of the object(s) and the location where it was uncovered.

- The archaeologist will assess the situation. Options for proceeding include: continue excavations, cease excavations in the area and move to another area, a site visit by the archaeologist, and contacting appropriate authorities including the provincial Archaeology regulator;
- When accidental discovery of archaeological resources or human remains has occurred, the Indigenous community representatives will be notified and informed of how the discovered feature is to be addressed. Any concerns or advice provided by the Indigenous group shall be taken into consideration and recorded in an engagement and communication tracking log.

Discovery of Human Remains:

- All personnel are responsible for reporting any unusual materials discovered or unearthed during site activities to the Site Manager.
- If the discovered unusual materials appear to be related to illegal activity or physical human remains, stop work, halt all activities in the vicinity of the find at once (minimum 10 x 10 m area), and secure the area.
- Immediately contact the Site Manager of the discovery.
- Until determined otherwise, the items should be treated as evidence in a criminal investigation. If the items are found in the bucket of heavy equipment, the bucket should not be emptied as physical evidence may be destroyed.
- The area should immediately be designated as “Out of Bounds” to all personnel and the public.
- Depending on the weather and other conditions, provide non-intrusive protection, such as covering the find with a cloth or canvas tarp (non-plastic preferred).
- All personnel and traffic should exit the site by one common non-intrusive path. Curiosity seekers should be kept off the site.
- Should the discovery appear to be related to illegal activity, the Site Manager will contact the local or lead police agency (911).
- Should the discovery potentially be human remains, the Site Supervisor will visually examine the find, take photographs (if possible), and record the following information:
- A description of the possible archaeological resource;
- The location of the activity and construction activity being conducted;
- If possible, the approximate depth at which the materials were identified;
- The Site Supervisor shall contact a qualified archaeologist and provide the information. If possible, email the photographs of the object(s) and the location where it was uncovered;
- The archaeologist will assess the discovery to confirm whether or not it is human skeletal material. This might be accomplished via the telephone and email but may require a site visit.
- If the discovery is determined to be human remains, the Site Manager will contact the local or lead police agency (911), while the Project archaeologist will contact the provincial Archaeology regulator. The lead police agency will determine if the situation is associated with a crime or an archaeological feature.
- Work can only restart in the vicinity of the discovery once clearance has been received from the authorities and agencies concerned.

Operation Phase

No other site disturbances should occur during the Operation Phase of the wind farm. Significant effects on heritage and archeological resources are not expected.

5.2.15.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

Given the mitigative measures above, no significant adverse residual environmental effects on heritage and archaeological resources are anticipated.

The effect on heritage and archaeological resources in the Project Study Area caused by construction, operation and maintenance of the wind farm is not expected to be significant.

5.3 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Several environmental factors could have adverse effects on the Project such as extreme weather events, fire, and global climate change. These effects have been considered during the Project design phase.

5.3.1 EXTREME WEATHER

Severe weather events could potentially damage wind turbines due to conditions exceeding the operational design. High winds, extreme temperatures, and icing on blades all have the potential to shut down wind turbines, posing negative effects on energy production and revenue.

Violent local storms in the form of tornadoes, severe thunderstorms, and hailstorms are atypical for the Province. Nonetheless, the Island is susceptible to the destructive forces of powerful Atlantic storms that can generate strong winds, heavy rains, and storm surge. Recently, on the 24 September, 2022, Hurricane Fiona struck PEI as a post-tropical cyclone with extreme force. Wind gusts were measured at up to 136 km/h at North Cape with 71 mm rain (CBC News 2022). A previous storm in September 1999 recorded 200 mm of rain at Charlottetown - the highest daily total ever recorded for any PEI station.

Winter storms can also produce a variety of rapidly changing weather conditions. These can consist of hurricane force winds exceeding 100 km/h with heavy precipitation composed of rain, snow, or a mix thereof (ECCC 2013a). When such events occur during high tide, storm surges become a problem in coastal areas around PEI (ECCC 2013b). These storm surges are expected to worsen with rising sea levels, with sea levels rising 30 cm since 1900 (Atlantic Climate Adaptation Solutions Association nd). These winter storms can pass rapidly through the region or stall and batter the Province for days. When the centres of the storms remain on the southern shore, precipitation reaches the Gulf and the Island in the form of snow. If the low centre passes to the northern region, the snow changes to freezing rain and then rain. Freezing rain is rare, and generally occurs for approximately 40 hours per year. On the 19 February, 2004, a system colloquially known as "White Juan" (having occurred the winter after 2003's Hurricane Juan hit the Maritimes) blew winds up to 104 km/hr and dumped 74 cm of snow in Charlottetown (Atlantic Climate Adaptation Solutions Association 2011).

These winter storms can bring high winds, freezing rain/sleet, heavy snowfalls and below freezing temperatures. With the extreme events, snow and ice buildup is common on objects such as tree branches and power lines (Government of Prince Edward Island 2020). Ice can also accumulate on the wind turbine blades, even when they are moving. This ice can be thrown off the blades, which poses a hazard to onsite personnel, as well as the public in the vicinity of the turbines.

Ice can build up due to melting snow or when the air temperature is below 0ºC while there is humidity in the air (including rain, fog, or drizzle). These conditions are relatively frequent along PEI's Atlantic coast, despite the winter weather conditions being comparatively mild. The amount and the consistency of ice depend on the weather conditions and the operational status of the turbines (i.e., moving or stationary). Morgan et al., 1998 (in Sea Breeze 2004) mention that ice build-up is greater on moving turbines than on stationary ones.

Most ice shedding occurs as temperatures rise and the ice thaws from the rotor (Morgan et al., 1998 in Sea Breeze 2004). Typically, icing on the rotors and nacelle leads to automatic rotor shutdown. Restart occurs only when the ice has melted and the operators re-start the turbine. However, the authors state that it is common practice for operators to speed up this process by thawing the sensors and re-starting the still ice-covered rotors. This leads to heavy ice shedding. Few data are available on the mass of the ice pieces and the distance they travel (Morgan et al., 1998 in Sea Breeze 2004). Observations put the mass of pieces found on the ground between 0.1 and 1 kilogram (kg), and the distance to 15 - 100 m (rotor diameter up to 60 m), but it is not known how well the area was searched. Large pieces tend to disintegrate in flight. Ice tends to fall predominantly downwind from the turbine. It also appears that most ice drops off rather than being thrown off (Morgan et al., 1998 in Sea Breeze 2004).

To date, no fatalities have been reported as a result of icing, and relatively few known incidents of ice shedding injury have been observed (Caithness Windfarm Information Forum (CWIF) 2019). Ice shedding can be of little danger to the public since the setbacks required to minimize noise are usually sufficient to protect the public from any danger from shed ice. In addition, ice build up on the rotors slows down the rotation. This is sensed by the turbine's control system and causes the turbine to shut down. Morgan et al., (1998 in Sea Breeze 2004) states that the risk of being struck by ice shed from a turbine is "diminishingly small" at distances over 250 m from a turbine with moderate icing. The same report points out that there were no earlier studies on this concern, attributable to there being no reported injuries from thrown ice, despite the 6000 MW of turbine power installed worldwide at the time. However, the authors also state that there had been several "significant incidents" in Germany in 1997-1998. The Canadian Wind Energy Association (CanWEA 2007) recommends a distance of blade length plus 10 m from public roads, non-participating property lines and other developments. Distances between turbine locations and nearest residences and public roads for the Project exceed 600 m.

Ice being thrown off the blades in theory poses a health and safety concern for any person onsite or near the turbine, since it may result in injuries. The ice may be thrown up to 100 m (Morgan et al., 1998 in Sea Breeze 2004). However, ice is mainly a public safety issue since operations personnel are trained and are more likely to avoid the hazard. On the other hand, operations staff is at greater risk from ice since they work more regularly and at shorter distances from the turbine. In addition to personal injuries, ice impacts may cause damage to residences and vehicles.

Adverse effects from ice build up and ice shedding are likely. While the frequency is relatively low, the effects are potentially severe. Therefore, ice is considered to potentially cause significant impacts, and mitigation measures should be applied.

Recommended Mitigation

Based on the climate data available, some extreme weather events are possible. Extreme weather events that could occur within PEI are listed in Table 5.6 as well as the possible effects and mitigations associated with these events are presented.

Table 5.6 Extreme Events, Associated Effects, and Mitigation

Weather Event	Effect	Mitigation
Extreme Wind	Damage to blades.	Automated control system would initiate shut down.
Hail	Damage to blades.	Appropriate turbine maintenance.
Heavy rain and flooding	None anticipated.	None.
Heavy snow	Damage to turbine components.	Automated control system would initiate shut down.
Ice Storms	Icing on blades resulting in potential ice shedding.	Automated control system would initiate shut down.
Lightning	Potential for fires within nacelle of turbine.	Lightning protection system would conduct surge away from nacelle.

The effects on the turbines have been considered during the Project designs, and losses to productivity are not a concern. The turbine towers will be equipped with lightning protection and electronic wind speed monitoring. In cases of extreme weather conditions with wind speeds exceeding 25 m/s, the rotors will cut-out automatically.

All workers will be trained on the hazards due to ice build up on tall structures. The wind turbines will be set back a sufficient distance from the nearest residences, roads and public access areas for an appropriate distance to prevent ice impacts.

The turbines will be equipped with technology to detect when there is significant ice build up on the blades and the operator can shut or slow down the turbines when there is a high risk of ice shedding or damage to the turbine due to the added weight from the ice buildup.

With the application of the aforementioned mitigation measures, significant adverse effects of extreme weather events on the Project are not likely.

5.3.2 WILDFIRE

Uncontrolled wildfires can be very destructive and may arise through natural occurrences such as lightning strikes; negligence such as grass-burning practices; or by accident such as equipment sparks. In PEI, fire season typically runs from 15 March to 30 November. Between 2007 and 2010 there were between four and eight forest fires fought by the PEI Forest Service per year with an average of approximately 6 ha of land burned. In years previous, there have been anywhere from 12 to 80 fires per year with over 200 ha burned during the worst year (PEIDAF 2012).

To prevent damage to the project infrastructure from wildfires, an area of 25 m around each structure should be kept free of scrub and low brush. Safety mechanisms are to be in place to shut down facilities in case of fire.

5.3.3 GLOBAL CLIMATE CHANGE

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as “a change of climate which can be attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (Government of Canada 2010b). Emissions of GHGs, including CO_2, methane (CH_4), nitrous oxide (N_2O), ozone (O_3), sulphur hexafluoride (SF_6), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and chlorofluorocarbons (CFCs) released into the atmosphere primarily through anthropogenic activities such as the burning of fossil fuels are contributing to global climate change (Government of Canada 2010b).

The Intergovernmental Panel on Climate Change (IPCC) is an international organization of the world’s leading climate scientists and is affiliated with the UN. According to the IPCC, human activities have already resulted in an overall global warming of 1.0°C and is forecasted to reach 1.5 between 2030 and 2052 should it continue to increase at the current rate (IPCC 2018).

The increase in average temperatures is projected to be accompanied by an increase in severe weather events and a rise in sea levels. Severe weather events include flood, drought and storms, as well as the rise in sea levels that will increase the number and severity (height) of storm surges, the wave energy and erosion (Lemmen et al., 2008).

Although PEI produces less than 1% of Canada’s GHG emissions and is considered a “low emitter,” this province has been identified as an area most vulnerable to sea level rise due to its characteristic highly erodible sandstone bedrock, indented sandy shoreline with many estuaries and marshes, and ongoing submergence of coastline. The sea level has already risen by 30 cm since 1900, is expected to rise another 73 cm by 2090. Warmer waters have triggered earlier molting for lobster fished in Island waters, which can prompt changes to fishing seasons (CBC News 2012).

Based on this information and location of the Project in Skinners Pond, it is likely that the Study Area will be impacted by increased occurrences of severe weather. Watercourse crossings in the Project Study Area will need to be designed to reflect projected future higher precipitation events.

6 CUMULATIVE EFFECTS

The PEI EECA requires consideration of cumulative effects that are likely to occur in respect to the Project. The recently enacted federal *Impact Assessment Act* (August 2019) defines cumulative effects as "changes to the environment that are caused by an action in combination with other past, present and future human actions" and that a cumulative effects assessment should:

- Assess effects over a larger (i.e., "regional") area that may cross jurisdictional boundaries, including effects due to natural perturbations affecting environmental components and human actions.
- Assess effects during a longer period of time into the past and future.
- Consider effects on VCs that may result in interactions with other actions, and not just the effects of the single action under review.
- Include other past, existing and future (reasonably foreseeable) actions.
- Evaluate significance in consideration of beyond localized, direct effects.

To-date, the IAAC has adopted the existing reference guide entitled "Cumulative Effects Assessment Practitioners Guide" from the Agency (CEAA 1999).

6.1 BOUNDARIES

For the purpose of identifying and assessing cumulative effects, the spatial dimensions can be variable, depending on the VC that is being assessed. For example, the cumulative effects on air quality can cover an area well beyond the footprint of the Study Area. For this assessment, interaction with other major developments within about 15 km have been considered. The temporal boundaries are extended to include past, current, and known planned or reasonably foreseeable projects.

6.2 OTHER PROJECTS IN THE AREA

6.2.1 EXISTING

In general, development activity in the area is focused on the nearshore and inshore fishery, agriculture, tourism and forestry. The land / water interface of the fishery in the area is concentrated at Skinners Pond DFO SCH. The Skinners Pond Wind Project site is located approximately 5 km southwest of the Norway Wind Park and 33 km northeast of the West Cape Wind Park.

6.2.2 FUTURE

As part of the Provincial Energy Strategy, the PEIEC was given the directive to develop another 30 MW of wind power to enable the Province to aid in the federal CO_2 eq reduction targets equal to or greater than 30% below 2005 levels by 2030. The eight operating wind farms in the Province produce 204 MWs of electricity, about 25% of

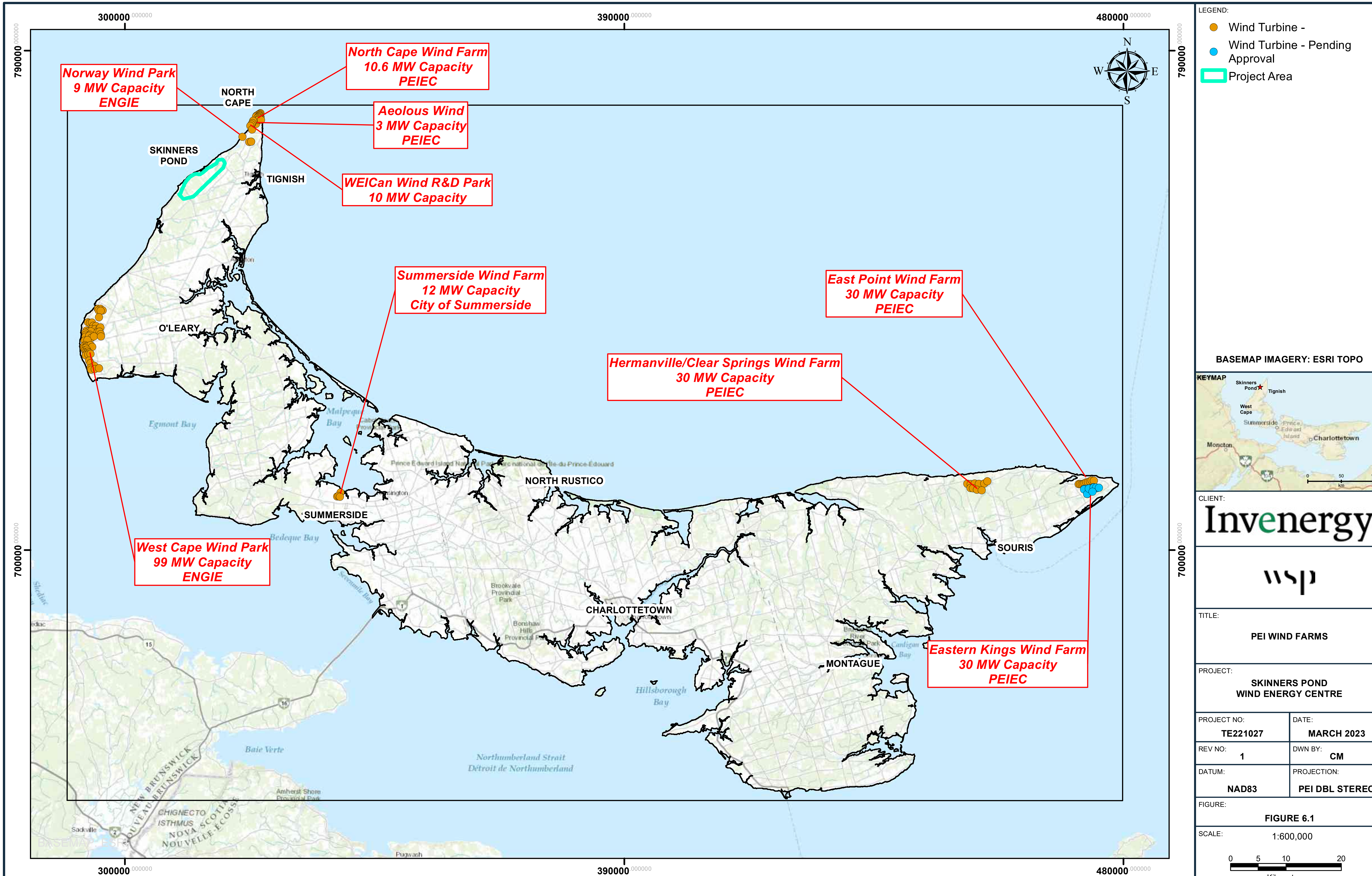
PEI's electricity supply (Figure 6.1). It is anticipated there will be wind projects being undertaken in the Province going forward, but future wind facilities near the Project Study Area that are not yet proposed cannot be included in this assessment.

It is assumed that a high-voltage transmission powerline extension will be constructed (by others) into northwestern Prince County immediately prior to or coincident with the Project construction schedule.

A search of the Canadian Impact Assessment Registry (IAAC 2022) was conducted to identify proposed or recently approved major activities in the region around the Project site that should be considered reasonably foreseeable. The search revealed the following proposed projects:

- Harbour improvement projects at the nearby Skinners Pond Small Craft Harbour (SCH); both determined as having no significant adverse effects and approved in 2021(https://iaac-aeic.gc.ca/050/evaluations/proj/82971, https://iaac-aeic.gc.ca/050/evaluations/proj/81732, https://iaac-aeic.gc.ca/050/evaluations/proj/80857).
- Howards Cove SCH Wharf Upgrades (https://iaac-aeic.gc.ca/050/evaluations/proj/81778)
- Darnley Bridge SCH Basin Dredging (https://iaac-aeic.gc.ca/050/evaluations/proj/80651).

A similar search of the PEI EECA registry of Projects Under Environmental Review (PEI EECA, 2022c) indicated there are no current major activities under review or recently approved in the Project Study Area.



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6.3 IMPACT ASSESSMENT

The cumulative effects assessment considers the potential for Project related "residual effects on the environment" (i.e., effects after mitigation measures have been applied), when combined with the environmental effects of past, present and future (reasonably foreseeable) projects and activities, to cause significant impacts that are not predicted from the Project residual effects alone. A significant cumulative impact may occur when multiple separate projects or activities have the same effect on the same environmental component in an overlapping manner.

The VCs presented in Section 5 have been examined along with other past, present and future projects to identify potential adverse cumulative effects; a summary of which are outlined in Table 6.1. There have been 10 specific VCs identified with reference to the proposed Project (Table 5.1). Of those VCs identified, four can be considered components of cumulative effects analysis. Table 6.1 indicates the potential cumulative effects VCs and the rationale for inclusion / exclusion. The examination of cumulative effects will focus on projects within an approximate 10 km radius of the Study Area as well as present and future wind farm developments. There are no other major developments initiated or planned within the region that will have overlapping effects on the VCs associated with Project related impacts.

Table 6.1: Potential Cumulative Effects for VCs and Rationale

VC	Potential for Cumulative Effect	Rationale for Inclusion/Exclusion	Cumulative Effect Level
Atmospheric Environment	Yes	Potential effects on local ambient air quality and acoustic environment primarily limited to short construction/decommissioning phases and will reduce reliance on fossil fuel generated grid electricity and contribute to renewable energy for PEI to address climate change.	Moderate (benefits)
Surface Water	No	Potential effects on local watercourses/wetlands combined with existing agricultural and private woodlot activities. All activities are controlled by regulation (Watercourse, Wetland and Buffer Zone Activities Permit), therefore, no cumulative effects are expected.	na
Groundwater	Yes	Potential effects on local groundwater availability in combination with residential wells and agricultural irrigation allocations.	Low
Terrestrial Fauna SAR	No	Effect limited to Project footprint and short-term in construction/decommissioning phases. No predicted Project residual effects.	na
Wetland	No	Potential permanent loss of wetland habitat will occur up to 5.66 ha. A wetland compensation plan will be developed to offset the Project related impacts, therefore there will be no residual effect.	na
Birds and Bats	Yes	Increased possibility of interaction with a turbine. Removal of Habitat.	Low
Indigenous Land Use and Resources	No	Construction related loss of Indigenous archaeological and heritage resources. Proposed mitigation will eliminate the potential for accidental destruction of Indigenous archaeological features or heritage resources; therefore, no residual impacts are expected.	na

VC	Potential for Cumulative Effect	Rationale for Inclusion/Exclusion	Cumulative Effect Level
Land Use and Economy	No	Construction/decommissioning-related purchasing and demand are not expected to strain the locally available services, and creation of long-term high wage employment and taxation revenue during Operation.	na
Visual Landscape	Yes	Multiple wind facility turbines will be visible from certain local vantage points.	Low
Public Safety	No	Onsite Construction and Operation effects localized and 4-times turbine height setback generally protective of local residents. There are no Operation turbine effects overlap with other projects. Construction related material transportation on local roads will be controlled by regulatory permits and guidelines, therefore, no residual impacts are expected.	na
Archaeological and Heritage Resources	No	Effect localized and limited to short construction/ decommissioning phases. Proposed mitigation will eliminate potential for loss of archaeological and heritage resources; therefore, no residual effects are expected.	na

6.3.1 ATMOSPHERIC ENVIRONMENT

There is some potential for Project related emissions to combine with dust from local agricultural activities and air contaminants from local traffic and affect ambient air quality. Anticipated Project residual effects after mitigation are very low magnitude and restricted to the construction period (approximately 6-12 months). Many Project activities are planned during winter and parts of the year when climate conditions are wet or with frozen/snow covered ground when dust from agriculture does not occur. Mitigation for these effects is summarized in Section 5.2.1. Cumulative effects from increased air contaminants is expected to be below regulatory air quality guidelines.

During Operation, the Project will generate green energy sourced power for the provincial grid which will displace current remaining fossil fuel sourced electricity. In combination with other existing and future wind and solar energy projects in the Province, the cumulative effect will be to meet the provincial goals of carbon free energy in PEI and significantly reduced provincial Greenhouse Gas contributions to climate change.

6.3.2 GROUNDWATER

There is potential for the Project-related temporary water withdrawal to have a cumulative impact on the local groundwater availability in combination with local residential wells. As there are no agricultural irrigation systems located within 15km, no related impact is anticipated. Local groundwater could be shared by a number of local stakeholders and the proposed Project withdrawal is relatively large. There are many strategies that can be used in the design of an onsite water supply system to minimize the impact on local groundwater availability. Mitigation for these effects is summarized in Section 5.2.3. Prior to installation and operation of an onsite groundwater supply system, a provincial Water Withdrawal Permit will be obtained, including an extensive groundwater supply assessment and review and approval of the detailed design by regulators. Groundwater permitted allocations are managed by the Province, and it is expected that appropriate coordination with other local groundwater users will be part of the approval process. Some special mitigation may be required to address this potential cumulative effect, likely implemented as conditions of approval for the Water Withdrawal Permit.

6.3.3 BIRDS

Birds can be affected by wind generation developments during construction and operation phases. During construction (particularly during sensitive breeding and nesting periods) disruption of breeding, nesting and rearing can result from exposure to noise, vegetation clearing and destruction of nests as well as suitable habitat. Mitigation for these effects is summarized in Section 5.2.8 - most importantly the avoidance of clearing during the sensitive nesting period. No other proposed projects or activities are expected to be conducted in the Project Study Area during the currently planned Project construction schedule. Habitat loss can have a long-term cumulative effect on bird populations, though it is unlikely that habitat loss due to this small footprint (about 16 ha displaced from a total forest area of 1376.8 ha within the Project Study Area) will have an appreciable negative impact on species diversity or numbers. It is noted that the local landscape does not appear to have changed significantly in at least 25 years. There is no particular reason to think that local land use practices will change in the future.

During operation and maintenance, displacement can occur, resulting in habitat loss for birds (Drewitt and Langston 2006). Birds may be displaced by the presence of the turbines themselves through visual, noise and vibration impacts, as well as repetitive vehicle movements related to maintenance. While the other wind farms in the region are in operational mode, regular maintenance does not result in excessive intrusion. There will, however, be some cumulative effects through implementation of this Project. Mitigative measures (minimizing footprint, making maximum use of existing access routes, and remote monitoring) will aid in limiting the cumulative impact.

Previous studies have indicated that birds may exhibit avoidance behavior when encountering a series of turbines. They may either fly around or over the turbines without stopping (Dalzell 2010). While risk of collision has been thought of as a major cause of bird mortality in relation to wind turbines, studies have shown this to be a relatively low level of mortality in birds (Drewitt and Langston 2006).

Cumulative effects to local and migratory birds are not expected to be significant following implementation of recommended mitigation measures (Section 5.2.8). A summary of the cumulative effects assessment is presented in Table 6.2.

Table 6.2: Summary of Cumulative Effects

VC	Project Activities	Other Projects/Activities	Predicted Cumulative Effects	Cumulative Effect Level
Atmospheric Environment	Construction related air emissions from mobile equipment, vehicles, and temporary concrete batch plant. Generation of green energy and displacement of fossil fuel generated grid electricity in the Province during Operation (i.e., reduced carbon intensity).	Local agricultural activities (dust), traffic (air emissions), and other existing and future wind and solar projects in PEI.	• Increased dust and air contaminants in the local airshed. Proposed mitigation will eliminate residual effects. • Reduced carbon intensity in provincial electricity grid will reduce greenhouse gas impacts on climate change. Effects are considered significant to the extent that climate change is predicted to cause severe damage to provincial infrastructure and risk to public health and safety.	Moderate (benefits)

Groundwater	Construction related temporary concrete batch plant water supply	Local residential wells only (no proximate agricultural irrigation water supply systems.	• Increased demand on local available groundwater supply. Managed by regulatory water withdrawal permits and annual groundwater allocations.	Low
Birds	Turbine, transmission line, turbine laneway; Construction & Operation	WEICan North Cape site, agriculture	• Incremental increase in collisions with turbine blades, structure, and powerlines • Incremental reduction in habitat due to development	Low
Bats	Turbine, transmission line, turbine laneway; Construction & Operation	WEICan North Cape site, agriculture	• Incremental increase in collisions with turbine blades • Incremental reduction in habitat due to development	Low
Aesthetic and Visual Landscape	Turbine Operation	Norway Wind Farm	• Increased number of turbines in visual landscape (e.g., vantage point from local roads increased from 0 to approximately 12 structures).	Low

6.3.4 BATS

Bats can be subject to disruption by wind turbines through construction activities, human activities during operations, and mortality resulting from passing close to rotating turbine blades.

The small scope of the project is anticipated to have a negligible cumulative effect on bat populations. Minimal clearing will be undertaken for construction activities which result in little change to the existing habitat, resulting in benign effects to the bat population. A follow-up program will be developed to monitor the local bat population and determine whether Project impacts, including cumulative effects, are positive or negative.

Cumulative effects to bats are not expected to be significant following implementation of recommended mitigation measures (Section 5.2.9). A summary of the cumulative effects assessment is presented in Table 6.2.

6.3.5 AESTHETICS AND VISUAL LANDSCAPE

Considering other windfarms in proximity to the Project, the addition of new turbine structures to the local landscape will not pose a significant change to the skyline. The turbines will likely be most visible to boaters and fishermen. According to visual simulations created for the Project, up to 12 Project turbines at a time will be visible from local roads around the site. Mitigation is proposed to minimize the potentially negative effects on aesthetic appearance (Section 5.2.13) and impacts are not expected to be significant following implementation of those measures as recommended. A summary of the cumulative effects assessment is presented in Table 6.2.

7 CONSULTATION PROGRAM

Engagement of Indigenous communities is a critical element in the regulatory review of all proposed projects throughout Canada, a mandatory requirement in the provincial EA process, and is a best practice for project proponents to understand and address potential issues and concerns. There is also a legal Duty to Consult with the Mi'kmaq of PEI.

Consultation with Provincial agencies such as the PEI EECA has been ongoing since the inception of the Project and continues as it evolves. The Provincial EIA process also requires consultation with all interested stakeholders. PEI EECA has been and will continue to be an integral part of that process. Consultation and engagement activities completed by the Proponent are documented in the following subsections.

7.1 REGULATORY CONSULTATION

WSP and the Proponent have maintained ongoing consultation with representatives from federal and provincial regulatory agencies, local government representatives, and resource managers to identify issues specific to the proposed Project and identify appropriate mitigation strategies. The agencies/individuals consulted, and the topics of these consultations are noted in Table 7.1.

Table 7.1: Regulatory Representatives from Federal, Provincial and Municipal Organizations Contacted, their Affiliation and Topics Discussed

Contact	Affiliation	Topics
Wendell Labobe	L'nuey	• Project description • Project development, • EIA process and progress • Consultation
Lori St. Onge	Indigenous Relations Coordinator, PEIIRS	• Potential for heritage and archaeological resources
Greg Wilson	Manager, Environmental Land Management, PEI EECA	• Project description • Summary of environmental work completed to date • Early-stage planning process • Avifauna study design • EIS progress
Ross Bernard	PEI EECA	• Watersheds and aquatic study design
Maryam Fazeli	Physical Science Officer, Environmental Protection Operations, ECCC	• Avifauna study design

7.2 PUBLIC ENGAGEMENT

Since the early planning phase of the Project, the proponent has been engaging the local community and the Project has received regular media coverage. The Project was initially conceived by a large group of local landowners who selected the Proponent to design and build the Project. There are now over 85 participating landowners. These important stakeholders have been routinely consulted and informed on Project updates and progress through the Project website, email updates, telephone conversations with specific landowners and stakeholders, Project newsletters, annual dinners, and open house sessions.

Recently, the proponent sent out a Project newsletter to residents in May of 2022, hosted a community dinner on September 27, 2022 at the Stompin' Tom Centre for approximately 70, and held a preliminary Open House on November 16th, 2022, at the Palmer Road Community Centre in Saint Louis PEI. This event consisted of an afternoon/evening information session from 4 - 8 pm in an informal, drop-in format allowing the public to speak to members of the Project team. The open house was advertised twice in the West Prince Graphic (November 2 and 9, 2022) and by local mail out to nearby residents.

Despite some inconvenient foul weather and resulting poor road conditions, 25 members of the public attended the session, with 15 comment forms submitted. Sign-in sheets were provided by the entrance to identify the home communities of the attendees. 16% of the attendees were from the Palmer Road area, 16% from the Tignish area, 12% from the Nail Pond area, 12% from the Skinners Pond area, and the balance were from other communities in Prince County

As previously mentioned, 15 attendees submitted comments on the Project and Open House. Attendees indicated positive overall support for the Project and no negative comments were recorded. A summary of the received comments includes the desire for additional information regarding the PEI Energy Corporation Transmission Line Project, information regarding employment and business opportunities, and more detail regarding impact of the turbines to residents.

The Open House was covered by the West Prince Graphic with an article about the event published on November 23, 2022. Invenergy also gave an interview to CBC following the open house which aired in early December.

Upon EIS submission, the Provincial EIA process requires consultation with the public in an open house format which is well advertised. For this type of Project, a Level II Notification will be required. This will involve a public information session and a newspaper advertisement that will run for 6 consecutive days in the Guardian as well as in one edition of the West Prince Graphic, a weekly paper.

7.3 CONSULTATIONS WITH STAKEHOLDERS AND INTEREST GROUPS

Non-Governmental Organizations (NGOs) and resource people with local historical knowledge were consulted during the preparation of the EIA, providing useful background environmental and social information. In other circumstances, their professional opinions and perspectives were obtained.

Table 7.2 provides a list of persons contacted, their affiliation and information discussed.

Table 7.2: Organizations and Local Representatives Contacted, their Affiliation and Topics Discussed

Contact	Affiliation	Topics
Sarah Doyle	Senior Operations Officer, Abegweit First Nation	• Project development • Indigenous engagement
Chief Darlene Bernard	Chief, Lennox Island Mi'Kmaq First Nation	• Project Development • Indigenous engagement
Dawn MacInnis	Tignish & Area Watershed Management Group	• Discussed watershed and aquatic study • Fish species • Activities

Floyd Keefe Randy Doyle Wilbert O'Shea	members of the original committee that conceived the Project	• Project activities • Field work coordination • Local engagement

8 MONITORING, FOLLOW-UP AND MITIGATION

Table 8.1 presents a summary of mitigation measures, including applicable monitoring and follow-up activities.

Table 8.1: Summary of Mitigation Measures

Environmental Resources	Environmental Components of Concern (ECC)	Mitigation Measures
Atmospheric Environment	Ambient Air Quality	• If possible, schedule activities when weather conditions (winds) are favourable • Equipment should be kept in good running order • Use water as dust suppressant • The exits of the construction sites will be equipped with effective dirt traps • Impose and enforce speed limits on turbine laneways • Do not load trucks with soil above the freeboard • Minimize drop heights when loading trucks • During operation allow vegetation disturbed in the lay down areas to grow back • Minimize air emissions through proper planning • All heavy construction equipment will be equipped to reduce air emissions • Water will be applied as a dust suppressant as needed to prevent fugitive emissions • The speed limit will be reduced • Idling of vehicles will be limited • Do not load trucks with soil above the freeboard • Minimize drop heights when loading trucks • Disturbed soil will be stabilized as soon as possible
	Acoustic Environment (Noise)	• All construction equipment should have appropriate noise-muffling equipment installed and in good working order • Complaint registry to be developed for traffic, noise, and other Project concerns • Limit traffic to regular working hours
Hydrology	Groundwater	• Collect and retain all construction wastewater and solids in leak proof containers. • Recycle collected construction wastewater and solids. • Never discharge wash water directly to storm drains or receiving waters. • No POL storage will occur in sensitive areas (e.g., near watercourses or wells) or associated buffer zone. • The Contractor will, with the prior approval of the Site Supervisor, designate and use areas for the transfer and limited temporary storage of hazardous materials and special wastes. These sites will be properly labeled and appropriately controlled. • WHMIS program to be implemented. • Hazardous materials to be used only by personnel trained and qualified in the handling of these materials and only in accordance with manufacturers' instruction and applicable regulations. • A complete inventory of hazardous materials will be maintained onsite according to WHMIS regulations and will be made available. • Material Safety Data Sheets (MSDS) are to be readily available for all hazardous materials in use or stored on-site. • Transportation of hazardous materials to be in compliance with Transportation of Dangerous Goods Act. • The number and volume of hazardous materials on site will be minimized to the extent possible.

Environmental Resources	Environmental Components of Concern (ECC)	Mitigation Measures
		• All containers are to bear labels that identify their contents. • All containers are to be lined or constructed of materials that are compatible with the waste being stored. • All containers are to be in good condition, free from corrosion, leaks or ruptures. • Lids are to be kept on containers at all times when not in use. • All hazardous materials are to be stored in a designated location to be determined by Construction Manager. • Hazardous materials including petroleum products may not be stored within 30 m of a watercourse or wetland, including small containers. • All hazardous materials are to be stored on an impermeable surface. • All hazardous materials are to be collected and disposed of in accordance with applicable local and provincial requirements. • Appropriate spill response equipment must be maintained in a readily accessible location and in sufficient quantity for the relative amount of petroleum product on-site. • All large machinery shall have a spill kit on-board. • All spills and releases shall be promptly contained, cleaned up and reported. • Inspect storage containers, vehicles and equipment regularly for leakage. • Maintain equipment in good repair to avoid leakage of hydraulic, fuel, cooling and system fluids. • Do not cut, puncture or weld on fuel storage containers. • Keep fuel and waste oils away from heat, sparks, open flames and any other sources of ignition. • Refuelling and maintenance (including lubrication and oil change) of equipment must take place off-site or in designated areas only. These designated areas are to be determined by the Construction Manager. • Designated refuelling areas (if used) are to be on level terrain, a minimum of 30 m away from any surface water, wetland and potable water supply well, on a prepared impermeable surface with collection system to contain oil, gasoline and hydraulic fluids. • All containers, hoses and nozzles shall be free of leaks. • All fuel nozzles shall be equipped with automatic shut-offs. • During fuel dispensing, operators must be present at all times. • Petroleum contaminated wastes, waste rags, spill clean-up materials, etc. are to be collected in an approved container (sealed and contaminant-proof) for pickup and disposal by an approved contaminated material disposal company or recycling firm.
	Surface Water	• Environmentally sensitive areas (i.e., watercourse) will be staked out prior to work operations so that these areas are protected • A buffer zone will be established on each side of a watercourse • Activity to be limited within watercourse buffer zones • Implement erosion/sedimentation mitigation measures of watercourses when necessary • No waste or debris into watercourses or buffer zone • No heavy equipment or motorized vehicles will enter watercourses • Work to be completed in shortest duration possible • The on-site POL storage container shall be located on level terrain, at least 100 m from any water body • No POL storage will occur in sensitive areas (e.g., near watercourses or wells) or associated buffer zone • Fuelling must be done at least 50 m from a waterbody

Environmental Resources	Environmental Components of Concern (ECC)	Mitigation Measures
		• Servicing of equipment will not be allowed within 100 m of a watercourse or drainage ditch • No chemicals will be used to wash equipment • Use turbine laneways for equipment movement • During foundation laying, form oil may be used sparingly to allow forms to separate from concrete following curing • Washing of chutes on-site will occur at a designated location • Replace hazardous materials with less harmful ones when possible • Incorporate preventative and response measures into construction practices • Provide environmental awareness training • Maintain appropriate spill response equipment • Report all spills to applicable authorities, including the PEI spill report line Monday to Friday: 8:00AM - 4:30PM: 1-866-368-5044, evenings and weekends: 1-800-565-1633 • Inspect equipment to ensure equipment and vehicles have no obvious leaks • Do not refuel vehicles on-site • Store all hazardous materials outside of a 30 m buffer around watercourses • Maintain and update and inventory of hazardous materials on-site
Biological Environment	Species at Risk	• If found, carcasses of SARA-listed species will be sent to the Sackville CWS office with suitable permitting as advised by CWS • Replace hazardous materials with less harmful ones when possible • Incorporate preventative and response measures into construction practices • Provide environmental awareness training • Maintain appropriate spill response equipment • Train workers to adhere to safe driving rules in order to prevent traffic accidents • Report all incidents of injured or dead wildlife to the on-call Conservation Officer in Wellington at (902) 854-7250 • Minimize area disturbed • Use turbine laneways for equipment movement • Clearing and grubbing will be restricted to areas necessary to carry out the Project • Native plant regeneration will be promoted in any areas that are cleared but not built upon (i.e., roadside ditches, temporary laydown areas, etc.) • Use native plants or no vegetation around turbines • Materials cleared from the sites (brush, soil, etc.) should not be dumped into otherwise unaffected land • All construction equipment should have appropriate noise-muffling equipment installed and in good working order • Keep work area clean of food scraps and garbage and transport waste to an approved landfill on a regular basis • Vehicles will yield the right-of-way to wildlife • Do not harass or disturb wildlife • Alterations to existing natural drainage patterns will be minimized
	Terrestrial Wildlife	• Replace hazardous materials with less harmful ones when possible • Incorporate preventative and response measures into construction practices • Provide environmental awareness training • Maintain appropriate spill response equipment • Train workers to adhere to safe driving rules in order to prevent traffic accidents • Report all incidents of injured or dead wildlife to the on-call Conservation Officer in Wellington at (902) 854-7250 • Minimize area disturbed • Use turbine laneways for equipment movement

Environmental Resources	Environmental Components of Concern (ECC)	Mitigation Measures
		• Clearing and grubbing will be restricted to areas necessary to carry out the Project • Native plant regeneration will be promoted in any areas that are cleared but not built upon (i.e., roadside ditches, temporary laydown areas, etc.) • Use native plants or no vegetation around turbines • Materials cleared from the sites (brush, soil, etc.) should not be dumped into otherwise unaffected land • All construction equipment should have appropriate noise-muffling equipment installed and in good working order • Keep work area clean of food scraps and garbage and transport waste to an approved landfill on a regular basis • Vehicles will yield the right-of-way to wildlife • Do not harass or disturb wildlife • Alterations to existing natural drainage patterns will be minimized
	Terrestrial Flora	• Replace hazardous materials with less harmful ones when possible • Incorporate preventative and response measures into construction practices • Provide environmental awareness training • Maintain appropriate spill response equipment • Report all spills to applicable authorities, including the GN 24-hour spill report line Monday to Friday: 8:00AM - 4:30PM: 1-866-368-5044, evenings and weekends: 1-800-565-1633 • Inspect equipment to ensure equipment and vehicles have no obvious leaks • Do not refuel vehicles on-site • Maintain and update an inventory of hazardous materials on-site • Clearing and grubbing will be restricted to areas necessary to carry out the Project • Native plant regeneration will be promoted in any areas that are cleared but not built upon (i.e., roadside ditches, temporary laydown areas, etc.) • Use native plants or no vegetation around turbines • Materials cleared from the sites (brush, soil, etc.) should not be dumped into otherwise unaffected land
	Wetlands	• Environmentally sensitive areas (i.e., wetlands) will be staked out prior to work operations so that these areas are protected • A buffer zone will be established on each side of a wetland • Activity to be limited within wetland buffer zones • Implement erosion/sedimentation mitigation measures of wetlands when necessary • No waste or debris into wetlands or buffer zone • No heavy equipment or motorized vehicles will enter wetlands • Work to be completed in shortest duration possible • The on-site POL storage container shall be located on level terrain, at least 100 m from any wetland • No POL storage will occur in sensitive areas (e.g., near wetlands) or associated buffer zone • Fuelling must be done at least 50 m from a wetland • Servicing of equipment will not be allowed within 100 m of a wetland • No chemicals will be used to wash equipment • Minimize area disturbed • Use turbine laneways for equipment movement • Place and maintain proper erosion/sedimentation measures • Washing of chutes on-site will occur at a designated location • No chemicals will be used in the washing of concrete trucks or forms on-site
	Avifauna	• Vehicles will yield the right-of-way to wildlife

Environmental Resources	Environmental Components of Concern (ECC)	Mitigation Measures
		• All personnel will report notable wildlife sightings (dangerous, injured, dead, or SAR) to the Construction Manager • The Construction Manager will initiate any reasonable action to reduce the chance of disruption or injury to reported wildlife • Should disruption or injury to wildlife occur, the Construction Manager will contact the on-call Conservation Officer in Wellington at (902) 854-7250 • If encountered, dead animals will be removed and disposed of as soon as possible • Handling of bird carcasses will be conducted in accordance with MBCA scientific permits • If found, carcasses of SARA-listed species will be sent to the Sackville CWS office with suitable permitting as advised by CWS • If an injured or dead bird is encountered, personnel will record the following information: date and time, injury sustained, cause of injury, and species • Native plant regeneration will be promoted to allow natural revegetation • Inspect and clean imported equipment for invasive species • Inspect borrow areas for presence of invasive species prior to use • Dust abatement and prevention measures shall be implemented • Clearing and grubbing will be restricted to areas necessary to carry out the Project • A nest search will be conducted prior to clearing and grubbing activities occurring within the regional avian nesting period (1 May to 15 August). Any active nests will be protected with a species-appropriate buffer until the young have vacated the nest. For species that re-use nests for multiple years (e.g., some raptors), vacant nests will be relocated outside the clearing/grubbing zone • Native plant regeneration will be promoted in any areas that are cleared but not built upon (i.e., roadside ditches, temporary laydown areas, etc.) • Use native plants or no vegetation around turbines • Materials cleared from the sites (brush, soil, etc.) should not be dumped into otherwise unaffected land • All construction equipment should have appropriate noise-muffling equipment installed and in good working order • Keep work area clean of food scraps and garbage and transport waste to an approved landfill on a regular basis • Maintain appropriate spill response equipment • Vehicles will yield the right-of-way to wildlife • Do not harass or disturb wildlife • Alterations to existing natural drainage patterns will be minimized • For construction activities required during the sensitive nesting season the following measures will be implemented: – Clearing activities will be scheduled in consideration of critical habitat features (e.g., wetland areas) identified during the pre-construction field survey – The proponent will instruct the management team and contractors on the MBCA, the importance of habitat, the significance of the nesting period, and measures to be implemented to minimize any disturbance to birds/nests – Construction workers will be informed of the potential for SAR to be present and will be instructed on measures to take if a SAR is observed – If a migratory bird nest is discovered within the active work zone, work in the area should cease until CWS is contacted for guidance. A buffer of an appropriate size may be required until young have fledged from the area • Replace hazardous materials with less harmful ones when possible • Incorporate preventative and response measures into construction practices • Provide environmental awareness training

Environmental Resources	Environmental Components of Concern (ECC)	Mitigation Measures
		• Report all incidents of injured or dead wildlife to the on-call Conservation Officer in Wellington at (902) 854-7250 • Bird impact surveys may need to be conducted during the Operation phase of the project
	Bats	• Vehicles will yield the right-of-way to wildlife • All personnel will report notable wildlife sightings (dangerous, injured, dead, or SAR) to the Construction Manager • The Construction Manager will initiate any reasonable action to reduce the chance of disruption or injury to reported wildlife • Should disruption or injury to wildlife occur, the Construction Manager will contact the on-call Conservation Officer in Wellington at (902) 854-7250 • If encountered, dead animals will be removed and disposed of as soon as possible • If found, carcasses of SARA-listed species will be sent to the Sackville CWS office with suitable permitting as advised by CWS • Native plant regeneration will be promoted to allow natural revegetation • Inspect and clean imported equipment for invasive species • Dust abatement and prevention measures shall be implemented • Clearing and grubbing will be restricted to areas necessary to carry out the Project • Native plant regeneration will be promoted in any areas that are cleared but not built upon (i.e., roadside ditches, temporary laydown areas, etc.) • Use native plants or no vegetation around turbines • Materials cleared from the sites (brush, soil, etc.) should not be dumped into otherwise unaffected land • All construction equipment should have appropriate noise-muffling equipment installed and in good working order • Replace hazardous materials with less harmful ones when possible • Incorporate preventative and response measures into construction practices • Provide environmental awareness training • Report all incidents of injured or dead wildlife to the on-call Conservation Officer in Wellington at (902) 854-7250 • Bat impact surveys may need to be conducted during the Operation phase of the project
	Fish	• Environmentally sensitive areas (i.e., watercourse) will be staked out prior to work operations so that these areas are protected • A buffer zone will be established on each side of a watercourse • Activity to be limited within watercourse buffer zones • Implement erosion/sedimentation mitigation measures of watercourses when necessary • No waste or debris into watercourses or buffer zone • No heavy equipment or motorized vehicles will enter watercourses • Work to be completed in shortest duration possible • The on-site POL storage container shall be located on level terrain, at least 100 m from any water body • No POL storage will occur in sensitive areas (e.g., near watercourses or wells) or associated buffer zone • Fuelling must be done at least 50 m from a waterbody • Servicing of equipment will not be allowed within 100 m of a watercourse or drainage ditch • No chemicals will be used to wash equipment • Use turbine laneways for equipment movement

Environmental Resources	Environmental Components of Concern (ECC)	Mitigation Measures
		• During foundation laying, form oil may be used sparingly to allow forms to separate from concrete following curing • Washing of chutes on-site will occur at a designated location • Replace hazardous materials with less harmful ones when possible • Incorporate preventative and response measures into construction practices • Provide environmental awareness training • Maintain appropriate spill response equipment • Minimize area disturbed • Place and maintain proper erosion/sedimentation measures • Replace hazardous materials with less harmful ones when possible • Incorporate preventative and response measures into construction practices • Provide environmental awareness training • Maintain appropriate spill response equipment • Inspect equipment to ensure equipment and vehicles have no obvious leaks • Do not refuel vehicles on-site • Store all hazardous materials outside of a 30 m buffer around watercourses
Socio-Economic Setting	Indigenous Land use and Resources	• Caution will be taken during construction • Any accidental discoveries will be discussed with regulators and the local Indigenous community • Will engage with the local Indigenous community about project plans and schedule
	Land Use and Economy	• Land use agreements will be in place for the duration of the Project • Property boundaries will be identified, where possible, prior to commencing work activities. This may include staking out private property prior to work operations • The Contractor will ensure landowners and the public are notified of the schedule of construction activities taking place • All site activities will be carefully planned and performed in such a manner that noise is minimized • The frequency and/or duration of noise producing activities will be minimized wherever possible • Vehicle traffic, construction activities, and heavy equipment operation on-site will be limited to normal working hours • The Contractor will ensure idling of construction vehicles is limited • The routing of truck traffic through residential areas will be controlled during the maximum period of activity • Equipment and vehicles will only operate on cleared rights-of-way or areas designated for construction activities in the Plans/Drawings • The area of disturbance will be limited to that which is absolutely necessary to conduct the work • Clearing will be minimized to that necessary to construct and operate the turbines and the electrical substation, install single phase line, collector lines and transmission lines and implement turbine laneways • All surplus materials, rubbish, waste materials, and construction debris will be removed from the Site upon completion of construction of the Project • All waste will be handled in accordance with relevant provincial and federal requirements • Waste material will not be dumped on-site. In such case as waste materials are inadvertently dumped, the Construction Manager (or designate) will immediately act to have the dumped material cleaned up and removed
	Visual Landscape	• Aesthetically lower impact style of turbines will be used for the Project • Minimize the lighting on the turbines

<table>
<tr><th>Environmental Resources</th><th>Environmental Components of Concern (ECC)</th><th>Mitigation Measures</th></tr>
<tr><td rowspan="2"></td><td></td><td>• Minimize the Project footprint
• Implement dust and erosion control
• Repair turbines as soon as possible
• Clean the turbines when necessary
• Remove access materials from the Project footprint
• Inform and educate the public</td></tr>
<tr><td>Public Safety</td><td>• Notify landowners and the public of construction activities schedule
• Complaint registry to be developed for traffic, noise, and other Project concerns
• Limit traffic to regular working hours
• The routing of truck traffic through the hamlet will be controlled during all activities
• Repairs to public roads to be implemented should the need arise
• All Project vehicles will be properly maintained and muffled to reduce noise emissions
• Train workers to adhere to safe driving rules in order to prevent traffic accidents
• Public notification of an increase in construction traffic
• POL storage areas will be identified by signs, and “No Smoking” signs will be displayed at all POL storage sites and refueling areas
• Smoking will not be permitted within 50 m of any POL storage area. On-site signage will indicate the location of smoking areas</td></tr>
<tr><td>Site History</td><td>Heritage and Archaeological Resources</td><td>• Caution when grubbing, grading, and excavating the Project site so as to not destroy any archaeological findings
• Archaeological surveys will be conducted as necessary</td></tr>
</table>

9 SUMMARY OF RESIDUAL EFFECTS

The potential adverse effects of the proposed wind farm on biophysical and socioeconomic environmental components were assessed. The assessment considered all works and activities associated with the construction and operation phases of the Project. The assessment included regular Project-environment interactions as well as potential effects of unplanned events and accidents. Subsequently, mitigation and environmental management measures were developed to avoid and/or minimize adverse effects. Upon the successful implementation of these measures, no significant adverse residual environmental effects are likely to occur because of the turbines' construction and operation.

The assessment also looked at the potential effects that environmental conditions (severe weather, climate change) could have on the Project. The assessment concluded that combined with environmental management and mitigation measures, no significant environmental effects are likely to occur.

Positive effects are expected as a result of the wind farm by creating employment opportunities for the general public of PEI. It is expected that this would create a better economy in the future for the community. The generation of electricity from renewable resources such as wind is also in accordance with federal and provincial strategies since it contributes to the reduction of GHG emissions and air pollutants. The wind farm, if approved, would contribute to the reduction of GHG emissions required to meet targets for PEI and Canada.

Table 9.1: Summary of Residual Effects

Environmental Resources	Environmental Components of Concern (ECC)	Impact	Residual Environmental Effects	Level of Residual Impact
Atmospheric Environment	Ambient Air Quality	• Formation of dust and exhaust fumes • Dust created from soil depleted of vegetation and from gravel turbine laneways • Formation of dust and exhaust fumes • Reduced carbon intensity in provincial electricity grid (i.e., reduced greenhouse gas emissions)	No significant effects on local airshed expected. Significant long-term benefits from reduced greenhouse gas contributions to climate change.	Moderate (benefits)
	Noise	• Temporary increase in ambient noise during construction	No significant effects expected.	Low
Hydrology	Groundwater	• Impacts on local residential water wells • Large temporary water withdrawal from local groundwater aquifer	No significant effects expected.	Low
	Surface Water	• Impacts to water flow and drainage within local watershed boundaries • Degradation of water quality • Impacts to potable water supply • Changes to the water regime by erosion and runoff • Potential hydrocarbon contamination of water	No significant effects expected.	Low
Biological Environment	Species at Risk	• Noise, visual impacts, and the presence of humans (workers in the area)	No significant effects expected.	Low

Environmental Resources	Environmental Components of Concern (ECC)	Impact	Residual Environmental Effects	Level of Residual Impact
		• Habitat loss by clearing and grubbing, excavation, equipment (silt run-off, infilling; fuel spills) • Collisions with turbines • Lights • Barrier effect • Toxic leaks and spills • Habitat destruction		
	Terrestrial Wildlife	• Killing of individuals during land clearing activity • Loss, fragmentation, or degradation of breeding, feeding, and resting habitat • Respiratory health effects from dust • Habitat degradation by invasive species • Exposure to toxic chemicals • Reduction of quality and quantity of habitat • Reduced species diversity • Potential adverse effects to fauna as a result of exposure to toxic substances • Damage or injury because of traffic accidents	No significant effects expected.	Low
	Terrestrial Flora	• Potential adverse effects to flora as a result of exposure to toxic substances • Habitat degradation by invasive species • Reduction of quality and quantity of habitat • Reduced species diversity	No significant effects expected.	Low
	Wetlands	• Loss of wetland habitat within Project footprint (offset by wetland compensation) • Reduced species diversity • Degradation of water quality and watershed health • Impacts to water flow and drainage within local watershed boundaries • Changes to the water regime by erosion and runoff • Habitat degradation by invasive species • Impacts to water flow and drainage • Toxic effects from chemicals substances	No significant effects expected.	None
	Avifauna	• Mortality due to vehicle collisions • Avoidance and changes to movement caused by noise, visual impacts, and human presence • Disturbance of normal behaviour during foraging and breeding • Habitat degradation from invasive species • Potential mortality of adults, young and eggs from collisions, or nest destruction • Killing of individuals during land clearing activity • Avoidance and changes to migratory movement caused by noise, visual impacts, and human presence	Long-term risk of collisions and avoidance behavior.	Low

Environmental Resources	Environmental Components of Concern (ECC)	Impact	Residual Environmental Effects	Level of Residual Impact
		• Loss, fragmentation, or degradation of breeding, feeding, and resting habitat • Respiratory health effects from dust • Habitat degradation by invasive species • Exposure to toxic chemicals • Reduced species diversity • Damage or injury as a result of traffic accidents		
	Bats	• Mortality due to vehicle collisions • Avoidance and changes to movement caused by noise, visual impacts, and human presence • Disturbance of normal behaviour during foraging and breeding • Habitat degradation from invasive species • Potential mortality of adults and young from collisions, or nest destruction • Killing of individuals during land clearing activity • Avoidance and changes to migratory movement caused by noise, visual impacts, and human presence • Loss, fragmentation, or degradation of breeding, feeding, and resting habitat • Respiratory health effects from dust • Habitat degradation by invasive species • Exposure to toxic chemicals • Reduced species diversity • Damage or injury as a result of traffic accidents • Damage or injury due to collisions with the turbines • Possible barotrauma • Sensitivities to magnetic fields	Long-term risk of collisions/barotrauma and avoidance behavior.	Low
	Fish	• Impacts to water flow and drainage within local watershed boundaries • Loss of fish habitat • Reduced species diversity • Degradation of water quality and watershed health • Reduction of quality and quantity of habitat • Loss, fragmentation, or degradation of breeding, feeding, and resting habitat • Changes to the water regime by erosion and runoff • Habitat degradation by invasive species • Impacts to water flow and drainage • Reduced species diversity • Toxic effects from chemicals substances • Potential hydrocarbon contamination of water	No significant effects expected.	Low

Environmental Resources	Environmental Components of Concern (ECC)	Impact	Residual Environmental Effects	Level of Residual Impact
Socio-Economic Setting	Indigenous Land use and Resources	• Potential for Indigenous archeological resources	No significant effects expected.	None
	Land Use and Economy	• Loss of personal land use due to construction of the Project • Long-term employment and taxation revenue	No significant effects on local services expected. Long-term economic benefits.	Low
	Visual Landscape	• Contrasting visuals to that of a natural landscape • Glare from shiny surfaces • Negative visuals (i.e., still blades, missing parts, garbage, etc.)	No significant effects expected.	Low
	Public Safety	• Ice shedding • Shadow flicker • Increased traffic including possible damage to roads and interference with traffic flows • Damage or injury as a result of traffic accidents	No significant effects expected.	None
Site History	Heritage and Archaeological Resources	• Construction activities leading to the loss of irreplaceable cultural and archaeological resources/knowledge	No significant effects expected.	None

As mentioned in Section 2.1, a portion of the proposed footprint was not field surveyed at the adjusted locations of Turbines T14 and T15, and along the proposed alternative electrical collector corridor adjacent to Palmer Road. This affects the assessment of SAR, wetlands, and archaeological and heritage resources. Based on available desktop information, it is considered these areas do not have high potential for SAR or wetlands to occur, so potential interaction is unlikely, but this will need to be confirmed with field surveys in May and June of 2023. No information is known about the presence of archaeological high potential areas at these locations and will need to be established in May/June of 2023. Field survey results will be submitted in an addendum report, including an updated effects assessment.

10 CONCLUSION

This Environmental Impact Statement report addresses the environmental effects of the construction, operation, and decommissioning Project phases. The information to-date has shown that no significant adverse residual impacts on the VCs identified are likely. The generation of electricity from renewable resources such as wind is in accordance with federal and provincial strategies since it contributes to the reduction of GHG emissions and air pollutants. The Skinners Pond Wind Energy Centre, if approved, would contribute to the reduction of GHG emissions required to meet targets for PEI and Canada.

11 LIST OF SUPPORTING DOCUMENTS

Acadian-Cajun Genealogy & History. (2012). Ile St. Jean. Accessed 2012. http://www.acadian-cajun.com/stjean.htm.

Acharya, L., Fenton, M.B. (1999). Bat attacks and moth defensive behaviour around street lights. Canadian Journal of Zoology. 77(1): 27-33

Agriculture Canada. (2006). Topography. Available at: collections.ic.gc.ca/agriccan/pubweb/hs190004_f.asp.

Ahlen, I. (2003). Wind turbines and bats – a pilot study. Final Report. Dnr 5210P-2002-00473, P-nr P20272-1. December 11, 2003.

Allen, C. R. (1880). Illustrated Historical Atlas of the Province of Prince Edward Island. J. H. Meacham and Company, Toronto

American Wind Energy Association. (2010). Wind Turbines and Health Factsheet. Updated May 2010.

Anderson, P.G., Taylor, B.R. and Balch, G.C. (1996). Quantifying the Effects of Sediment Release on Fish and their Habitats. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2346: 110 p. + 3 Appendices.

Appleby, J.P. and Scarratt, D.J.. (1989). Physical effects of suspended solids on marine and estuarine fish and shellfish with special reference to ocean dumping: A Literature Review. Can. Tech. Rep. Fish. Aquat. Sci. 168:v + 33 p.

Atlantic Canada Conservation Data Centre (ACCDC). (2022). DATA REPORT 7046: Skinners Pond, PE.

Atlantic Climate Adaptation Solutions Association. (2011). Historical List of Climate Change Storm Events. Available at: https://atlanticadaptation.ca/en/islandora/object/acasa%3A623

Atlantic Climate Adaptation Solutions Association. (nd). Sea Level Rise and Storm Surge Hazard Mapping in Prince Edward Island. Retrieved from: Sea Level Rise and Storm Surge Hazard Mapping in Prince Edward Island | Atlantic Climate Adaptation Solutions Association (atlanticadaptation.ca). DOI: Nov. 17, 2022

Baerwald, E. F. (2008). Variation in the activity and fatality of migratory bats at Wind Energy facilities in southern Alberta: causes and consequences (Unpublished master's thesis). University of Calgary, Calgary, AB. doi:10.11575/PRISM/2201

Baerwald, Erin F., D'Amours, G.H., Klug, B.J., Barclay, R.M.R.. (2008). Barotrauma is a Significant Cause of Bat Fatalities at Wind Turbines. Current Biology: Vol 16, No. 16. pp R695 – R696. 25 August 2008.

Baerwald, Erin F., Edworthy, J., Holder, M., Barclay, R.M.R.. (2009). A Large-Scale Mitigation Experiment to Reduce Bat Fatalities at Wind Energy Facilities. The Journal of Wildlife Management: Volume 73, Issue 7. 13 December 2010.

Ball, Joseph. (1853). Plan of Lot No 1 Shewing the Extent of the Fishery Reserve to the Crown and situation of settlers theron. Also the site of the respective fishery establishments of the same, as delineated from the latest surveys and part from actual survey. Island Imagined Digital Map Collection.

Banfield, A. W. F. (1974). The Mammals of Canada. University of Toronto Press. Toronto, Ontario. 438 p

Barbour, R. W. and Davis, W. H.. (1969). Bats of America. The University Press of Kentucky.Press. Lexington, Kentucky.

Barclay, R. M. R. (1984). Observations on the migration, ecology and be- haviour of bats at Delta Marsh, Manitoba. Canadian Field-Naturalist 98:331-336.

BatCon (Bat Conservation International, Inc.). (2006). Available at: www.batcon.org.

Beanlands, Gordon E., and Duinker, Peter N.. (1983). An Ecological Framework of Environmental Impact Assessment in Canada. Institute for Resource and Environmental Studies, Dalhousie University, Halifax, and Federal Environmental Assessment Review Office, Hull, Canada, 132 pp.

Belmont Women's Institute (W.I.). (1973). The History of Belmont, Prince Edward Island. Belmont Women's Institute.

Bird Studies Canada (BSC). (2019). New Brunswick Nocturnal Owl Survey Guide for Volunteers, Revised March 2019. Bird Studies Canada, Atlantic Region. 18 pp.

Bond, W.K., Cox, K.W., Heberlein, T., Manning, E.W., Witty, D.R. and Young, D.A.. (1992). Wetland Evaluation Guide. Final Report of the Wetlands are Not Wastelands Project. North American Wetlands Conservation Council (Canada). Issues Paper, No. 1992-1. 121 p.

Boylan, D.B. (1973). Rule Britannia In Canada's Smallest Province: A History of Prince Edward Island. Edited by F.W.P. Bolger. Canada: John Deyell Company. Pp. 33-36.

Bringham, R. Mark, Vonhof, M.J., Barclay, R.M.R., Gwilliam, J.C.. (1997). Roosting Behaviour and Roost-Site Preferences of Forest-Dwelling California Bats (Myotis californicus). Journal of Mammalogy: Vol 78, Issue 4 pp 1231-1239. 26 November 1997.

Broders HG, Quinn GM, Forbes GJ. (2003). Species status, and the spatial and temporal patterns of activity of bats in southwest Nova Scotia, Canada. Northeastern Naturalist 10:383-398.

Broders, H. G. and Forbes, G. J.. (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(3): 602-610.

Brown, Charles R. and Brown, Mary B.. (1999). Barn Swallow (*Hirundo rustica*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/barswa

Buchler, E. R. and Wasilewski, P. J.. (1985). Magnetic remanence in bats. in: Kirschvink, J. L., D. S. Jones, B. J. MacFadden, eds. Magnetite biomineralization and magnetoreception in organisms: a new biomagnetism. New York: Plenum Press.

Bureau of Land Management (BLM). (2004). Draft Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States. U.S. Department of the Interior, Bureau of Land Management. September 2004. Available at: windeis.anl.gov/eis/guide/index.cfm.

Caithness Windfarm Information Forum (CWIF). (2019). Summary of Wind Turbine Accident data to 30 Sept 2019. Accessed October 2019. Available at: www.caithnesswindfarms.co.uk

California Air Resources Board. (2018). Mobile Source Emissions Inventory – Off Road Diesel Vehicles. SCAB Fleet Average Emission Factors (Diesel), 2018 for wheel loaders and haul trucks. https://www.arb.ca.gov/msei/ordiesel.htm

Calvert, A. M., Bishop, C. A., Elliot, R. D., Krebs, E. A., Kydd, T. M., Machtans, C. S., and Robertson, G. J.. (2013). A synthesis of human-related avian mortality in Canada. Avian Conservation and Ecology 8(2): 11. http://dx.doi.org/10.5751/ACE-00581-080211

Campbell, D. (1875). History of Prince Edward Island. Charlottetown: Bremner Brothers.

Canadian Centre for Occupational Health and Safety (CCOHS). (2016). Noise – Occupational Exposure Limits in Canada. Retrieved from https://www.ccohs.ca/oshanswers/phys_agents/exposure_can.html

Canadian Council of Ministers of the Environment (CCME). (2000). Canadian Wide Standards for Particulate Matter (PM) and Ozone. June, 2000.

Canadian Council of Ministers of the Environment (CCME). (2008). Assessment of Regulatory Quantification and Reporting Requirements for Air Emissions from Industrial Facilities.

Canadian Council of Ministers of the Environment (CCME). (2007). Water Quality Guidelines for the Protection of Aquatic Life.

Canadian Environmental Assessment Agency (The Agency). (1994). Reference Guide. Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects.

Canadian Environmental Assessment Agency (The Agency). (1999). Cumulative Effects Assessment Practitioners Guide. Prepared by: The Cumulative Effects Assessment Working Group and AXYS

Consulting Ltd. Available at www.ceaa-acee.gc.ca.

Canadian Environmental Assessment Agency (The Agency). (1994). Reference Guide. Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects.

Canadian Wind Energy Association (CanWEA). (2007). Canadian Wind Energy Association Position on Setbacks for Large-Scale Wind Turbines in Rural Areas (MOE Class 3) in Ontario. September 28, 2007.

CBC News. (2022). Fiona's trajectory, power and precipitation – illustrated in graphics. 25 September, 2022. Available: https://www.cbc.ca/news/canada/fiona-s-trajectory-power-and-precipitation-illustrated-in-graphics-1.6595312

CBC News. (2012). Lobster molting early in warm P.E.I. weather. Retrieved from: https://www.cbc.ca/news/canada/prince-edward-island/lobster-molting-early-in-warm-p-e-i-weather-1.1202815.

Charlottetown Airport Authority. (2022). Available at: http://www.flyyyg.com

COSEWIC. (2013). COSEWIC assessment and status report on the Piping Plover circumcinctus subspecies (*Charadrius melodus circumcinctus*) and the melodus subspecies (*Charadrius melodus melodus*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiv + 39 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

Cowan, James P. (1994). Handbook of environmental acoustics. Van Nostrand Reinhold. 283 pages.

Cran, Emily Elizabeth. (2000). Success on the Edge: Portrait of a Small Town. New World Publishing: Halifax.

Curley, Rosemary, Keenlyside, David L., Kristmanson, Helen E., and Dibblee, Randall L.. (2019). A review of the historical and current status of American Beaver (Castor canadensis) on Prince Edward Island, Canada. Canadian Field-Naturalist 133: 332-42.

Cryan, P.M. (2008). Mating Behavior as a possible cause of bat fatalities at wind turbines. Journal of Wildlife Management. 72(3), 845-849. https://doi.org/10.2193/2007-371

Cryan PM, Gorreson PM, Hein CD, Schirmacher MR, Diehl RH, Huso MM, Hayman DTS, Fricker PD, Bonaccorso FJ, Johnson DH, Heist K, Dalton DC. (2014). Behavior of bats at wind turbines. Proceedings of the National Academy of Sciences of the United States of America 111:15126–15131

Cyr, J.-R. (1989). Compte rendu de ARSENAULT, Georges, Les Acadiens de l'Île, 1720-1980. Moncton, Les Éditions d'Acadie, 1987. Revue d'histoire de l'Amérique française, 43(1): 99–101.

Dalzell, B. (2010). Pre-construction Bird Monitoring at a proposed wind-power project near Waterview Road (in the area of Norway, PEI) - Final report. Produced for Frontier Power Systems, Alberton, PEI. 03 June 2010.

de Jong, N. (1973). The French Regime, 1534-1758 In Canada's Smallest Province: A History of Prince Edward Island. Edited by F.W.P. Bolger. Canada: John Deyell Company. Pp. 11-32.

Deal, Michael. (2006). Vignette 3.1: Lithic Periods of the Maritime Peninsula. Accessed 2020 http://www.ucs.mun.ca/~mdeal/Anth3291/vignette3i.htm

Drewitt, A.L. and R.H.W. Langston, 2006. Assessing the impact of wind farms on birds. Ibis 148 (1):19-42.

Ducks Unlimited Canada (DUC). (2019). 2018 Annual Report. Available: www.ducks.ca/assets/2018/AR-2018-Final.pdf

Earthquakes Canada. (2019). Available: http://earthquakescanada.nrcan.gc.ca

Ecological Stratification Working Group. (1995). A National Ecological Framework for Canada. Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada. State of the Environment Directorate, Ecozone Analysis Branch, Ottawa/Hull.

Environment Canada (EC). (2006). The Climate of Prince Edward Island. Retrieved from http://atlantic-web1.ns.ec.gc.ca/climatecentre/default.asp?lang=En&n=CACEE433-1

Environment Canada (EC). (2007). Wind Turbines and Birds: A Guidance Document for Environmental Assessment. 46 pp.

Environment Canada. (2022). Canadian Climate Normals 1981-2010. Available at: https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnProv&lstProvince=PE&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=6519&dispBack=0

Environment Canada. (2022). National Pollutant Release Inventory 2005 Facility & Substance Information. Available at: https://pollution-waste.canada.ca/air-emission-inventory/

Environment Canada. (2022). Canada's Greenhouse Gas Inventory – Annex 11. Available at: https://publications.gc.ca/collections/collection_2021/eccc/En81-4-2019-3-eng.pdf

Environment and Climate Change Canada (ECCC). (nd). Protecting Our Natural Heritage: Conservation Areas in Atlantic Canada,. Environment Canada, Undated

Environment and Climate Change Canada (ECCC). (2013a). Winter Weather. Retrieved from: Environment and Climate Change Canada - Weather and Meteorology - Hazardous weather-Winter weather DOI: Nov. 17, 2022

Environment and Climate Change Canada (ECCC). (2013b). Learn about hurricanes: hazards and impacts. Retrieved from: Learn about hurricanes: hazards and impacts - Canada.ca DOI: Nov. 17, 2022

Environment and Climate Change Canada (ECCC). (2016). Canadian Wind Energy Atlas. Available at: http://www.windatlas.ca/nav-en.php?field=E1&height=50&season=ANU&no=12

Environment and Climate Change Canada (ECCC). (2018a). Nesting Periods. Retrieved from: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html.

Environment and Climate Change Canada (ECCC). (2019) Lightning Activity in Canadian Cities. Available at: https://www.canada.ca/en/environment-climate-change/services/lightning/statistics/activity-canadian-cities.html. Last modified August 2019.

Environment and Climate Change Canada (ECCC). (2019b). Canadian Climate Normals 1981 – 2010 for East Baltic, PEI. Accessible: http://climate.weatheroffice.gc.ca/climate_normals/results_e.html?stnID=6529&prov=&lang=e&dCode=1&dispBack=1&StationName=East_Baltic&SearchType=Contains&province=ALL&provBut=&month1=0&month2=12

Environment and Climate Change Canada (ECCC). (2022b). Canadian Weather RADAR. Available at: https://www.canada.ca/en/environment-climate-change/services/weather-general-tools-resources/radar-overview/modernizing-network.html

Environment and Climate Change Canada (ECCC). (2020c). Guidelines for Wind Turbine and Weather Radar Siting. Available at: https://www.canada.ca/en/environment-climate-change/services/weather-general-tools-resources/radar-overview/wind-turbine-interference/guidelines-for-wind-turbine-weather-radar-siting.html

Environmental Laboratory. (1987). Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U. S. Army Engineer Waterways Experiment Station. Vicksburg, Mississippi.

Erickson, W., Johnson, G., Young, D., Strickland, D., Good, R., Bourassa, M., Bay, K. and Sernka, K.. (2002). Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments. Report prepared for Bonneville Power Administration. December 2002.

Evans, W.R. and Rosenberg, K.V. (1999). Acoustic monitoring of night-migrating birds: a progress report. In: Bonney, R.E. Jr., Pashley, D.N., and Cooper, R. (eds.), Strategies for bird conservation: the Partners in Flight planning process. Cornell Lab of Ornithology, Ithaca, NY.

Evans, W.R. (2000). Applications of acoustic bird monitoring for the wind power industry. National Avian-Wind Power Planning Meeting III, San Diego, 141-152.

Fenton, M. B. and Barclay, R. M. R.. (1980). *Myotis lucifugus*. Mammalian Species. 142: 1-8.

Foo, Cecily F., Bennett, Victoria J., Hale, Amanda M., Korstian, Jennifer M., Schildt, Alison J. and Williams, Dean A.. (2017). Increasing evidence that bats actively forage at wind turbines. PeerJ 5:e3985; DOI 10.7717/peerj.3985

Foster, R. W. and Kurta, A.. (1999). Roosting ecology of the Northern Bat (*Myotis septentrionalis*) and comparisons with the endangered Indiana Bat (*Myotis sodalist*). Journal of Mammology 80(2): 659-672.

Fox, Don, Robinson, Clare and Zentilli, Marcos. (1997). Pyrrhotite and Associated Sulphides and Their Relationship to Acid Rock Drainage in the Halifax Formation, Meguma Group, Nova Scotia. Atlantic Geology 33, 87-103.

Gammon, J. R. (1970). The effect of inorganic sediment on stream biota. Environmental Protection Agency, Water Quality Office. Washington, D.C. pp 1-142, Water Pollution Control Research Series.

Garrison, Barrett A. (1999). Bank Swallow (*Riparia riparia*), version 2.0. In The Birds of North America (P. G. Rodewald, editor). Cornell Lab of Ornithology, Ithaca, New York, USA.

German Wind Energy Association (BWE). (2005). www.wind-energie.de/home/ Google Earth. 2019. Available at: https://www.google.com/earth/

Government of Canada. (2010b). Fifth National Communication on Climate Change. Actions to Meet Commitments Under the United Nations Framework Convention on Climate Change. Submitted to the UNFCCC Secretariat on February 12th, 2010. 196 p.

Government of Canada. (2021a). Interactive Maps: Soils of Canada, National Ecological Framework for Canada and Canada Land Inventory. Available: https://sis.agr.gc.ca/cansis/publications/webmaps.html

Government of Canada. (2021b). Small Craft Harbours. Available at: https://www.dfo-mpo.gc.ca/sch-ppb/index-eng.html

Government of Canada. (2022). Skinners Pond Small Craft Harbour Containment Cell Expansion. Retrieved from: https://iaac-aeic.gc.ca/050/evaluations/proj/82971.

Government of PEI. (2013). Occupational Health and Safety Act General Regulations.

Government of Prince Edward Island. (2018). Post-Secondary Institutions. Retrieved from: https://www.princeedwardisland.ca/en/information/education-and-lifelong-learning/post-secondary-institutions .

Government of Prince Edward Island. (2021). Public School. Retrieved from: https://www.princeedwardisland.ca/en/information/education-and-lifelong-learning/public-schools

Government of Prince Edward Island. (2020). Extreme Weather Safety. Extreme Weather Safety | Government of Prince Edward Island. DOI: Nov. 17, 2022

Griffin, D.R. (1970). Migration and homing of bats. Biology of bats (W.A. Wimsatt, ed.): 233-264. Academic Press, New York

Grindal, S. D. and Brigham, R. M.. (1998). Short-term effects of small-scale habitat disturbance on activity by insectivorous bats. Journal of Wildlife Management (62): 996–1003.

Hanson, A.R. and Calkins, L. (1996). Wetlands of the Maritime Provinces: Revised Documentation for Wetlands Inventory. Technical Report No. 267. Canadian Wildlife Service. Atlantic Region.

Harvey, D.C. (1926). The French Regime in Prince Edward Island. New Haven: Yale University Press.

Hayes, J. P. (2003). Habitat ecology and conservation of bats in western coniferous forests. Pages 81-119 in C. J. Zabel and R. G. Anthony, editors. Mammal community dynamics in coniferous forests of western North America—management and conservation. Cambridge University Press, UK

Health Canada. (2008). Response Statement in Public Concerns Regarding Electric and Magnetic Fields (EMFs) from Electric Power Transmission and Distribution Lines. Health Canada, Federal-Provincial- Territorial Radiation Protection Committee. Issued November 8, 2008. Available online at: https://www.bchydro.com/content/dam/BCHydro/customerportal/documents/corporate/community/fptrpcresponsestatementpowerlineemffinal08nov08.pdf. Accessed October 2019.

Health Canada. (2022). Guidelines for Canadian Drinking Water Quality—Summary Table. Sept 2022

Health PEI. (2022). PEI Hospitals. Available at: https://www.princeedwardisland.ca/en/topic/pei-hospitals

Henderson LE, Farrow LJ, Broders HG. (2009). Summer distribution and status of the bats of Prince Edward Island. Northeastern Naturalist 16: 131-140.

Hickey, M., Fenton, M.B. (1990). Foraging by red bats (Lasiurus borealis): do intraspecific chases mean territoriality? Canadian Journal of Zoology. 68. 2477-2482. 10.1139/z90-346

Hickey, C., Brian, M., Acharya, L., Pennington, S. (1996). Resource Partitioning by Two Species of Vespertilionid Bats (Lasiurus cinereus and Lasiurus borealis) Feeding around Street Lights, Journal of Mammalogy, 77(2): 325–334

Hinds, H.R. (2000). Flora of New Brunswick, Second Edition: A Manual for Identification of the Vascular Plants of New Brunswick.

Hoffman, Bernard G. (1955). The Historical Ethnography of the Micmac of the Sixteenth and Seventeenth Centuries. Unpublished PhD thesis. University of California.

Hogan, Geoff. (1986). 'White Gold and Train Oil': The Walrus on P.E.I. Island Magazine 20: 19-22.

Holland R.A, Thorup K, Vonhof M.J, Cochran WW, and Wikelski M. (2006). Bat orientation using Earth's magnetic field. Nature 444: 653.

Horn, J., Arnett, E. and R. Rodriguez. (2004). Bats and wind turbines: infrared analysis of abundance, flight patterns, and avoidance behaviour. Bat Research News. 45(4): 227-228.

Howells, K. and Fox, D. (1998). Geophysical Methods for Detecting Shallow Sulphide Mineralization in the Halifax Formation, Nova Scotia: a Reconnaissance Study. Atlantic Geology 34, 211 – 227.

Humphrey, S.R. (1982). Bats, Pages 52-70, in Chapman, J.A. and G.A. Feldhamer, eds. Wild Mammals of North America. Biology, Management, and Economics. The Johns Hopkins University Press, Baltimore. 1147 p.

Important Bird Areas (IBA). (2022a). Important Bird Areas in Canada. Available at: http://www.ibacanada.ca. Accessed 12 August 2022.

Important Bird Areas (IBA). (2022b). Important Bird Areas in Canada [Site Summary: Norway, PE010]. Available at: https://www.ibacanada.ca/site.jsp?siteID=PE010&lang=EN&siteID=PE010&lang=EN. Accessed 12 August 2022.

Important Bird Areas (IBA). (2022c). Important Bird Areas in Canada [Site Summary: Cascumpec Bay/Alberton Harbour, PE003]. Available at: https://www.ibacanada.ca/site.jsp?siteID=PE010&lang=EN&siteID=PE010&lang=EN. Accessed 12 August 2022.

Intergovernmental Panel on Climate Change (IPCC). (2018). IPCC, 2018: Summary for Policymakers. World Meteorological Organization, Geneva, Switzerland. Accessible: https://www.ipcc.ch/sr15/chapter/spm/

Island Narratives Program. (2022). Accessed 2022 http://vre2.upei.ca/cap/node/450

Island Register. (2022). The Island Register: Prince Edward Island's Premier Genealogy Home Page. Accessed 2022: http://www.islandregister.com/.

Jen, P.H.S. and McCarty, J.K. (1978). Bats avoid moving objects more successfully than stationary ones. Nature 275: 743–744

Jenkins, Alison. (2020). Bilingual signage now in place at significant Mi'kmaq locations across P.E.I. The Guardian, May 26, 2020. Accessed online at https://www.theguardian.pe.ca

Johnson, G. D., Erickson, W. P., Strickland, M. D., Shepherd, M. F., Shepherd, D. A., and Sarappo, S. A.. (2002). Collision mortality of local and migrant birds at a large-scale wind-power development on Buffalo Ridge, Minnesota. Wildlife Society Bulletin. 30: 879-887.

Keeley, Brian, Ugorez, Steve and Strickland, Dale. (2001). Bat Ecology and Wind Turbine Considerations. Presentations and Panel Discussion. Proceedings of the National Avian-Wind Planning Meeting IV, Carmel, California, May 2000. Prepared for the Avian Subcommittee of the National Wind Coordinating Committee by RESOLVE INC. Washington, DC, May 2001. Available at: www.nationalwind.org.

Keenlyside, D. L. (1982). Prince Edward Island Archaeological Research – 1981 Field Season. Manuscript on file, Indigenous Relations Secretariat, Charlottetown.

Keenlyside, D. and Kristmanson, H.. (2016). The Palaeo-Environment and the Peopling of Prince Edward Island: An Archaeological Perspective. In Time and Place: An Environmental History of Prince Edward Island, edited by E. MacDonald, J. MacFayden, and I. Novaczek, pp. 59–81. McGill-Queens University Press and Island Studies Press, Montreal and Charlottetown.

Knight, E., Hannah, K., Brigham, M., McCracken, J., Falardeau, G., Julien, M.F., Guenette, J.S. (2019). Canadian Nightjar Survey Protocol. 21 pp. http://wildresearch.ca/wp-content/uploads/2019/05/National-Nightjar-Survey-Protocol-WildResearch-2019.pdf

Kristmanson, Helen. (2019). Pitawelkek: A 2000 year old archaeological site in Malpeque Bay. Island Magazine 84: 2-14.

Kunz, T.H., Arnett, E.B., Erickson, W.P., Hoar, A.R., Johnson, G.D., Larkin, R.P., Strickland, M.D., Thresher, R.W., and Tuttle, M.D.. (2007). Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. Frontiers in Ecology and the Environment 5: 315-324.

Langston, R.H.W. & Pullan, J.D. (2003). Windfarms and birds: an analysis of the effects of wind farms on birds, and guidance on environmental assessment criteria and site selection issues. Report T-PVS/Inf (2003) 12, by BirdLife International to the Council of Europe, Bern Convention on the Conservation of European Wildlife and Natural Habitats. RSPB/BirdLife in the UK.

Lemmen, D.S., Warren, F.J., Lacroix, J., and Bush, E. (editors). (2008). From Impacts to Adaptation: Canada in a Changing Climate 2007. Government of Canada. Ottawa, Ontario. 448 p.

Leonard, Kevin J.M. (1996). Mi'kmaq Culture During the Late Woodland and Early Historic Periods. Unpublished PhD thesis. University of Toronto: Toronto.

Lockerby, Earle. (1998). The Deportation of the Acadians from Île St.-Jean, 1758' Acadiensis, Journal of the History of the Atlantic Region

MacDonald, Ernest (ed.). (2007). The Burke Chronicles: The Story of the Beginnings of the Roman Catholic Parishes in Prince Edward Island to 1885. PEI: published by the author.

Maloney, J.H. (1973). And in the Beginning... In Canada's Smallest Province: A History of Prince Edward Island. Edited by F.W.P. Bolger. Canada: John Deyell Company. Pp. 1-10.

Maritimes Breeding Bird Atlas (MBBA). (2006). Maritime Breeding Bird Atlas: Guide for Atlassers. 41 pp. https://www.mba-aom.ca/downloads/mbbaguide.pdf

Maritimes Breeding Bird Atlas (MBBA). (2022). Site hosted by Birds Canada. Available at: https://www.mba-aom.ca/jsp/datasummaries.jsp. Accessed 12 August 2022.

Massachusetts Department of Environmental Protection and Massachusetts Department of Public Health. (2012). Wind Turbine Health Impact Study: Report of Independent Expert Panel. January 2012.

McBurney, T.S., Segers, J.L.. (2020). Acoustic Guide for Bat Monitoring in Atlantic Canada. Canadian Wildlife Health Cooperative. 233 pp.ies.jsp. Accessed 12 August 2022.

Menzel, J. M., Menzel, M. A., Kilgo, J. C., Ford, W. M., Edwards, J. W. and McCracken, G. F.. (2005). Effect of habitat and foraging height on bat activity in the coastal plain of South Carolina. Journal of Wildlife Management. 69(1): 235-245.Black 1974

Michaud D, Keith S.E., Feder K.P., Marro L. (2013). Self-reported and Objectively Measured Health Indicators among a Sample of Canadians Living within the Vicinity of Industrial Wind Turbines: Social Survey and Sound Level Modelling Methodology. 21(4): 14-23. Noise News International 2013

Mi'gmaq-Mi'kmaq Online (MMO). (2019). Mi'gmaq-Mi'kmaq Online Talking Dictionary. https://mikmaqonline.org/default.html, accessed October 9, 2019.

Mi'kmaq Confederacy of PEI. (2022). PEI MI'KMAQ COMMUNITIES. Retrieved from: https://mcpei.ca/community/

Mickleburgh, Simon P., Hutson, Anthony M., and Racey, Paul A.. (2002). A review of the global conservation status of bats. Oryx, 36(1):18-34.

Moseley, M. (2007). Records of bats (*Chiroptera*) at caves and mines in Nova Scotia. Curatorial Report #99, Nova Scotia Museum, Halifax, NS, Canada

Murphy, Michael C. and Gillam, Karen M. (2013). Greenhouse Gases and Climate in Environmental Impact Assessment-Practical Guidance, Michael C. Murphy, PhD, P.Eng. and Karen M. Gillam, M.Sc.

Murray, Doug. (2008). The Dominion Post Office at Tignish, Prince Edward Island. PHSC Journal 135, 14-19.

Native Plant Trust. (2022). GoBotany. Accessed November 2022: https://gobotany.nativeplanttrust.org.

New Brunswick Department of the Environment and Local Government (NBDELG). (nd). An Introduction to Air Quality in New Brunswick. Accessed 2022 at: https://www2.gnb.ca/content/gnb/en/departments/elg/environment/content/air_quality.html.

Newcombe, C.P. (1994). Suspended Sediments in Aquatic Ecosystems: Ill Effects a Function of Concentration and Duration of Exposure. Habitat Protection Branch. British Columbia Ministry of Environment, Lands and Parks. Victoria, British Columbia, Canada 298 pg.

O'Grady, Brendan. (2004). Exiles and Islanders: The Irish Settlers of Prince Edward Island. McGill-Queen's University Press: Montreal & Kingston.

Ontario Ministry of Natural Resources (OMNR). (2006). Wind Power and Bats: Bat Ecology Background Information and Literature Review of Impacts. December 2006. Fish and Wildlife Branch. Wildlife Section. Lands and Waters Branch. Renewable Energy Section. Peterborough, Ontario. 61 p.

Ontario Ministry of Natural Resources and Forestry (OMNRF). (2017). Survey Protocol for Species at Risk Bats within Treed Habitats – Little Brown Myotis, Northern Myotis & Tri-colored Bat. April 2017. Ontario Ministry of Natural Resources and Forestry, Guelph Division. 13 pp.

Parks Canada. (2020). The Canadian Register of Historic Places. Accessed 2020 https://www.historicplaces.ca/en/pages/about-apropos.aspx.

PEI Department of Agriculture and Forestry (PEIDAF). (2012). Wild Fire Information. Available at: http://www.gov.pe.ca/forestry/wildfires. Last updated: April 16, 2012. Accessed: October 2019.

PEI Department of Agriculture and Forestry (PEIDAF). (2014). Field Checklist of Birds. 8th Edition. Accessible: https://www.princeedwardisland.ca/sites/default/files/publications/2014_pei_birdchecklist-english.pdf

PEI Department of Environment, Water and Climate Change (PEI EECA). (2021). Prince Edward Island 2019 Watershed Quality Report Cards. October 2021.

PEI Department of Environment, Water and Climate Change (PEI EECA). (2020). Air Quality Monitoring. Available at: https://www.princeedwardisland.ca/en/information/communities-land-and-environment/air-quality-monitoring

PEI Department of Environment, Energy and Climate Action (PEI EECA). (2022a). Prince Edward Island Groundwater Level Monitoring Program Dashboard: Bloomfield. Available: https://www.arcgis.com/apps/dashboards/4f474bd0f99e4260bed9f253869481b6

PEI Department of Environment, Energy and Climate Action (PEI EECA). (2022b). Environmental Protection Act, Air Quality Regulations. Available at: https://www.princeedwardisland.ca/sites/default/files/legislation/e09-02-environmental_protection_act_air_quality_regulations.pdf

PEI Department of Environment, Energy and Climate Action (PEI EECA). (2022c). Projects Under Environmental Review (Undertakings). Accessed September 27, 2022: https://www.princeedwardisland.ca/en/feature/projects-under-environmental-review-undertakings#/service/EnvironmentalImpactAssessments/EnvironmentalImpactAssessmentSearch

PEI Department of Justice and Public Safety (PEIDJPS). (2022). Fire Safety throughout PEI. Available at: https://www.princeedwardisland.ca/en/information/justice-and-public-safety/fire-services-throughout-pei.

PEI Executive Council Office (PEIECO). (2019). Historic Milestones. Available at: https://www.princeedwardisland.ca/en/information/executive-council-office/historic-milestones. Last Updated: September 2019.

Pieplow. (2017). Peterson Field Guide to Bird Sounds of Eastern North America. Houghton Mifflin Harcourt Publishing Company, New York, NY. 593 pp.

Porter, Reginald. (1990). Archaeological Resource Survey: The Perrey House Cellar Site, Tignish, PEI. Manuscript on file, Indigenous Relations Secretariat, Charlottetown.

Radio Advisory Board of Canada (RABC) and the Canadian Wind Energy Association (CanWEA). (2020). Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems. Updated February 6, 2020

Reddy, E., and Fenton, M.B. (2003). Exploiting vulnerable prey: moths and red bats (*Lasiurus borealis*; Vespertilionidae). Canadian Journal of Zoology. 81(9): 1553-1560

Reitsma, Len, Goodnow, Marissa, Hallworth, Michael T., and Conway, Courtney J.. (2009). Canada Warbler (*Cardellina canadensis*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/canwar

Renfrew, Rosalind, Strong, Allan M., Perlut, Noah G., Martin, Stephen G., and Gavin, Thomas A.. (2015). Bobolink (*Dolichonyx oryzivorus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology

Rivard, C., Y. Michaud, R. Lefebre, C. Deblonde and A. Rivera. (2008). Characterization of a Regional Aquifer System in the Maritimes Basin, Eastern Canada. Published in the Water Resource Management Journal. 2008 – 22:1649-1675.

Rivera, Alfonso. (2014). Canada's Resources. Compiled and edited by Alfonso Rivera, Chief Hydrogeologist, Geological Survey of Canada. Published by Fitzhenry & Whiteside Limited. ISBN 978-1-55455-292-4. 801 pp.

Robertson, Ian Ross. (2020). PALMER, EDWARD in Dictionary of Canadian Biography 11, University of Toronto/Université Laval, Accessed 2020 http://www.biographi.ca/en/bio/palmer_edward_11E.html.

Rowe, J.S. (1972). Forest regions of Canada. Department of Environment, Canadian Forestry Services, Ottawa. Publication No. 1300. 172 pp.

Royal Canadian Mounted Police (RCMP). (2022). The RCMP in Prince Edward Island. Available at: http://www.rcmpgrc. gc.ca/en/pe/home. Last Updated: November 2022

Rydell, J., Bodganowicz W, Boonman A, Pettersson S, Suchecka E, Pomorski JJ. (2016). Bats may eat diurnal flies that rest on wind turbines. Mammalian Biology 81:331–339 DOI 10.1016/j.mambio.2016.01.005

Sable, Trudy and Francis, Bernie. (2012). The Language of this Land, Mi'kma'ki. Cape Breton University Press, Sydney, Nova Scotia.

Sawicki, Anna. (1984). 1984 Archaeological Survey, Prince County, Prince Edward Island. Manuscript on file at Canadian Museum of History.

Schmidt, U. and Joermann, G.. (1986). The influence of acoustical interferences on echolocation in bats. – Mammalia 50: 379-389.

Scruton, D.A., and Gibson, R.J.. (1995). Quantitative Electrofishing in Newfoundland and Labrador: Result of Workshops to Review Current Methods and Recommend Standardization of Techniques.

Sea Breeze, Sea Breeze Energy Inc.. (2004). Proposed Knob Hill Wind Farm - Environmental Assessment Application. Available at: http://www.eao.gov.bc.ca/epic/output/html/deploy/epic_document_219_16996.html.

Sherk, J. A., O'Connor, J. M., Neumann, D. A., Prince, R. D., and Wood, K. V. (1974). "Effects of suspended and deposited sediments on estuarine organisms, Phase II," Reference No. 74-20, Natural Resources Institute, University of Maryland, College Park, MD.

Slemon Park. (2022). Summerside Airport at Slemon Park. Available at: https://slemonpark.com

Statistics Canada (StatsCan). (2019). Community Profiles from the 2016 Census. Available at: https://www12.statcan.gc.ca/census-recensement/2016/dppd/prof/details/page.cfm?Lang=E&SearchText=Lot%2044&SearchType=Begins&SearchPR=01&TABID=1&G=1&Geo1=CSD&Code1=1101032&Geo2=PR&Code2=11&type=0&B1=Population Date, last modified: August 2019.

Statistics Canada (StatsCan). (2022). Census Profile. 2021 Census of Population. Statistics Canada Catalogue no. 98-316-X2021001. Ottawa, Ontario. August 17, 2022.

The Canadian Encyclopedia. (2009). Prince Edward Island.

The Government of Prince Edward Island. (2000). 2000 Forest Outline. Retrieved from: http://www.gov.pe.ca/gis/index.php3?number=1006288&lang=E

The Weather Network. (2019). The Climate of Prince Edward Island. Available at: http://www.theweathernetwork.com/index.php?product=wxhome&placecode=cape0013&pagecontent=pe

The Veteran Farmer. (nd). Accessed 2022: https://www.theveteranfarmer.ca/

Time and Date AS. (2022). Skinners Pond, Prince Edward Island, Canada – Sunrise, Sunset, and Daylength. Time and Date AS 1995 – 2022. Available at https://www.timeanddate.com/sun/@6148955.

U.S. Army Corps of Engineers. (2008). Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Draft), ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

van de Poll, H.W. (1983). Geology of Prince Edward Island. Charlottetown, PEI.

van Zyll de Jong, C.G. (1985). Handbook of Canadian Mammals. Volume 2. Bats. National Museum of Canada, Ottawa.

Verboom, B. and Spoelstra, K. (1999). Effects of food abundance and wind on the occurrence of pipistrelle bats Pipistrellus and serotines Eptesicus serotinus near treelines. Canadian Journal of Zoology (77):1393–1401.

Waldien, D. L., Hayes, J. P., and Arnett, E. B.. (2000a). Day roosts of female long-eared myotis in coniferous forests in western Oregon. Northwest Science 75:307-331.

Waldien, D. L., Hayes, J. P., and Arnett, E. B.. (2000b). Day roosts of female long-eared Myotis in western Oregon. Journal of Wildlife Management 64: 785-796

Warburton, A.B. (1923). A history of Prince Edward Island from its discovery in 1534 until the departure of Lieutenant-Governor Ready in A.D. 1831. Barnes & Co: Saint John.

White-nose Syndrome (WNS) Response Team. (nd). Where is WNS now? Interactive map. U.S. Fish and Wildlife Service, Department of the Interior. https://www.whitenosesyndrome.org/where-is-wns

World Health Organization (WHO). (1999). Guidelines for Community Noise. http://www.who.int/docstore/peh/noise/guidelines2.html

Zimmerling, J. R., Pomeroy, A. C., d'Entremont, M. V., and Francis, C. M.. (2013). Canadian estimate of bird mortality due to collisions and direct habitat loss associated with wind turbine development. Ace-Eco 8:10 http://dx.doi.org/10.5751/ACE-00609-080210

Appendix A

“Appendix B: Special Note for Wind Turbine Projects” from the *Environmental Protection Act*

Special Note for Wind Turbine Projects

A single wind turbine whose energy output is less than 1 megawatt (MW), or a combination of wind turbines whose energy outputs do not equal or exceed 1 MW are excluded from the EIA process.*

All wind turbine project proposals must include a means for transmitting the power. If a new transmission line is required to transmit the power from the new wind turbine(s), the power corridor proposal must also be included as part of the original EIA submission. **A wind turbine project will not be considered for approval without submission of a proposed power corridor route from the responsible electrical utility.**

*NOTE: Even though they are excluded from the Department of Environment, Labour & Justice's Provincial EIA process, proponents need to ensure that their projects meet with all other provincial department's requirements i.e. building permit requirements, as well as federal and municipal requirements.

Appendix B

Vegetation Survey

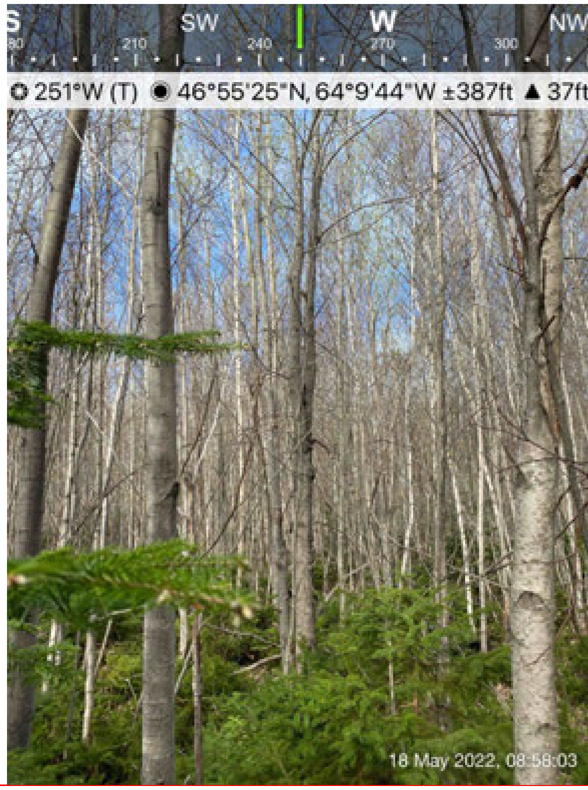
	**Photo 1:** T1 Immature Deciduous 18 May 2022 **Direction:** West

	**Photo 2:** T1 Immature Deciduous 18 May 2022 **Direction:** Southwest

Photo 3:
T2

Immature Deciduous

17 May 2022

Direction:
West

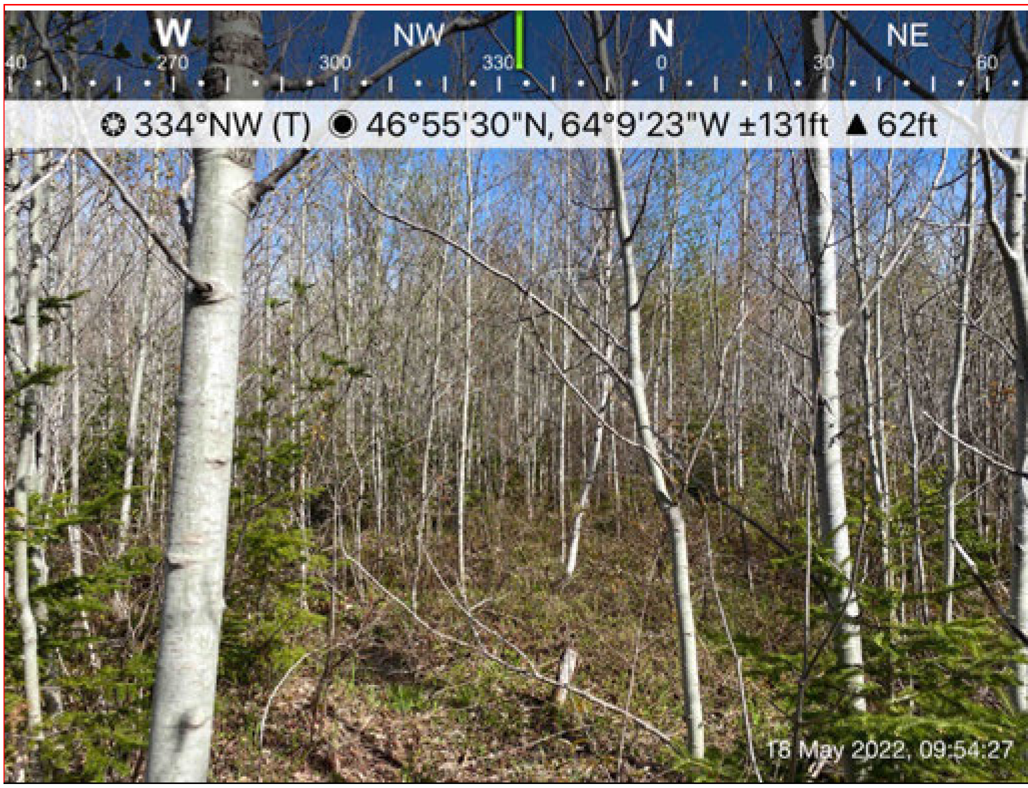


Photo 4:
T4

Immature Mixed Forest

18 May 2022

Direction:
Northwest

Photo 5:
T4

Immature Mixed Forest

18 May 2022

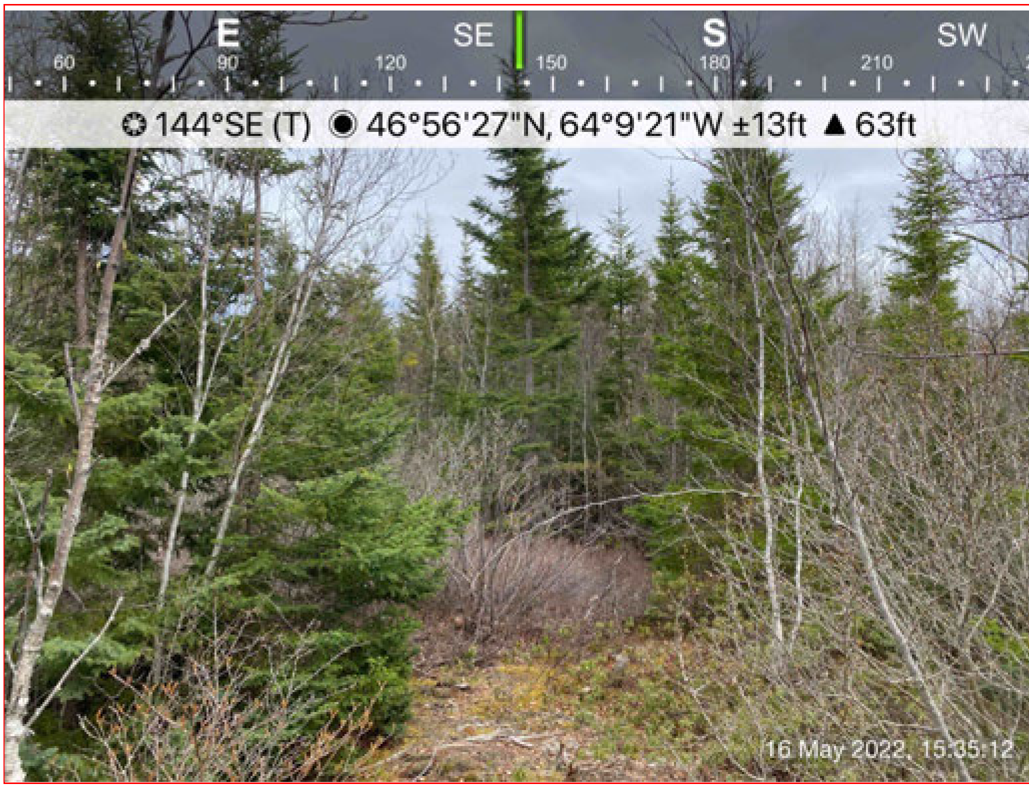
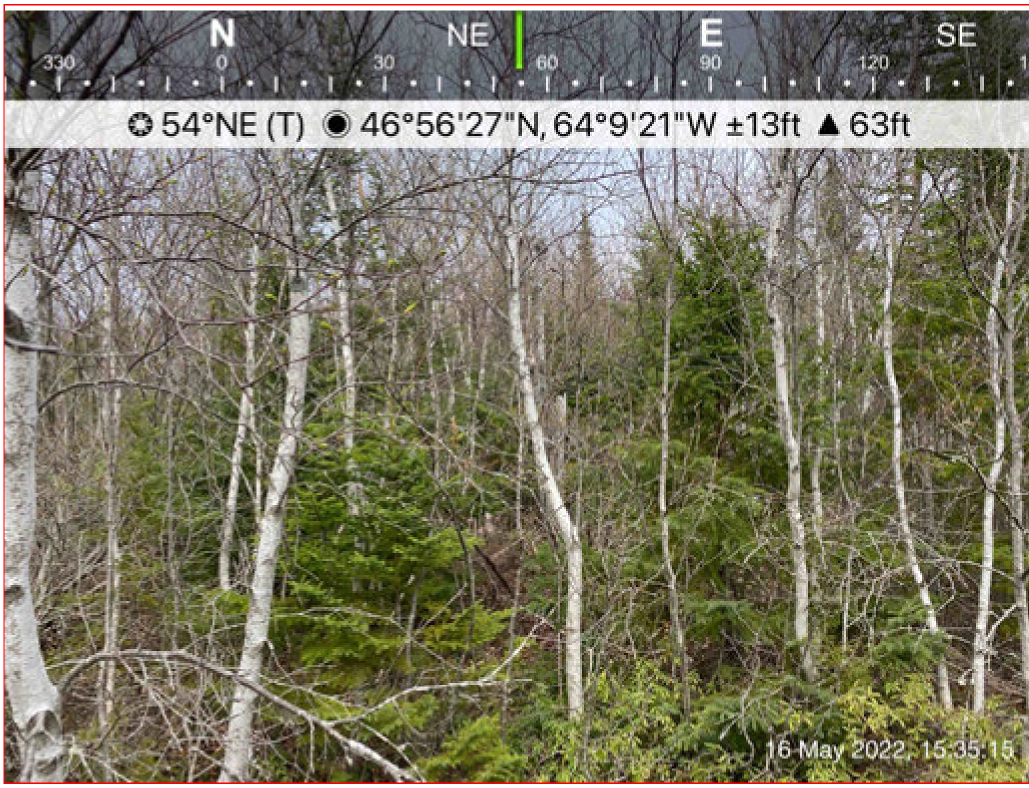
Direction:
East

Photo 6:
T5

Immature Mixed Forest

17 May 2022

Direction:
East

	**Photo 7:** T6 Immature Coniferous 16 May 2022 **Direction:** Southeast
	**Photo 8:** T6 Immature Coniferous 16 May 2022 **Direction:** Northeast

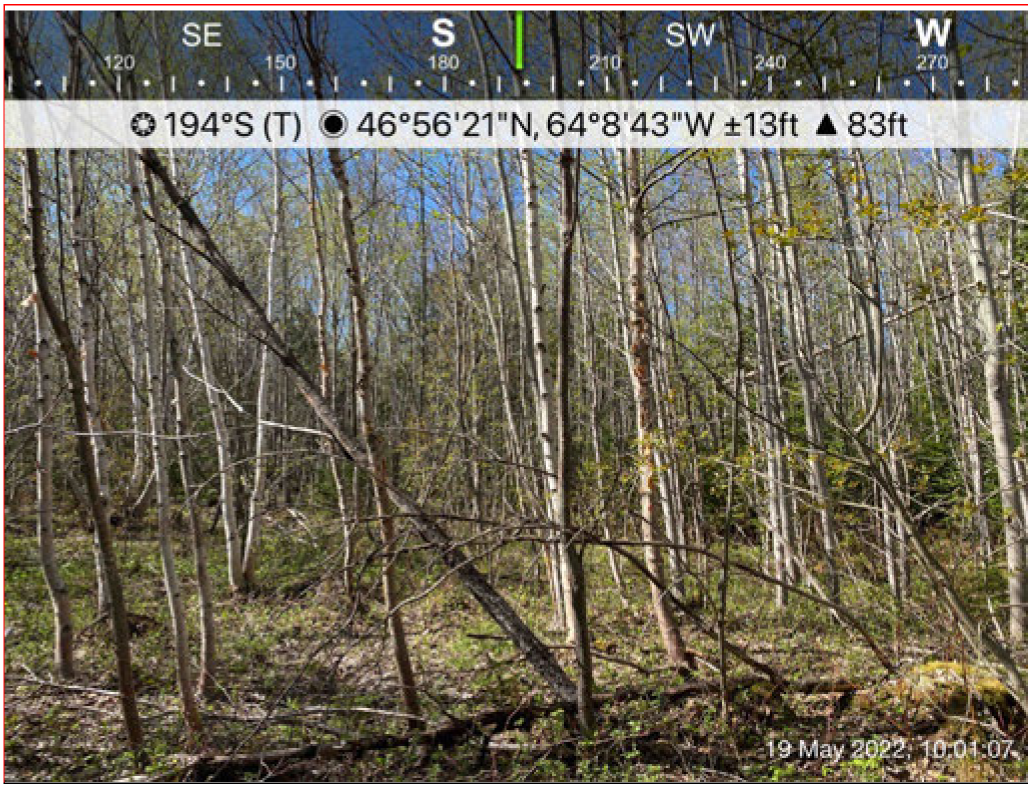
	**Photo 9:** T7 Immature Mixed Forest 19 May 2022 **Direction:** South
	**Photo 10:** T8 Mature Coniferous 19 May 2022 **Direction:** Southwest

Photo 11:
T9

Mature Coniferous

17 May 2022

Direction:
North

Photo 12:
T9

Mature Coniferous

17 May 2022

Direction:
Southeast

	**Photo 13:** T10 Immature Mixed Forest 19 May 2022 **Direction:** Southeast
	**Photo 14:** T10 Immature Mixed Forest 19 May 2022 **Direction:** Northwest

Photo 15:
T12

Clear-cut

19 May 2022

Direction:
Northeast

Photo 16:
T12

Clear-cut

19 May 2022

Direction:
Southwest

Photo 17:
T14

Clear-cut

19 May 2022

Direction:
Southwest

Photo 18:
T15

Mature Coniferous

20 May 2022

Direction:
East

	**Photo 19:** T15 Mature Coniferous 20 May 2022 **Direction:** South

Table 1: Complete plant list for Skinners Pond based on 2021-2022 field surveys

Scientific Name	Common Name	SRank
Abies balsamea	Balsam Fir	S5
Acer pensylvanicum	Striped Maple	S5
Acer rubrum	Red Maple	S5
Acer saccharum	Sugar Maple	S4
Achillea millefolium	Common Yarrow	SNA
Actaea rubra	Red Baneberry	S4
Agrostis capillaris	Colonial Bent Grass	SNA
Agrostis scabra	Rough Bent Grass	S5
Alisma triviale	Northern Water-plantain	S4S5
Alnus incana	Speckled Alder	S5
Amelanchier laevis	Smooth Serviceberry	S4
Anaphalis margaritacea	Pearly Everlasting	S5
Apocynum androsaemifolium	Spreading Dogbane	S4
Aralia nudicaulis	Wild Sarsaparilla	S5
Argentina anserina	Common Silverweed	S5
Arisaema triphyllum ssp.stewardsonii	Swamp Jack-in-the-pulpit	S4
Aronia melanocarpa	Black Chokeberry	S4S5
Artemisia vulgaris	Common Wormwood	SNA
Athyrium filix-femina	Common Lady Fern	S5
Betula alleghaniensis	Yellow Birch	S5
Betula papyrifera	Paper Birch	S5
Betula populifolia	Gray Birch	S5
Calamagrostis canadensis	Bluejoint Reed Grass	S5
Calopogon tuberosus	Grass-pink	S3
Caltha palustris	Marsh Marigold	S4S5
Carex disperma	Two-seeded Sedge	S4
Carex echinata	Star Sedge	S4S5
Carex folliculata	Northern Long Sedge	S2

Scientific Name	Common Name	SRank
Carex gracillima	Graceful Sedge	S4
Carex gynandra	Nodding Sedge	S5
Carex intumescens	Bladder Sedge	S4S5
Carex scoparia	Broom Sedge	S4S5
Carex stipata	Awl-fruited Sedge	S5
Carex stricta	Tussock Sedge	S4
Carex trisperma	Three-seeded Sedge	S5
Centaurea nigra	Black Knapweed	SNA
Circaea alpina	Small Enchanter's-nightshade	S5
Circaea canadensis	Broadleaf Enchanters Nightshade	S2S3
Clintonia borealis	Yellow Bluebead Lily	S5
Comarum palustre	Marsh-Cinquefoil	S4
Coptis trifolia	Goldthread	S5
Cornus canadensis	Bunchberry	S5
Corylus cornuta	Beaked Hazel	S5
Cypripedium acaule	Pink Lady's-Slipper	S5
Danthonia spicata	Poverty Oat Grass	S5
Doellingeria umbellata	Hairy Flat-top White Aster	S5
Drosera rotundifolia	Round-leaved Sundew	S4
Dryopteris carthusiana	Spinulose Wood Fern	S4S5
Dryopteris intermedia	Evergreen Wood Fern	S5
Dulichium arundinaceum	Three-Way Sedge	S3
Eleocharis tenuis	Slender Spikerush	S3
Epigaea repens	Trailing Arbutus	S4
Epipactis helleborine	Broad-leaved Helleborine	SNA
Equisetum arvense	Field Horsetail	S5
Equisetum fluviatile	Water Horsetail	S4
Equisetum sylvaticum	Wood Horsetail	S5
Euphrasia nemorosa	Common Eyebright	S5

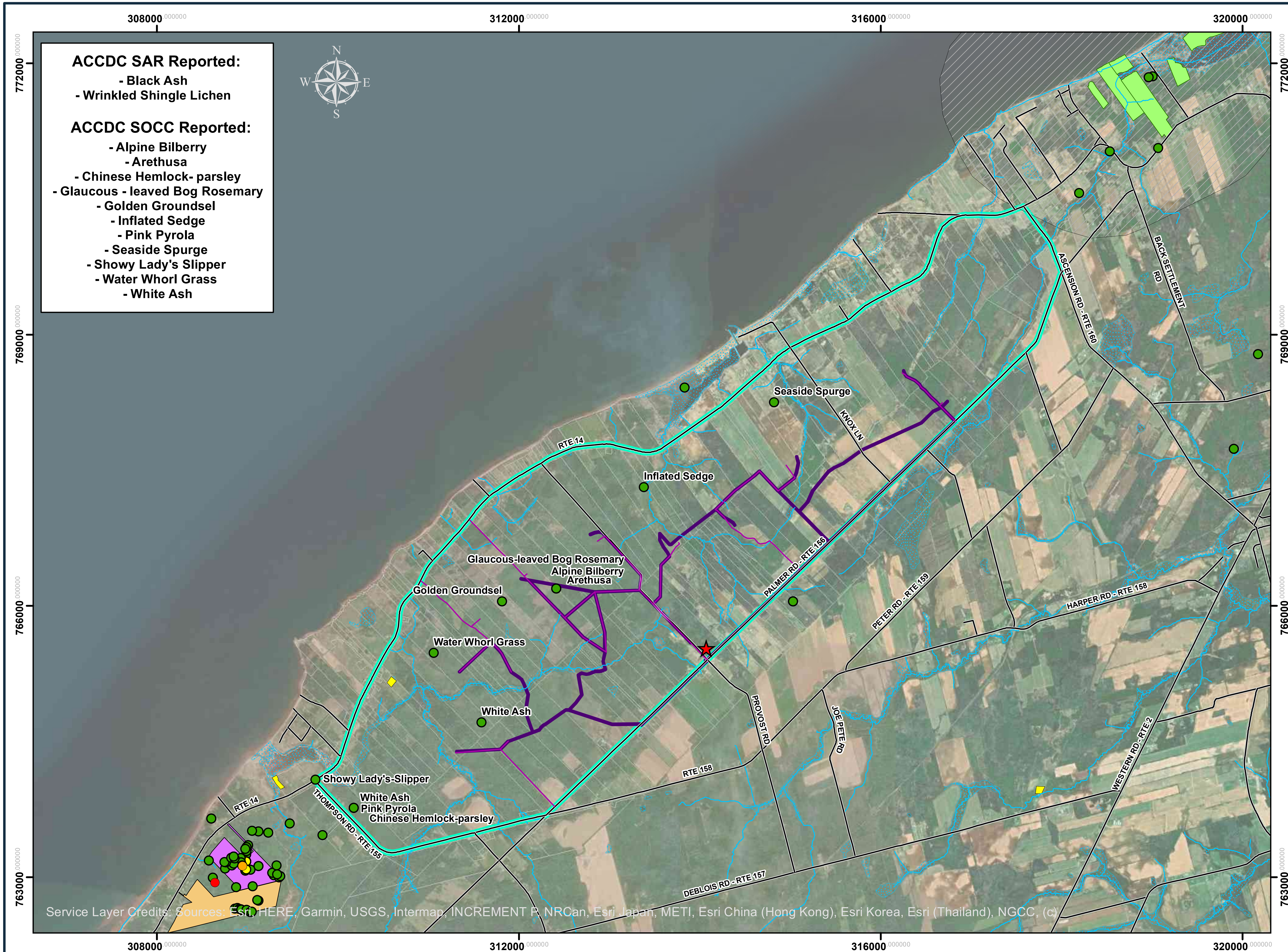
Scientific Name	Common Name	SRank
Euthamia graminifolia	Grass-leaved Goldenrod	S5
Eutrochium maculatum	Spotted Joe-Pye Weed	SNA
Fallopia cilinodis	Fringed Bindweed	S4
Fragaria vesca	Woodland Strawberry	SNA
Fragaria virginiana	Wild Strawberry	S5
Fraxinus americana	White Ash	S2S3
Fraxinus pennsylvanica	Red Ash	SNA
Galeopsis tetrahit	Common Hemp-nettle	SNA
Galium palustre	Marsh Bedstraw	S5
Galium triflorum	Fragrant Bedstraw	S5
Gaultheria hispidula	Creeping Snowberry	S5
Geum macrophyllum	Large-leaved Avens	S3S4
Geum rivale	Water Avens	S4
Glyceria canadensis	Canada Manna Grass	S3S4
Glyceria striata	Fowl Manna Grass	S5
Hieracium lachenalii	Common Hawkweed	SNA
Hypericum fraseri	Fraser's Marsh St John's-wort	S5
Hypericum perforatum	Common St. John's-wort	SNA
Ilex mucronata	Mountain Holly	S5
Ilex verticillata	Common Winterberry	S5
Impatiens capensis	Spotted Jewelweed	S5
Iris versicolor	Blue Flag	S5
Juncus canadensis	Canada Rush	S4
Juncus effusus	Soft Rush	S5
Juncus pelocarpus	Brown-Fruited Rush	S4
Juncus tenuis	Slender Rush	S5
Kalmia angustifolia	Sheep Laurel	S5
Lactuca biennis	Tall Blue Lettuce	S5
Larix laricina	Tamarack	S5

Scientific Name	Common Name	SRank
Leucanthemum vulgare	Ox-eye Daisy	SNA
Linnaea borealis	Twinflower	S5
Lonicera canadensis	Canada Fly Honeysuckle	S5
Lotus corniculatus	Garden Bird's-foot-trefoil	SNA
Luzula multiflora	Common Woodrush	S5
Lycopus uniflorus	Northern Water Horehound	S5
Lysimachia borealis	Northern Starflower	S5
Maianthemum canadense	Wild Lily-of-The-Valley	S5
Maianthemum racemosum	Soloman's Plume	S4
Maianthemum trifolium	Three-leaved False Soloman's Seal	S4
Melampsorella elatina	Fir Broom Rust	--
Mitella nuda	Naked Bishop's-cap	S4
Moneses uniflora	One-flowered Wintergreen	S3
Morella pensylvanica	Northern Bayberry	S5
Myrica gale	Sweet Gale	S5
Mysotis laxa	Smaller Forget-me-not	S4
Nabalus trifoliatus	Three-leaved Rattlesnake-root	S5
Oclemena nemoralis	Bog Aster	S3
Oenothera biennis	Common Evening-primrose	S5
Onoclea sensibilis	Sensitive Fern	S5
Osmunda claytoniana	Interrupted Fern	S5
Osmunda regalis	Royal Fern	S4
Osmundastrum cinnamomeum	Cinnamon Fern	S5
Oxalis dillenii	Slender Yellow Wood Sorrel	SNA
Oxalis montana	Common Wood Sorrel	S4
Packera aurea	Golden Groundsel	S2
Parathelypteris noveboracensis	New York Fern	S5
Parthenocissus quinquefolia	Virginia Creeper	SNA
Phalaris arundinacea	Reed Canary Grass	SNA

Scientific Name	Common Name	SRank
Picea glauca	White Spruce	S5
Picea pungens	Colorado Blue Spruce	SNA
Picea rubens	Red Spruce	S5
Plantago lanceolata	Ribwort Plantain	SNA
Plantago major	Common Plantain	SNA
Poa pratensis	Kentucky Blue Grass	SNA
Pogonia ophioglossoides	Rose Pogonia	S3
Populus balsamifera	Balsam Poplar	S3
Populus grandidentata	Large-toothed Aspen	S4S5
Populus tremuloides	Trembling Aspen	S5
Potentilla simplex	Old Field Cinquefoil	S4
Prunella vulgaris	Common Self-heal	S5
Prunus pensylvanica	Pin Cherry	S5
Prunus virginiana	Chokecherry	S5
Pteridium aquilinum	Bracken Fern	S5
Pyrola elliptica	Shinleaf	S5
Quercus robur	English Oak	SNA
Ranunculus acris	Common Buttercup	SNA
Ranunculus repens	Creeping Buttercup	SNA
Raphanus raphanistrum	Jointed Charlock	SNA
Rhododendron canadense	Rhodora	S5
Rhododendron groenlandicum	Labrador Tea	S5
Ribes glandulosum	Skunk Currant	S5
Ribes hirtellum	Hairy-stemmed Gooseberry	S5
Ribes lacustre	Bristly Swamp Current	S5
Ribes triste	Swamp Red Current	S3S4
Rosa multiflora	Multiflora Rose	SNA
Rosa nitida	Shining Rose	S4
Rosa virginiana	Virginia Rose	S5

Scientific Name	Common Name	SRank
Rubus allegheniensis	Alleghaney Blackberry	S4S5
Rubus hispidus	Bristly Dewberry	S4
Rubus idaeus	Red Raspberry	S5
Rubus pubescens	Dwarf Red Raspberry	S5
Salix bebbiana	Bebb's Willow	S5
Salix discolor	Pussy Willow	S5
Salix eriocephala	Cottony Willow	S4
Salix humilis	Upland Willow	S4S5
Sambucus racemosa	Red-berried Elder	S5
Scirpus cyperinus	Common Woolly Bulrush	S5
Scirpus hattorianus	Mosquito Bulrush	S4
Scirpus microcarpus	Small-fruited Bulrush	S4S5
Sisyrinchium angustifolium	Narrow-leaved Blue-eyed-grass	SNA
Sisyrinchium montanum	Strict Blue-Eyed Grass	S5
Sium suave	Water-parsnip	S5
Solidago canadensis	Canada Goldenrod	S5
Solidago rugosa	Rough-stemmed Goldenrod	S5
Solidago uliginosa	Northern Bog Goldenrod	S4
Sorbus americana	American Mountain Ash	S5
Spinulum annotinum	Bristly Clubmoss	S5
Spiraea alba	White Meadowsweet	S5
Spiraea tomentosa	Steeplebush	S4
Stellaria graminea	Grass-leaved Stitchwort	SNA
Swida alternifolia	Alternate-leaved Dogwood	S4
Swida rugosa	Round-leaved Dogwood	S2
Swida sericea	Red-osier Dogwood	S5
Symphyotrichum novi-belgii	New York Aster	S5
Taraxacum officinale	Common Dandelion	SNA
Thalictrum pubescens	Tall Meadow-Rue	S5

Scientific Name	Common Name	SRank
Thelypteris palustris	Eastern Marsh Fern	S4S5
Thuja occidentalis	Eastern White Cedar	S3S4
Toxicodendron radicans	Poison Ivy	S4
Trifolium hybridum	Alsike Clover	SNA
Trifolium pratense	Red Clover	SNA
Trillium cernuum	Nodding Trillium	S4
Trillium undulatum	Painted Trillium	S5
Tussilago farfara	Coltsfoot	SNA
Typha latifolia	Broad-leaved Cattail	S5
Vaccinium angustifolium	Late Lowbush Blueberry	S5
Vaccinium myrtilloides	Velvet-leaved Blueberry	S4S5
Viburnum cassinoides	Northern Wild Raisin	S5
Viburnum opulus	Guelder-rose	S3
Vicia cracca	Tufted Vetch	SNA
Viola cucullata	Marsh Blue Violet	S5
Viola macloskeyi	Small White Violet	S5



LEGEND:

Species At Risk
- Non-vascular Flora
- Vascular Flora

Species of Conservation Concern
- Non-vascular Flora
- Vascular Flora
- Point of Interconnection Option
- Power Collection Corridor
- Turbine Laneway
- Roads
- Streams/Creeks
- Wetlands (Provincial)
- Property Boundary
- Project Area

Managed Area
- Ducks Unlimited Canada, PEI Conservation Agreements
- Nail Pond Natural Area
- Norway IBA
- Pleasant View Cedars Natural Area
- Pleasant View Cedars Woodland Natural Area

ALL WIND FARM INFRASTRUCTURE MAPPING WAS PROVIDED BY INVENERGY LABELLED LAYOUT 014

CLIENT:

INVENERGY CANADA

TITLE:

FLORA SPECIES OF CONSERVATION CONCERN

PROJECT:

SKINNERS POND WIND ENERGY CENTRE

PROJECT NO: TE211027	DATE: NOV 2022
REV NO: 0	DWN BY: LC
DATUM: NAD83 CSRS 2010	PROJECTION: PEI DBL STEREO

FIGURE:

FIGURE TBD

SCALE: 1:40,000

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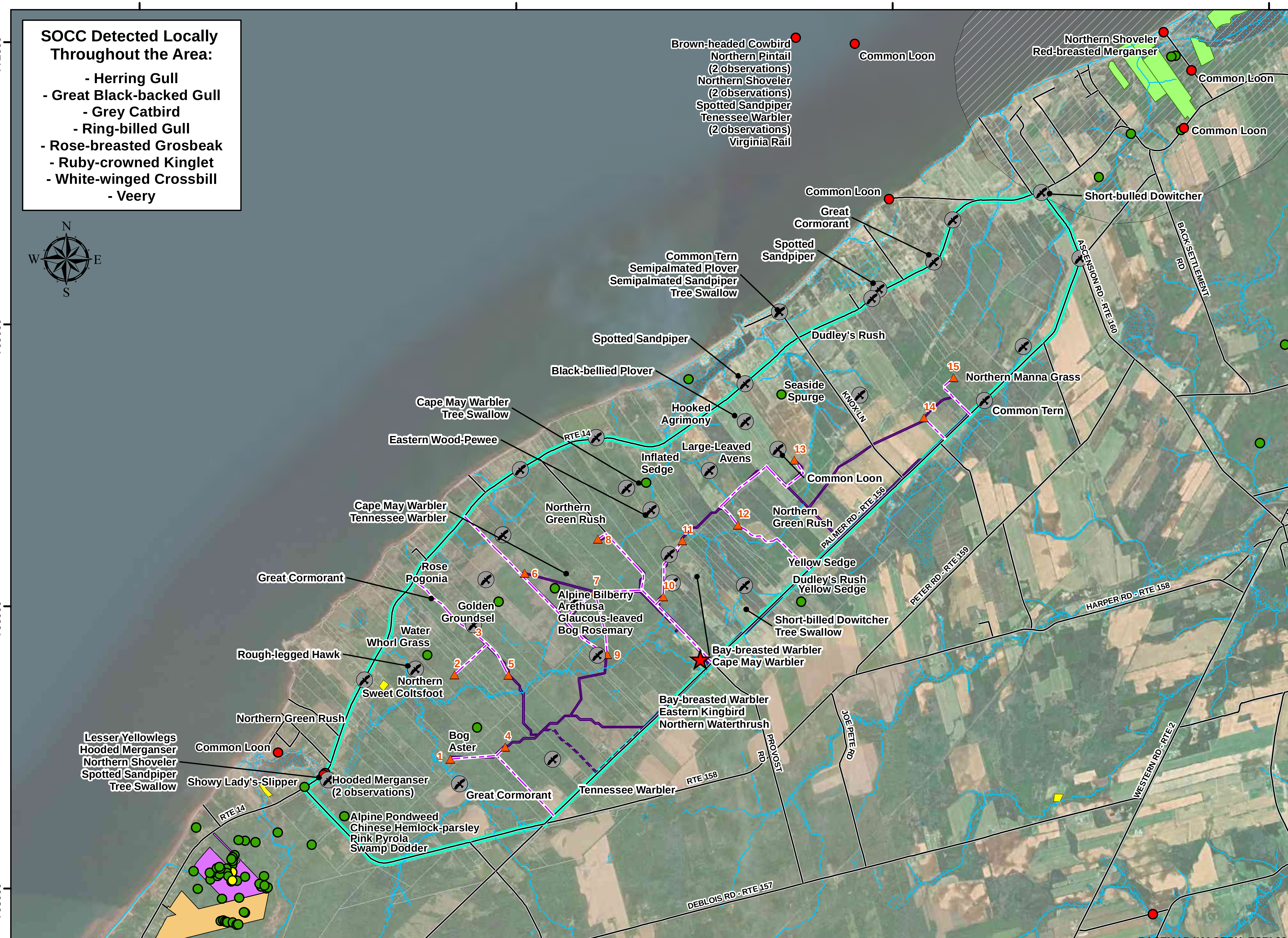
Metres

Path: Q:\PROJECTS\TE211027_Invenergy_Canada_EIA_Windfarm_PE\13 GIS\MXD\TE211027_FIGURE_TBD_Flora_ACCDC_Reported_SAR_&_SOCC.mxd User: leah.carbyn Date: 11/15/2022



LEGEND:
- 2021 Bird SOCC Observations

ACCDC Species At Risk
- Vertebrate Fauna
- Non-vascular Flora
- Vascular Flora
- Layout
- Point of Interconnection Option
- Turbine Laneway
- Roads
- Streams/Creeks
- Wetlands
- Power Collection Corridor
- Alternate Power Collection Corridor
- Property Boundary
- Project Area

Managed Area
- Ducks Unlimited Canada, PEI Conservation Agreements
- Nail Pond Natural Area
- Norway IBA
- Pleasant View Cedars Natural Area
- Pleasant View Cedars Woodland Natural Area

ALL WIND FARM INFRASTRUCTURE MAPPING WAS PROVIDED BY INVENERGY LABELLED LAYOUT 016

KEYMAP

CLIENT: Invenergy

wsp

TITLE: FLORA & FAUNA SPECIES OF CONSERVATION CONCERN

PROJECT: SKINNERS POND WIND ENERGY CENTER

PROJECT NO: TE211027	DATE: MARCH 2023
REV NO: 6	DWN BY: CM
DATUM: NAD83 CSRS 2010	PROJECTION: PEI DBL STEREO

FIGURE: FIGURE B-1

SCALE: 1:40,000

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Metres

Path: Q:\PROJECTS\TE211027_Invenergy_Canada_EIA_Windfarm_PE\13 GIS\MXD\TE211027_FIGURE_2_SOCC.mxd User: candace.macdonald Date: 3/28/2023

Appendix C

Report for Wetland Survey – Skinners Pond Wind Energy Centre

Report for Wetland Survey – Skinners Pond Wind Energy Center

January 31, 2023

Prepared for: WSP E&I Canada Limited – Skinners Pond Wind Energy Center
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Bruce Fraser – bruce.fraser@wsp.com, (902) 452-9670

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INTRODUCTION

WSP E&I Canada Limited had enlisted the services of Maqamigew Anqotumeg Inc to conduct a wetland assessment for PIDs 549741, 11874, 11809, 826578, 12021, 747337, 720912, 11023, 10959, 10934, 740159, 11353, 11296, 11718, 11353, 11296, 11767, 846816, 11668, 720920, 10942, 10983, 10991, 409805, 11346, 11320, 11775, 646653, 11643, 11601, 11304, 11320, 11099, 10942, 1002351, 88617, 10132, 12070, 10322, 10314, 537621, and 460261. Including Wetland Delineations, Functional Assessments, and a wetland delineation report to summarize the findings. The intention of the presented report is to supplement a previous preliminary wetland delineation report and additionally being done as a part of the regulatory requirements for the Invenergy Skinners Pond Wind Energy Center. Prince Edward Island has a policy of no-net-loss of wetlands as described in the Prince Edward Island Watercourse and Wetland Protection Regulations. Wetlands are legally protected under the Environmental Protection Act. Alterations to wetlands require a Watercourse or Wetland Alteration permit and may also require compensation where affected wetlands are replaced at a ratio of 1:1, or greater.

The Study Area (Figure 1) is in the traditional Mi'kmaw district of *Epekwitk*, the towns of Skinners Pond and Waterford, Prince County, Prince Edward Island, Canada. Highways 156, 155 & 14 surround the SA. And an estimated 1.5 km southeast from the Northumberland Strait. Fifteen proposed turbines are placed over an area that is an estimated 25 km linear length, with 10 km adjacent to paved road and nearly 6 km of agricultural fields.

Both collectively and as individual units, wetland resources serve a variety of important ecological and socioeconomic functions. Wetlands function in the maintenance of surface and groundwater resources and quality, as well as in the provision of wildlife habitat. The value of wetlands to society and their ecological value are derived from their biological productivity, biodiversity, and functional role in processing surface and groundwater.

Wetlands are generally characterized by the presence of saturated soils in the upper 30 cm of soil for a period of time in the growing season sufficient to develop hydrophytic soils and vegetation. Wetland types can vary from a closed peat bog to an open water body dominated by submergent vegetation. By providing natural flood control, points of recharge and discharge of groundwater, acting as filters, and by trapping silt, wetlands play an important role in the hydrological cycle and generally enhance the water regime. Since they provide habitat for a wide variety of plants and animals, they may be highly productive and often exceed adjacent uplands in their productivity, biodiversity, and much higher incidence of rare species and species at risk. In the past, wetlands have been viewed mainly in terms of development, such as agricultural land or peat resources. However, their ecological value is now more clearly understood. Ecological wetland values may include sustenance for waterfowl; sources of fish production; storage and slow release of water; erosion protection; and areas of aesthetic or recreational enjoyment.

With increasing competition for land, particularly in urban areas, wetlands have continued to be impacted through diking, filling, drainage, flooding, and other forms of conversion. Such use has caused the number and extent of wetlands to decrease substantially (Bond, et al., 1992). This is particularly true of coastal wetlands where historical losses in the Maritimes may be as high as 80% (Hanson & Calkins, 1996).

PEI wetlands have been given protection under the Environmental Protection Act. Prince Edward Island Department of Environment, Energy and Climate Action requires a permit for any alternation within 15 m of the bank of a watercourse or wetlands. In addition, permanently impacted wetlands must be compensated at a 1:1 ratio or greater, to achieve the objectives for no net loss of wetland function. Compensation for the loss of wetland is required when an approval to impact a wetland is issued under the Environmental Protectional Act.

METHODOLOGY

Wetland surveys were conducted on four separate site visits: Monday July 25 to Friday, July 29, Tuesday, August 2 to Friday August 5, Monday September 12 to Friday September 16, and finally on October 18 and 19, 2022. Site visits were conducted by Lyle Vicaire of Maqamigew Anqotumeg with assistance on August 03 – 05 and September 12 - 16 by Ryan Power of Boreal Environmental. Both surveyors are experienced field biologists and trained wetland delineators. During the week of July 25, 2022, three wetlands (WL1, WL2, and WL3) were delineated. During the week August 2, 2022, seven additional wetlands (WL4, WL5, WL,6, WL7, WL8, WL9, and WL10) were delineated. During the week of September 12, 2022, nine additional wetlands (WL11, WL12, WL13, WL14, WL15, WL16, WL17, WL18 and WL19) were delineated. And finally, four additional wetlands (WL20, WL21, WL22, and WL23) were delineated on October 18 and 19, 2022. A total of 40.08 hectares (ha) had been identified and delineated within the Study Area boundaries. Table 1 describes the size, location, and type of each wetland.

Table 1 – Identified wetlands, size, location, and type for Skinners Pond Wind Energy Center.

Wetland	Size (Ha)	Location	Type
WL1	3.86	-64.095943, 46.959671	Mature Mix Wood Seepage Swamp
WL2	0.98	-64.116218, 46.948709	Shrub Seepage Swamp
WL3	4.18	-64.135173, 46.938117	Shrub Channel Swamp
WL4	2.26	-64.166799, 46.938358	Mature Mix Wood Discharge Swamp
WL5	0.40	-64.161004, 46.933856	Mature Mixed Wood Discharge Swamp
WL6	0.44	-64.163710, 46.932152	Hard Wood Forest Discharge Swamp
WL7	0.92	-64.154532, 46.921401	Mature Mixed Wood Seepage Swamp
WL8	0.72	-64.158435, 46.923451	Mixed Wood Forest Seepage Swamp
WL9	0.17	-64.160727, 46.924021	Sloped Hard Wood Forest Seepage Swamp
WL10	0.25	-64.156974, 46.924913	Hard Wood Forest Seepage Swamp
WL11	7.25	-64.154981, 46.927089	Mixed Wood Seepage Swamp w/Beaver Pond
WL12	5.74	-64.149589, 46.938070	Herbaceous Seepage Swamp w/Beaver Pond
WL13	1.82	-64.145614, 46.934822	Shrub Seepage Swamp
WL14a	3.11	-64.145659, 46.932032	Riverine Swamp w/Beaver Pond
WL14b	0.65	-64.154711, 46.930202	Riverine Swamp w/Beaver Pond
WL15	0.52	-64.144546, 46.936904	Mixed Wood Forest Seepage Swamp
WL16	2.12	-64.154864, 46.941991	Mixed Wood Forest Seepage Swamp
WL17	0.16	-64.138464, 46.939595	Shrub Seepage Swamp
WL18	0.06	-64.138858, 46.941838	Regen Herbaceous Seepage Swamp
WL19	1.80	-64.142196, 46.943866	Shrub Seepage Swamp
WL20	0.51	-64.099935, 46.961773	Shrub Seepage Swamp
WL21	0.79	-64.127810, 46.933975	Shrub Seepage Swamp
WL22	0.41	-64.126159, 46.948913	Hard Wood Forest Riverine Swamp
WL23	0.99	-64.132031, 46.944863	Shrub Riverine Swamp w/Beaver Pond

The wetland delineation was conducted using the methodology developed by the US Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory 1987), and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region, (U.S Army Corps of Engineers, 2012). This protocol has been adopted by Canadian regulators and practitioners. The wetland determination and boundary delineation is based on of the use of three parameters that must all be present for a wetland determination: wetland (hydrophytic) vegetation, hydric soil, and evidence of wetland hydrology. At representative locations along the boundary, paired sampling points are placed (one within the wetland, and one in the adjacent upland) where the three parameters are measured and recorded on data forms. The wetland boundary was recorded in the field using a Garmin GPSMAP 64X and a Garmin GPSMAP 64Xe, with an accuracy of (3 – 5 m). Figures 1 through 6 are supplemented.

Wetland Functional Assessments were completed for each wetland using the Wetland Ecosystem Services Protocol-Atlantic Canada (WESP) wetland evaluation technique. The WESP process involves the completion of three forms: a desktop review portion that examines the landscape level arial conditions within which the wetland is situated, and two field forms. The process serves as a rapid method for assessing individual wetland functions and benefits. WESP addresses 9 specific functions for tidal wetlands. may provide including their definitions and potential benefits (WESP Table 2 & Table 3). In non—tidal wetlands, the specific wetlands functions are individually allocated and also grouped into wetland functions, then measured for "Function" and "Benefits" scores. Wetland function relates to what a wetland does naturally through physical chemical, and/or biological processes (i.e., water purification). Wetland benefits relate to the importance of the functions, whether it be ecological, social, or economic importance.

In addition to the grouped wetland functions described, WESP also measures the following groups; however, these are only evaluated by their benefit scores:

- Wetland Condition; and
- Wetland Risk

The following individual functions are assessed to determine the benefit scores with these groups:

- Public use & Recognition
- Wetland Sensitivity
- Wetland Ecological Conditions; and
- Wetland Stressors

For each wetland evaluated, the WESP process calculates the overall score for the 7 grouped wetland functions and the 17 specific wetlands functions for non-tidal wetland, the tidal wetland WESP process calculates the overall score for the 9 individual wetland functions. One score each is provided for function and benefit. Scores are ranked as 'Lower', 'Moderate', or 'Higher', allowing for analysis of the wetland. A 'Higher' WESP score means that wetland has a greater capacity to support those processes as compared to other wetlands in the province. A "Higher' WESP score in both the function and benefits category means the wetland supports the natural ecosystem functions and provides services potentially important to society. For example, a 'Higher' function and benefit score in the specific wetland function 'Water Cooling' means the wetland is very effective in maintaining or reducing the temperature of downslope waters.

benefit score in the specific wetland function ‘Water Cooling’ means the wetland is very effective in maintaining or reducing the temperature of downslope waters.

To improve the analysis for the Functional Assessments, this report illustrates the 5 Summary Ratings for grouped Functions as follows:

- Hydrologic Group (Water Storage & Delay)
- Water Quality Support Group (Sediment Retention, Phosphorus Retention, Nitrate Removal & Retention, and Carbon Sequestration).
- Aquatic Support Group (Stream Flow Support, Aquatic Invertebrate Habitat, Organic Nutrient Export, and Water Cooling)
- Aquatic Habitat Group (Anadromous Fish Habitat, Resident Fish Habitat, Amphibian & Turtle Habitat, Waterbird Feeding Habitat, and Waterbird nesting Habitat)
- Transition Habitat (Songbird, Raptor, & Mammal Habitat, Native Plant Habitat, and Pollinator Habitat).

Table 2 – Non-tidal wetland functions and other attributes (WESP-AC, 2018)

Function	Definition	Potential Benefits
HYDROLOGICAL FUNCTIONS:		
Water Storage & Delay (WS)	The effectiveness for storing runoff or delaying the downslope movement of surface water for long or short periods	Flood control, maintain ecological systems
Stream Flow Support (SFS)	The effectiveness for contributing water to streams, especially during the driest part of a growing season	Support fish and other aquatic life
WATER QUALITY MAINTENANCE FUNCTIONS:		
Water Cooling	The effectiveness for maintaining or reducing temperatures of downslope waters	Support cold water fish and other aquatic life
Sediment Retention & Stabilization	The effectiveness for intercepting the filtering suspended inorganic sediments thus allowing their deposition, as well as reducing energy of waves and currents, resisting excessive erosion, and stabilizing underlying sediments or soil	Maintain quality of receiving waters. Protect shoreline structures from erosion
Phosphorus Retention	The effectiveness for retaining phosphorus for long periods (>1 growing season)	Maintain quality of receiving waters
Nitrate Removal & Retention	The effectiveness for retaining particulate nitrate and converting soluble nitrate and ammonium to nitrogen gas while generating little or no nitrous oxide (a potent greenhouse gas)	Maintain quality of receiving waters
Organic Nutrient Export	The effectiveness for producing and subsequently exporting organic nutrients (mainly carbon), either particulate or dissolved	Support food chains in receiving waters
ECOLOGICAL (HABITAT) FUNCTIONS:		
Fish Habitat	The capacity to support an abundance and diversity of native fish (both anadromous and resident species)	Support recreational and ecological values
Aquatic Invertebrate	The capacity to support or contribute to an abundance or	Support salmon and other

Habitat	diversity of invertebrate animals which spend all or part of their life cycle underwater or in most soil. Includes dragonflies, midges, clams, snails, water beetles, shrimps, aquatic worms, and others	aquatic life. Maintain regional biodiversity

Function	Definition	Potential Benefits
Amphibian & Reptile Habitat	The capacity to support or contribute to an abundance or diversity of native frogs, toads, salamanders, and turtles	Maintain regional biodiversity
Waterbird Feeding Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that migrate or winter but do not breed in the region	Support hunting and ecological values. Maintain regional biodiversity
Waterbird Nesting Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that nest in the region	Maintain regional biodiversity
Songbird, Raptor, & Mammal Habitat	The capacity to support or contribute to an abundance or diversity of native songbird, raptor, and mammal species and functional groups, especially those that are most dependent on tidal wetlands or water	Maintain regional biodiversity and food webs
Native Plant Habitat, Pollinator Habitat	The capacity to support or contribute to a diversity of native, hydrophytic, vascular plant species, communities, and/or functional groups, as well as the pollinating insects linked to them	Maintain regional biodiversity and food chains
Public Use & Recognition	Prior designation of the wetland, by a natural resource or environmental agency, as some type of special protected area. Also, the potential and actual use of a wetland for low-intensity outdoor recreation, sustainable consumptive uses, education, or research	Commercial and social benefits of recreation. Protection of prior public investments

* a benefit rather than a function of wetlands

Historical imagery was acquired from *The Government of Prince Edward Island* (Jan 2023) and, in order to present past disturbances within the Study Area that have caused present ecological conditions and when. Disturbances described within the Study Area for this report go back as far as 1990.

RESULTS

A total of 23 wetlands were delineated in the field covering a total area of 40.08 ha. The wetlands delineated were all of non-tidal types as seen in Table 1. All wetlands identified presented evidence of past disturbances from agricultural, logging, or beaver activity. A large majority of the wetlands presented with Red Parent Material, resulting in problematic soils for these wetlands. The WESP-AC assessment scores for these wetlands generally showed a moderate amount of high grouped wetland functionality. Higher water quality support and transition habitat appeared to be the most common grouped function for Wetlands 1 through 23. The wetland shapes are shown on Figures 2 through 6 overlain on current Google Satellite. WESP-AC in Appendix B, and delineation forms in Appendix A.

WETLANDS

Wetland 01

Wetland 01 (WL01 Figure 2) on PIDs 549741 and 11874 is a Mature Mix Wood Seepage Swamp dominated by a healthy layer of canada mayflower (Maianthemum canadense). The area mapped is approximately 3.86 hectares. No watercourses were observed. The mapped wetland is part of a larger wetland continuing along the northern boundaries and bounded by Highway 156 along the southern boundaries. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. Upland areas surrounding the wetland are agricultural land, Highway 156 and a hard wood forest.

In the wetland, the mix wood forest is dominated by a moderate population of tamarack (*Larix laricina*) with smaller amounts of white spruce (*Picea glauca*). A shrub layer consisting of a fair amount grey alder (*Alnus incana*) and scattered populations of white spruce and red maple (*Acer rubrum*). The wetland contains an extensive herbaceous layer dominated largely by canada mayflower followed by dwarf-raspberry, lesser amounts of bladder sedge (*Carex intumescens*) and scattered amounts of canada goldenrod (*Solidago canadensis*) and starflower (*Trientalis borealis*). The topography is quite flat throughout the entire wetland with abrupt slopes along Highway 156. The wetland continues for an unknown length along the northern boundaries outside the Study Area. The PI was observed to be 2.82. A Depleted Matrix (10YR/4/2) with redox features (5YR/4/6) at 13 – 28 cm sits above a layer of Red Parent Material (5YR/4/6).

The immediately adjacent upland is a mix of regenerative forests along the western boundaries, recent logged hardwood forest to the north and agricultural lands approximately 20 meters from a section of the wetland on the western boundaries. The forest layer consists of a diminished population of red maple and paper birch (*Betula papyrifera*). A moderate population of trembling aspen (*Populus tremuloides*) and lesser amounts of paper birch sampling comprise the shrub layer. The herbaceous layer has a modest amount of low-bush blueberry (*Vaccinium Angustifolium*) and lesser amounts of fireweed (*Chamerion angustifolium*) and canada goldenrod. A flat upland borders the wetland with steep ditches just south of the wetland. The PI was observed to be 3.22. The sandy soil is well-drained with a restrictive layer of rock at 40 cm.

The wetland boundary was established utilizing changes in vegetation with a mostly broad transition zone due to the flat topography of the area, while noting changes in hydrology.

No surface outflow or inflow was observed during the survey; however, a fair amount of standing (~05 cm) water was present along the eastern boundaries where the wetland continues outside the Study Area. The wetland receives intermittent surface runoff and possible groundwater input from the upgradient forest. No SAR species were observed in the wetland or adjacent forest at the time of survey.

The Wetland Function Assessment revealed that WL01 has higher functional grouped values in water quality support, transition habitat, hydrologic group, and aquatic support group, in descending order.

Water quality support group scored the highest, likely due to an extensive-micro topography which decelerates runoff, retaining sediment, phosphorous, nitrogen, and carbon from having no outlet channel, a low internal gradient allowing less erosion within the wetland and allocation of suspended matter. The increase in nitrogen in WL01 assists in water quality with a large upland contact where denitrification occurs, less canopy coverage allowing for warmer soils, and loamy soils for higher denitrification. An increase in carbon sequestration also assists the water quality.

Higher grouped function for transition habitat is likely due to more bare pervious surfaces for nesting mammals and songbirds, a diverse wood height class, a good interspersion of woody cover for better feeding opportunities, lots of tree snags for songbirds, an extensive micro-topography, less persistent water, and having almost no human presence.

Higher grouped function in hydrological group is likely due to the extensive micro-topography, no channel outlet, thus having water storage for longer periods of time and a low internal gradient retaining more surface runoff and precipitation.

The lower of the four highest group function is the aquatic support group, largely due to more shaded vegetation that may cool down water, and less pooled water. Great invertebrate habitat from diverse vegetation, extensive micro-topography, a decent sized area of flooding to complete life cycles, dynamic water levels and adequate water depth.

Wetland 02

Wetland 02 (Wetland 02 Figure 3) on PIDs 11809 and 826578 is a small Shrub Seepage Swamp dominated by bebb’s willow (*Salix bebbiana*). The area mapped is approximately 0.98 hectares. No water courses were observed. The mapped wetland is part of a larger wetland continuing outside the Study Area on both the southwestern and northeastern borders of the wetland. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. The upland areas surrounding the wetland area agricultural fields and a regenerating clear-cut.

In the wetland, the dominating shrub layer mainly consists of a lush population of bebb’s willow with lesser amounts of grey alder. A diverse herbaceous layer is dominated by moderate populations of common cattail (*Typha latifolia*), marsh bedstraw (*Galium palustre*), fowl mana-grass (*Glyceria striata*) and awl-fruited sedge (*Carex stipata*). And scattered populations of blue-joint grass (C*alamagrostis canadensis*), spotted joe-pye weed (*Eutrochium maculatium*) and cyperus-like sedge (*Carex pseudocyperus*). The topography is quite flat throughout the entire wetland. The wetland continues for an unknown length beyond the Study Area on the northeastern and southwestern boundaries. The PI was observed to be 2.21. A Depleted Matrix (7.5YR/3/1) with redox features (7.5YR/4/4) was observed at 6 – 40 cm of soil, with a restrictive layer of water at 25 cm.

The immediately adjacent upland is agricultural land along the north and southern boundaries, and a regenerating clear cut along the northwestern corner of the wetland. The vegetation consists of mainly a rich herbaceous layer with a small population of red-osier dogwood (*Cornus sericea*) for a shrub layer. The herbaceous layer is dominated by lush populations of timothy grass (*Phleum pratense*) and canada goldenrod, with moderate amounts of wild carrot (*Daucus carota*) and birdvetch (*Vicia pracca*). And a scattered population of the common daisy (*Bellis perennis*). A flat upland borders the entire wetland. The PI was observed to be 3.57. The soil is a well-drained sandy loam.

The wetland boundary was established utilizing changes in vegetation, and a sometimes-broad transition zone, while noting changes in hydrology.

No surface outflow or inflow was observed during the survey: however, two mapped watercourses from PEI are shown coming in from the south and north and no surface water was present. The wetland receives intermittent surface runoff and possible groundwater input from the upgradient forest. No SAR was observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL02 only had aquatic support group rated high for grouped functions. The high functionality for aquatic support is likely due to the high percentage of shaded vegetation, more ponded water (when water is present), more visible bare ground, shallow ponded water when present and greater diversity of vegetation for aquatic invertebrates. The shallow water also provides habitat for the larvae.

Wetland 03

Wetland 03 (WL03 – Figure 3) on PIDs 12021 and 747337 is a large Shrub Channel Swamp dominated by grey alder, and a connecting Forested Seepage Swamp on the northern section of the wetland dominated by trembling aspen. The area mapped is approximately 4.18 hectares. No water courses were observed at the time of the survey. However, a pond is within the wetland. The mapped wetland is part of a larger wetland continuing outside the Study Area at the southwestern border. An abandoned ATV trail runs southeast to northwest of the wetland running parallel with the proposed access road found on Figure 3. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. The upland surrounding the wetland is a mature mixed wood forest.

In the wetland, the dominating shrub layer mainly consists of a healthy amount of grey alder and a moderate population of bebb's willow. A scattered mix wood forest canopy contains populations of balsam fir (*Abies balsamea*), white spruce, and trembling aspen. The herbaceous layer has modest amounts of common cattail and sensitive fern (*Onoclea sensibilis*) with scattered amounts of marsh bedstraw and cypress like sedge.

The topography of the wetland is quite flat with extensive micro-depressions throughout the wetland including ditches along the abandoned ATV trail.

The wetland boundary was established utilizing changes in vegetation, and a mostly broad transition zone, while noting changes in hydrology.

No surface outflow or inflow was observed during the survey: however, a mapped water watercourse from the Government of PEI is shown flowing northeast to southwest and a large pond site is present within the wetland boundaries. The wetland receives intermittent surface runoff and possible groundwater input from the upgradient forest. No SAR species were observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL03 has higher functional grouped values in transition habitat and water quality support. The higher rating for transition habitat is likely due to more bare pervious surfaces, longer distance to public roads, a diversity in woody height and form, lots of downed wood, and possible tree cavities in the larger trees. Many tree snags also contribute to the functional rating, including the extensive micro-topography, vegetated wetland boundaries, and the absence of human activity.

Although rated lower, the water quality support group also gives high functional value, largely due to the extensive micro-topography, the upland and wetland transition areas, a decent amount of open water, gentle slopes along open water, a narrow water outlet, southward flowing water, an almost flat internal gradient, loamy and course soils, and diverse woody diameter for carbon sequestration.

Wetland 04

Wetland 04 (WL04 – Figure 6) on PIDs 720912, 11023, and 10959 is a Mature Mix Wood Discharge Swamp dominated eastern white cedar (*Thuja occidentalis*). The area mapped is approximately 2.26 hectares. No water courses were observed at the time of the survey. The mapped wetland is part of a larger wetland continuing both the southwest and northeast borders. A dirt road runs through the wetland, aligning with the proposed access road found on Figure 4. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. The upland surrounding the wetland is a mature mixed wood forest and agricultural fields.

In the wetland, the dominated vegetation is a lush cover of eastern white cedar with a scattered population of paper birch (*Betula papyrifera*). A moderate amount of eastern white cedar saplings and a scattered population of grey alder consists of the shrub layer. The herbaceous layer entails a modest amount of sensitive fern with scattered populations of alpine enchanter's-nightshade a (*Circaea alpina*), dwarf raspberry and intermediate woodfern (*Drypoteris intermedia*). The topography is quite flat throughout the wetland with discrete slopes along the borders and a minor ditch beside the dirt road. The PI was observed to be 2.28. Underneath 20 cm or organic matter is a 2 cm (22 – 22 cm) layer of sandy loam Histic Epipedon (5YR/4/2) soils with 2% redox features (5YR/6/8). Continuing to 55 cm is Red Parent Material (7.5YR/4/4).

The immediately adjacent upland is mostly a mature mixed wood forest, with agricultural lands approximately 10 m southeast from the wetland. The dominating forest canopy is moderate populations of red maple and paper birch and lesser amounts of trembling aspen. A moderate population of balsam fir saplings and scattered populations of red maple saplings and wild rose (*Rosa virginiana*) comprised the shrub layer. The herbaceous layer contains a modest population of bunchberries with lesser populations of dwarf raspberry, twinflower (*Linnaea borealis*) and starflower. The topography in the forested upland has a discrete slope leading into the wetland and mostly flat for the agricultural fields. The PI was observed to be 3.19. The soil is a well-drained sandy loam.

The wetland boundary was established utilizing changes in vegetation and topography, while noting changes in hydrology.

No surface outflow or inflow was observed during the survey. The wetland receives intermittent surface runoff and possible groundwater input from the upgradient forest. No SAR species were observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL04 provides higher functional grouped values in the water quality support, transition habitat and hydrologic groups, in descending order. Higher functional grouped ratings for water quality support are likely due to an extensive micro-topography, large upland edge contact, southward flowing water, lack of a channel outlet, an almost flat internal gradient, minor fluctuation in flooding, and moderate functionality for carbon sequestration.

Higher grouped functional rating for transition habitat is likely due to the proximity of bare pervious surfaces, a high diversity in wood height and form, a decent amount of large snags and downed wood, an extensive micro-topography, lots of bare ground within the wetland, adequate peat depth, and a wider variety of herbaceous plants. Other factors include unmanaged vegetation surrounding the wetland, no invasive plant species, only one small water depth class, having most of the wetland dry up completely and the absence of human activity.

The higher grouped functional rating for the hydrologic group is likely due to southward flowing water, an extensive micro-topography, lack of a channel outlet, and an almost flat internal gradient.

Wetland 05

Wetland 05 (WL05 – Figure 6) on PIDs 720912 and 11023 is a Mature Mixed Wood Discharge Swamp dominated by balsam fir. The area mapped is approximately 0.40 hectares. No water courses were observed at the time of the survey. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. The upland surrounding the wetland is a mature mixed wood forest.

In the wetland, the dominating forest canopy contains mostly a modest population of balsam fir with lesser amounts of red maple and a scattered population of paper birch. A modest amount of mountain holly (*Ilex muconatus*) with lesser amounts of white spruce and a scattered population of red maple consists of the shrub layer. The herbaceous layer contains modest populations of starflower and two-seeded sedge (*Carex disperma*) with scattered populations of cinnamon fern (*Osmunda cinnamomea*), canada mayflower, bunchberry and twinflower. The topography is mostly flat with a discrete slope northeast to southwest and some micro-depressions. The PI was observed to be 2.92. A Depleted Matrix (5YR/3/1) with redox features (5YR/6/8) was observed at 18 – 26 cm of soil, over a layer of red parent material (2.5YR/4/3).

The immediately adjacent upland is a mature hard wood forest. The dominating forest canopy consists of fair amount of balsam fir with lesser amounts of paper birch, american mountain ash (Sorbus americana), and red maple. The shrub layer has a modest amount of balsam fir. A minor herbaceous layer contains a small population of starflower and lady fern (*Athyrium filix-femina*) with scattered amounts of canada mayflower. The topography is a discrete slope northeast to southwest. The PI was observed to be 3.14. The soil is a well-drained sandy loam.

The wetland boundary was established utilizing changes in vegetation, while noting changes in hydrology.

No surface outflow or inflow was observed during the survey. The wetland receives intermittent surface runoff and possible groundwater input from the upgradient forest. No SAR species were observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL05 provides higher functional grouped values in water quality support, transition habitat, and hydrologic group, in descending order. Higher functional grouped values for water quality support are likely due to a high upland edge contact, no channel outlet, southward flowing water, water completely drying up in a growing season, an almost flat internal gradient, and moderate functionality for carbon sequestration.

Higher grouped functional rating for transition habitat is likely due to the proximity of bare pervious surfaces, longer distance to public roads, fair number of large snags and downed wood, lack of surface water throughout the wetland, and one small depth when water is present. A wider variety of herbaceous plants and lack of invasive plants, with a consistent vegetated buffer complement the higher functional ratings, including the fine soils, shallow peat, and absence of frequent human activity.

Higher grouped functional rating for the hydrologic group is likely due to southward flowing water, no channel outlet, and almost flat internal gradient.

Wetland 06

Wetland 06 (WL06 – Figure 6) on PIDs 10934 and 740159 is a Hard Wood Discharge Swamp. The area mapped is approximately 0.44 hectares. No water courses were observed at the time of survey. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. The upland surrounding the wetland is a mature hard wood forest.

In the wetland, the dominating forest canopy contains moderate populations of paper birch and red maple with lesser amounts of trembling aspen and bebb’s willow. The shrub layer contains a modest population of grey alder, lesser amounts of red-osier dogwood and bebb’s willow, with a scattered population of balsam fir. The herbaceous layer consists of a lush population of fowl mana grass with lesser amounts of flat top white aster (*Doelingeria umbellate*) and dwarf raspberry. The topography is mostly flat with a discrete slope northeast to southwest and some micro-depressions. The PI was observed to be 2.70. A Depleted Matrix (5YR/6/1) with 20 % redox features (5YR/6/8) was observed at 10 – 17 cm of soil, over a layer of Red Parent Material (2.5YR/4/3), which contained about 2% redox features (2.5YR/6/8).

The immediately adjacent upland is a mature hard wood forest. The dominating forest canopy consists of a healthy amount of trembling aspen and red maple with a lesser amount of paper birch. The shrub layer consists of a moderate population of mountain holly and red maple with lesser populations of hobblebush (*Viburnum lantanoides*) and balsam fir. The minor herbaceous layer contains a moderate population of flat top white aster and scattered amounts of dwarf raspberry. The topography is a discrete slope northeast to southwest. The PI was observed to be 3.00. The soil is a well-drained sandy loam.

The wetland boundary was established utilizing changes in vegetation, while noting changes in hydrology.

No surface outflow or inflow was observed during the survey. The wetland receives intermittent surface runoff and possible groundwater input from the upgradient forest. No SAR species were observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL06 provides higher functional grouped values in water quality support, transition habitat and the hydrologic group, in descending order. Higher grouped functional ratings for water quality support are likely due to a broad upland edge contact, southward flowing water when water is present, no channel outlet, an almost flat internal gradient, water almost completely drying up, and the moderate functional value of carbon sequestration.

Higher grouped functional value for transition habitat is likely due to the proximity of bare pervious surfaces, longer distance to public roads, diversity of woody height and form, plentiful bare ground, water completely drying up supporting pollinators, shallow water when present, no invasive plants, vegetation surrounding the wetland, and absence of human activity.

Higher hydrologic group functional value is largely due to southward flowing water, absence of channel outlet, and an almost flat internal gradient.

Wetland 07

Wetland 07 (WL07 – Figure 5 on PIDs 11353 and 11296 is a Mature Mixed Wood Seepage Swamp dominated by paper birch and tamarack. The area mapped is 0.92 hectares. An abandoned ATV trail runs through the wetland aligning with the proposed access road from Figure 5. No water courses were observed; however, a beaver lodge and dam are present, with a small seepage flowing west. One paired sampling site was recorded. The wetland was determined to have abnormal site conditions/hydrology due to the beaver lodge/dam within it. The upland surrounding the wetland is a mature mixed wood forest.

In the wetland, the dominating forest canopy contains moderate populations of paper birch, tamarack, white ash (*Fraxinus americana*) and eastern white cedar and lesser amounts of balsam fir. The shrub layer contains modest populations of eastern white cedar and balsam fir with a scattered amount of white ash. An herbaceous layer contains modest populations of dwarf raspberry, marsh marigold (*Caltha palustris*), jewelweed (*Impatiens capensis*), lesser amounts of marsh blue violet (*Viola cucullata*) and sensitive fern, and a scattered population of bristly black currant. The topography overall is mostly flat with extensive micro depressions and a basin to where the beaver pond has pooled. The PI was observed to be 2.68. A sandy loam Dark Surface (5YR/2.5/1) soil appears at 6 - 26 cm over another 19 cm of organic material.

The immediately adjacent upland is a mature mixed wood forest. The dominating forest canopy consists of balsam fir and paper birch with scattered populations of red maple, white spruce and white ash. The shrub layer consists of only a moderate population of balsam fir. The herbaceous layer contains modest populations of wild raisin (*Viburnum nudum*), starflower and false solomon’s-seal (*Maianthemum racemosum*), with a scattered population of canada mayflower. The PI was observed to be 3.37. The soil is a well-drained sandy loam.

The wetland boundary was established utilizing changes in vegetation and a mostly broad transition zone, while noting changes in hydrology.

Surface seepage inflow/outflow and pooled water from the beaver dam was observed. The ponded water lay northeast of the ATV trail with observable water seeping from the surrounding forest and northeast where the wetland continues. A seepage area (Figure 5) travels west of the beaver pond where the wetland also continues to the west. The wetland may also receive groundwater input from the upgradient forest. No SAR species were observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL07 provides higher functional grouped values in transition habitat, aquatic habitat, and aquatic support, in descending order. Higher grouped functional rating for transition habitat is largely due to the proximity of bare pervious surfaces, distance to public roads, diversity of woody height and form, decent number of large snags and downed trees. Other factors include an active beaver lodge, lots of bare ground, diverse vegetated boundaries, no invasive plants, low water fluctuation, and lack of human activity.

Higher functional grouped rating for aquatic habitat is likely due to a constant water depth throughout the growing season, lack up impervious surfaces surrounding WL07 with more natural land cover, distance to public roads, lack of fish for better amphibian habitat, a constant flow of water and even depth of open pooled water, active beaver damn and lodge, vegetated boundaries, an almost flat internal gradient, lots of large snags for waterbirds, and lack of human activity.

Higher functional grouped rating for aquatic support is likely due to a constant flow of water, lack of impervious surfaces surrounding WL07, diverse vegetation within and surrounding WL07, open pooled water with minimum fluctuation and even depth.

Wetland 08

Wetland 08 (WL08 – Figure 5) on PIDs 11718 and 11353 is a Mixed Wood Forest Seepage Swamp dominated by a layer of bunchberry. The area mapped is approximately 0.72 hectares. The wetland is minorly bounded on the northeast corner by an abandoned ATV trail that aligns with the proposed access road shown on Figure 5. No water courses were observed. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. The upland surrounding the wetland is a mature mixed wood forest.

In the wetland, the forest canopy contains moderate populations of balsam fir and black spruce (*Picea mariana*), with lesser amounts of red maple and a scattered population of white ash. The shrub layer contains a modest population of beaked hazelnut (*Corylus cornuta*), grey alder and wild raisin, with a scattered population of american mountain ash. The diverse herbaceous layer consists of a fair amount of bunchberry with lesser amounts of dwarf raspberry, wood horsetail (*Equisetum sylvaticum*), twinflower, two-seeded sedge, sensitive fern, and a scattered population of interrupted fern. The topography is mostly flat with some micro-depressions throughout and a ditch adjacent to the abandoned ATV trail. The PI was observed to be 2.32. A Depleted Matrix (5YR/3/1) with 7% redox features (5YR/7/8) was observed at 14 – 19 cm of soil, over a layer of red parent material (5YR/4/4), which contained 3% redox features (7.5YR/6/6) at 20 – 30 cm. The bottom layer contains more Red Parent Material (2.5YR/4/4) observed at 31 – 43 cm.

The immediately adjacent upland is a mature mixed wood forest. The dominating forest canopy contains a modest population of eastern white cedar and balsam fir, with lesser amounts of paper birch and red maple. The shrub layer consists of a minor amount of beaked hazelnut and scattered amounts of trembling aspen and balsam fir. A bare herbaceous layer contains a scattered population of wild sarsaparilla (*Aralia nudicaulis*). The topography is quite flat surrounding the wetland apart from the ditches adjacent to the abandoned ATV trail. Although the PI was observed to be 2.73, indicating hydrophytic vegetation, no hydrology was observed, and the soils were a well-drained sandy loam. Determining to not be a wetland

The wetland boundary was established utilizing changes in vegetation and a mostly broad transition zone, while noting changes in hydrology.

No surface outflow or inflow was observed during the survey. The wetland receives intermittent surface runoff and possible groundwater input from the upgradient forest. No SAR species were observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL08 provides higher functional grouped ratings for transition habitat and aquatic support. Higher functional grouped rating for transition habitat is largely due to the proximity of bare pervious surfaces, distance to public roads, diversity of wood height and form with adequate interspersion of woody cover, a decent number of large snags and down wood, and an extensive micro-topography. Other factors include drier surfaces for songbirds and pollinators, vegetated boundaries, lack of invasive plants, fine soils with peat, shallow water depth when present, and lack of human activity.

Higher functional grouped rating for aquatic support is likely due to lack of pooled water and shallow pools when present, organic material from soils, vegetated boundaries, an extensive micro-topography, and presence of a ditch for major runoff events.

Wetland 09

Wetland 09 (WL09 – Figure 5) on PIDs 11718 and 11353 is a Sloped Hard Wood Forest Seepage Swamp dominated by a lush canopy of red maple. The area mapped is approximately 0.17 hectares. No water courses were observed. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. The upland surrounding the wetland is a mature mixed wood forest.

In the wetland, the dominating forest canopy consists of a rich population of red maple, a moderate amount of trembling aspen and lesser amounts of paper birch. The shrub layer contains a healthy population of grey alder and a minor amount of wild raisin and balsam fir.

The herbaceous layer contains a modest population of three-leaved false solomon's-seal (*Maianthemum trifolium*) with lesser amounts of flat top white aster, jewelweed and dwarf-raspberry. The topography is a discrete slope northeast to west, and several dug out trenches. The PI was observed to be 2.71. A Depleted Matrix (5YR/7/1) with 2% redox features (5YR/7/8) was observed at 14 – 22 cm of soil, over a layer of red parent material (2.5YR/4/4), containing about 3% redox features (2.5YR/7/8).

The immediately adjacent upland is a mature mixed wood forest. The dominating forest canopy consists of a moderate amount of trembling aspen, red maple, paper birch and lesser amounts of balsam fir. The shrub layer contains a modest amount of balsam fir with lesser populations of wild raisin and red maple. A shrub layer contains minor populations of false lily-of-the-valley, bunchberry, low-bush blueberry, and a scattered population of flat top white aster. The topography is a discrete slope northeast to east. The PI was observed to be 3.11. The soils are a well-drained silt.

The wetland boundary was established utilizing changes in vegetation and a mostly broad transition zone, while noting changes in hydrology.

No surface outflow or inflow was observed during the survey. Dug out trenches were observed that appear to hold water for a period throughout the year and was dried up at the time of the survey. The wetland receives intermittent surface runoff and possible groundwater input from the upgradient forest. No SAR species were observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL09 provides higher functional grouped ratings for water quality support, transition habitat, and hydrologic group, in descending order. Higher functional grouped rating for water quality support is largely due to lack of channel outlet, large upland edge contact, southward flowing water, an almost flat internal gradient, early drying up of the wetland, and moderate carbon sequestration functionality.

Higher functional grouped rating for transition habitat is likely due to the proximity of bare pervious surfaces, distance to public roads, diversity of wood height and form, dried up areas of the wetland for songbirds, one shallow water depth when present, lots of bare ground, well vegetated boundaries of the wetland with no invasive plants, adequate amounts of natural nitrogen fixation, and lack of human activity.

Higher functional grouped rating for the hydrologic group is possibly due to the southward flowing water, lack of channel outlet, and an almost flat internal gradient.

Wetland 10

Wetland 10 (WL10 – Figure 5) on PID 11296 is a Hard Wood Forest Seepage Swamp largely dominated by trembling aspen. The area mapped is approximately 0.25 hectares. No water courses were observed. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. The upland surrounding the wetland is a mature hard wood forest.

In the wetland, the dominating forest canopy contains a healthy population of trembling aspen, a minor amount of red maple and a scattered population of paper birch. The shrub layer contains a modest population of red-osier dogwood with lesser amounts of red maple and balsam fir with a scattered population of eastern white cedar. Small populations of black bristly currant, dwarf raspberry and two-seeded sedge is part of the herbaceous layer with scattered populations of marsh bedstraw, false lily-of-the-valley and canada goldenrod. The topography is relatively flat with some micro-depressions and a good number of trenches on the southeastern area of the wetland. The PI was observed to be 2.70. Underneath 20 cm of organic matter is a 5 cm (21 – 25 cm) layer of sandy clay Histic Epipedon (5YR/7/1) soils with 25% redox features (5YR/6/8). Continuing to 36 cm is a red parent material (2.5YR/4/4), containing about 10% redox features (2.5YR/5/8).

The immediately adjacent upland is a mature hard wood forest. The dominating forest canopy contains modest amounts paper birch and trembling aspen with lesser populations of white ash and bebb's willow. A shrub layer contains a modest population of beaked hazelnut with lesser amounts of trembling aspen and wild raisin, with scattered balsam fir. The topography is a discrete slope northeast to southwest with extensive micro-depressions and dug out trenches. The PI was observed to be 3.13. The soil is a well-drained sandy clay.

The wetland boundary was established utilizing changes in vegetation and a mostly broad transition zone, while noting changes in hydrology.

No water courses were observed during the survey. Dug out trenches were observed within the wetland and upland areas. The trenches within the wetland were dried up at the time of survey. The wetland receives intermittent surface runoff and possible groundwater input form the upgradient forest. No SAR species were observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL10 does not provide any higher grouped functionality, yet only supplies high pollinator habitat functionality. High pollinator habitat is likely due to the diverse vegetated boundaries of the wetland, no invasive plants and more dried up areas in the wetland.

Wetland 11

Wetland 11 (WL11 – Figure 5) on PIDs 11296, 11767, 846816, 11668, 740159, 720920, and 10934 is a large Mixed Wood Forest Seepage Swamp with a Beaver Pond. The area mapped is approximately 7.25 hectares. The wetland continues both the north and south boundaries. No water courses were observed. A beaver lodge and dam are present with dug out trenches moving southeast to northwest. A beaver pond of unknown depth was observed. One paired sampling site was recorded. The wetland was determined to have abnormal site conditions/hydrology within it. The upland surrounding the wetland is a mature mixed wood forest.

In the wetland, the dominating forest canopy includes a healthy population of eastern white cedar with minor populations of black spruce and paper birch. A shrub layer presents a small amount of balsam fir with scattered amounts of mountain holly, red-osier dogwood and red maple. A healthy herbaceous layer contains a moderate amount of brownish sedge (*Carex brunnescens*) with smaller amounts of bladder sedge, and scattered populations of wood horsetail, blue-joint grass, and three-seeded sedge (*Carex trisperma*). The topography varies from discrete slopes in different directions, small basin area where the beaver pond lies, extensive micro-depressions and dug out trenches throughout the wetland. The PI was observed to be 2.44. Problematic soils were observed in WL11 as shown in WL12 Photo 4. The observed soils did not match any hydric soil indicators but did present with problematic Red Parent Material (2.5YR/3/5) with about 3% redox features (2.5YR/4/8) at 28 – 40 cm, where the water table was observed. These abnormal conditions determined the area to be a wetland.

The immediately adjacent upland is a mature mixed wood forest. The dominating forest canopy consists of minor populations of balsam fir, eastern white cedar, trembling aspen, white spruce, and a scattered population of red maple. An exposed shrub layer contains scattered populations of balsam fir and red maple. A bare herbaceous layer consists of infrequent amounts of bunchberry and wild lily-of-the-valley. Although the area presented with a PI of 2.86 and fairly dark color soils (5YR/8/1), hydrology was not present, and the area was determined to not be a wetland.

The wetland boundary was established utilizing changes in vegetation and a mostly broad transition zone, while noting changes in hydrology.

Although no water courses were observed, many dug out trenches appeared to slowly flow water in and out of the wetland. The central wetland contains a beaver lodge and pond of unknown depth. No beavers were observed, but signs of recent foraging were observed, indicating the presence of active beavers. The wetland also receives possible groundwater input from the upgradient forest. No SAR species were observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL11 provides higher functional grouped ratings for transition habitat, aquatic support, aquatic habitat, and water quality support, in descending order. Higher functional grouped rating for transition habitat is likely due to the proximity of bare pervious surfaces, longer distance to public roads, diversity of wood height and form, diversity of shrub species, decent number of large snags and downed wood, and an extensive microtopography. Other factors include an interspersed population of robust emergents, a decent amount of bare ground, well vegetated boundaries of the wetland, lack of invasive plants, fine and organic soils, a natural water fluctuation depth, active beaver impoundments, and lack of human activity.

Higher functional grouped rating for aquatic support is possibly due to the fine and organic soils, lack of impervious surfaces, and extensive micro-topography, small area that is flooded annually with different depth classes and open water, vegetation surrounding the wetland the scattered interspersion of robust emergents, and complex water channelization during surface runoff events.

Higher functional grouped rating for aquatic habitat is likely due to proximity of bare pervious surfaces, extensive micro-topogrpahy, lack of impervious surfaces, small area that is flooded annually with lots of open water, and scattered interspersion of robust emergents. Other factors include complex water channelization during surface runoff events, active beaver presence, vegetated boundaries surrounding the wetland, an almost flat internal gradient, and lack of human activity.

Higher functional grouped rating for water quality support is likely due to an extensive micro-topography, upland edge contact, a flat shoreline where open water is present, scattered interspersion of robust emergents, narrow outlet and ditches, complex water channelization during surface runoff events, an almost flat internal gradient, and high wetland functionality for carbon sequestration.

Wetland 12

Wetland 12 (WL12 – Figure 4) on PIDs 10942, 10983, 10991, and 409805 is an Herbaceous Seepage Swamp with a Beaver Pond. The area mapped is approximately 5.74 hectares. An abandoned road runs through the wetland aligned with the Proposed Access Road shown in Figure 4. The wetland continues at the southwestern boundaries. Although a mapped water course is shown by the Government of PEI, no water courses were observed during the survey. One paired sampling site was recorded. The wetland was determined to have abnormal site conditions/hydrology within. The upland area surrounding the wetland is a mature mixed wood forest.

In the wetland, the forest canopy consists of a small population of red maple and lesser amounts of paper birch. A scarce shrub layer contains scattered populations of balsam fir, common winterberry (*Ilex verticillate*), trembling aspen and american mountain ash.

The dominating herbaceous layer consists of moderate amounts of soft rush (*Juncus effusus*), wood bulrush (*Scirpus expansus*), lesser amounts of low-bush blueberry and bunchberry, and scattered populations of flat top white aster, starflower, and calico aster (*Symphyotrichum lateriflorum*). The topography is quite flat throughout the wetland with extensive micro-depressions, some ditches along the abandoned ATV trail, and dug out trenches throughout the wetland. The PI was observed to be 2.45. A Depleted Matrix (5YR/8/1) with 2% redox features (5YR/6/8) was observed at 6 – 18 cm of soil, over a layer of red parent material (2.5YR/4/4), containing about 6% redox features (5YR/5/8).

The immediately adjacent upland is a mature deciduous forest. The dominating forest canopy contains a modest population of grey birch (*Betula populifolia*), lesser amounts of red maple and a scattered population of balsam fir. A shrub layer exists with a modest population of red maple, lesser amounts of wild raisin and a scattered population of grey alder. The shrub layer consists of small amounts of bunch berry, and velvet-leaved blueberry (*Vaccinium myrtilloides*). The topography is mostly flat surrounding the wetland with the occasional dug out trench. Although the area presented with a PI of 2.95 and fairly dark color soils (5YR/3/1), hydrology was not present, and the area was determined to not be a wetland.

The wetland boundary was established utilizing changes in vegetation and a mostly broad transition zone, while noting changes in hydrology.

One mapped water course was given by the Government of PEI, however no flowering water was present during the time of survey. Although no water courses were observed, many dug out trenches appeared to slowly flow water in and out of the wetland. The central area of the wetland contains a beaver lodge, dam and pond adjacent to the abandoned ATV trail. No beavers were observed, but signs of recent foraging were observed, indicating the presence of active beavers. The wetland also receives water from an adjacent wetland north of the Study Area, connected to WL12 through a dug-out trench, and possible groundwater input form the upgradient forest. No SAR species were observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL12 provides higher functional grouped ratings for transition habitat, aquatic habitat, aquatic support, and water quality support, in descending order. Higher functional group values for transition habitat are likely due to the proximity to bare pervious surfaces, proximity to open ponded water, diversity of wood height and form, high shrub richness, adequate woody cover height class interspersion, decent number of large snags and down wood, and an extensive micro-topography. Other factors include a mosaic wetland with lots of upland edge contact, lots of bare ground, lack of invasive plants, vegetation surrounding WL12, fine and organic soils, active beaver impoundments, fluctuating water depths, at least one tributary channel, and lack of human activity.

Higher functional grouped values for aquatic habitat are mostly due to lack of impervious surfaces, a herbaceous type wetland, lots of shade for open water, a good water depth with adequate amount of open water, active beaver habitat, and vegetation surrounding the boundaries. Other factors include the distance to public roads, proximity to ponded water, southward flowing water, fishless water for amphibians and waterbirds, an adequate height class interspersion of woody plants, an extensive micro-topography and mosaic wetland, adequate amount of permanent surface water, acceptable water fluctuation with diverse water depth throughout the wetland, and lack of human activity.

Higher functional grouped values for aquatic support are mostly due to fine organic soils, lack of impervious surfaces, an herbaceous type wetland, adequate woody height class interspersion, an extensive micro-topography, dynamic water levels with anthropogenic outlets, and well vegetated upland boundaries.

Higher functional grouped values for water quality support are likely due to an extensive micro-topography, a mosaic of upland inclusions, narrow anthropogenic outlets, an almost flat internal gradient, an suitable amount of ponded water, large amount of upland edge contact, a herbaceous type wetland, a balanced woody height class interspersion, and southward flowing water.

Wetland 13

Wetland 13 (WL13 – Figure 4) on PIDs 11346, 11320, 11775, and 646653 is a Shrub Seepage Swamp dominated by grey alder. The area mapped is approximately 1.82 hectares. The wetland continues for an unknown length at the southwestern border. Although a mapped water course is shown by the Government of PEI, no water course was observed during the survey. One paired sampling site was recorded. The wetland was determined to have abnormal site conditions/hydrology within it. The upland area surrounding the wetland is a mature mixed wood forest.

In the wetland, the forest canopy consists of a modest population of white spruce and scattered populations of balsam fir, grey birch, eastern white cedar, and american mountain ash. The dominating shrub layer contains a bountiful population of grey alder and scattered populations of balsam fir, eastern white cedar, and american mountain ash. An extensive herbaceous layer exists with a lush population of sensitive fern and scattered populations bladder sedge, dwarf raspberry, wood horsetail, canada goldenrod, intermediate fern and flat top white aster. The topography is quite flat throughout the wetland. The PI was observed to be 2.37. A silty Depleted Matrix (5YR/6/1) with 3% redox features (5YR/5/8) was observed at 10 – 19 cm of soil, over a layer of silty clay Depleted Matrix (5YR/7/2) with 15% redox features (5YR/7/8) observed at 20 – 26 cm. The reaming layer up to 50 cm is a Red Parent Material (2.5YR/4/4), containing about 6% redox features (5YR/5/8).

The immediately adjacent upland is a mature mixed wood forest. The dominating forest canopy contains small populations of red maple, white spruce, tamarack, balsam fir, and grey birch. A shrub layer exists with a modest population of balsam fir and scattered amounts of grey birch and wild raisin. The herbaceous layer contains a small population of twinflower and scattered amounts of sheep laurel (*Kalmia angustifolia*), wild lily-of-the-valley and bunchberry. The topography is flat surrounding the wetland. Although the area presented a PI of 3.00 and dark eluviated layer (2.5YR/8/1) observed at 11 – 17 cm, hydrology was not present, and the area was determined to not be a wetland.

The wetland boundary was established utilizing changes in vegetation and noting changes in hydrology.

One mapped water course was given by the Government of PEI, however, no flowering water was present during the time of survey. The wetland receives intermittent surface runoff and possible groundwater input from the upgradient forest. No SAR was observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL13 only provides higher functional values for transition habitat. Higher functional grouped values for transition habitat are likely due to proximity of bare pervious surfaces, distance to public roads, a small amount of pooled water, vegetated upland boundaries surrounding WL13, and a lack of human activity.

Wetland 14

Wetland 14 (WL14a and WL14b – Figures 4 and 5) on PIDs 11023, 11643, 11601, 11304, 11346, and 11320 is a Riverine Swamp with a Beaver Pond dominated by jewelweed. The two areas mapped are approximately 3.76 hectares with the wetland continuing for an unknown length on the eastern and western boundaries of WL14a and WL14b and continues at the southern boundaries of WL14a. One present mapped water course was observed, and areas dammed up in both WL14a and WL14b. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. The upland area surrounding the wetland is a mature mixed wood forest.

In the wetland, the forest canopy includes small populations of tamarack, white spruce and scattered populations of eastern white cedar and red maple. A shrub layer exists with scattered amounts of paper birch, red-osier dogwood, and wild raisin. The herbaceous layer includes a moderate amount of jewelweed, lesser populations of tussock sedge (*Carex stricta*), common cattail, canada goldenrod, and a scattered population of marsh bedstraw. The topography is sloped throughout the wetland leading up to the river where it flattens out. The PI was observed to be 2.19. A silty clay Depleted Matrix (2.5YR/8/1) was observed at 13 – 26 cm but an accurate observation of the redox features could not be taken due to the oversaturation. A layer of clay Red Parent Material was observed at 27 – 43 cm.

The immediately adjacent upland is a mature mixed wood forest. The dominating forest canopy includes moderate amounts of balsam fir and eastern white cedar, lesser amounts of white spruce and an infrequent amount of red maple. A small population of balsam fir consists of the shrub layer. Scarce populations of twinflower and three-leaved goldenthread (*Coptis trifolia*) consists of the herbaceous layer. The topography slopes into WL14. Although the area presented a PI of 2.75 and dark eluviated silty clay layer (5YR/7/2) observed at 13 – 32 cm, hydrology was not present, and the area was determined to not be a wetland.

The wetland boundary was established utilizing changes in vegetation, topography and noting changes in hydrology.

One mapped water course was observed to be approximately 700 m and extended beyond the mapped boundaries on the eastern and western boundaries. The wetland also receives intermittent surface runoff and possible groundwater input from the upgradient forest. No beavers were observed, but signs of recent foraging were observed, indicating the presence of active beavers. No SAR was observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL14 provides higher functional values for aquatic support, transition habitat, and aquatic habitat, in descending order. Higher functional grouped values for aquatic support are possibly due to the brook running through the center, fine and organic type soils, lack of impervious surfaces, and a scattered interspersion of robust emergents. Other factors include a well interspersed height class vegetation, an extensive micro-topography, balanced water depth classes, a good amount of ponded open water, and well vegetated uplands surrounding the wetland.

Higher functional grouped values for aquatic habitat is likely due to lack of impervious surfaces, distance to public roads, southward flowing water, lack of fish for amphibians, some deeper water with other depth classes, and a scattered interspersion of robust emergents. Other factors include the brook running through the center, active beaver habitat, some bare ground, extensive micro-topography, well vegetated wetland perimeter, lots of persistent surface water, large snags for waterbirds, active beaver habitat, a flat shoreline where water persists, and lack of human activity.

Higher functional grouped vales for transition habitat are likely due to proximity to bare pervious surfaces, distance to public roads, proximity to open water, a diverse wood height and form, thicker trees with tree cavities, lots of large snags and downed wood, an extensive micro-topography, and a scattered interspersion of robust emergents. Other factors include active beaver habitat, adequate annual water fluctuation, well vegetated wetland perimeter, lack of invasive plants, fine and organic soils, and lack of human activity.

Wetland 15

Wetland 15 (WL15 – Figure 4) on PIDs 11775 and 11099 is a Mixed Wood Forest Seepage Swamp that is dominated by eastern white cedar. The area mapped is approximately 0.52 hectares. No water courses were present at the time of survey. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. The upland area surrounding the wetland is a mature mixed wood forest.

In the wetland, the dominating forest canopy includes a healthy population of eastern white cedar, with lesser amounts of trembling aspen, red maple and balsam fir. The shrub later contains scattered populations of eastern white cedar, red maple and balsam fir. An herbaceous layer exists with a minor population of sensitive fern and scattered populations of interrupted fern, wild lily-of-the-valley and starflower. The topography is quite flat throughout the wetland with one berm running northeast to southwest within the center. The PI was observed to be 2.50. A silty Depleted Matrix (5YR/6/1) with 5% redox features (5YR/6/8) was observed at 10 – 20 cm of soil, over a layer of Red Parent material (2.5YR/5/4) that had too high saturation at time of survey to determine level and color of redox features present.

The immediately adjacent upland is a mature mixed wood forest. The dominating forest canopy includes a healthy population of red maple and lesser amounts of balsam fir and paper birch. The shrub layer contains a moderate population of balsam fir and a scattered population of american mountain ash. An herbaceous layer exists containing small amounts of bunchberry and scattered populations of twinflower, wild sarsaparilla, low-bush blueberry and wild lily-of-the-valley. The topography is mostly flat surrounding the wetland with a discrete slope in some areas. The PI was observed to be 3.14. The soils are a well-drained sandy silt.

The wetland boundary was established utilizing changes in vegetation, topography and noting changes in hydrology.

No water courses were observed during the survey. The wetland receives intermittent surface runoff and possible groundwater input from the upgradient forest. No SAR species were observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL15 provides higher functional grouped values for water quality support, transition habitat, and hydrologic group, in descending order. Higher functional values for water quality support are possibly due to the lack of an outflow channel, large amount of upland edge contact and upland inclusions, an almost flat internal gradient, more dried up areas of the wetland, and fine organic soils.

Higher functional grouped values for transition habitat are likely due to the proximity of bare pervious surfaces, distance to public roads, diversity of wood height and form, a good number of large snags and downed wood, a mosaic of upland inclusions, lots of bare ground, lack of invasive plants, well vegetated wetland perimeter, fine organic soils, and lack of human activity.

Higher functional grouped values for the hydrologic group are possibly due to the lack of an outflow channel and an almost flat internal gradient.

Wetland 16

Wetland 16 (WL16 – Figure 4) on PIDs 10942 and 10983 is a Hard Wood Seepage Swamp with regenerating clear cuts, largely dominated by grey birch saplings and wood bulrush. The area mapped is approximately 2.12 hectares. The wetland continues for an unknown length along a small section on the northeastern boundaries. No water courses were observed, however dug out trenches containing standing water were noted. One paired sampling site was recorded. The wetland was determined to have abnormal site conditions/hydrology within it. The upland area surrounding the wetland is a regenerating forest and abandoned ATV trail.

In the wetland, the small forest canopy includes scattered populations of trembling aspen, red maple and grey birch. The shrub layer includes a modest amount of grey birch and lesser amounts of trembling aspen. The herbaceous layer is dominated by a moderate population of wood bulrush, with lesser amounts of blue-joint grass and scattered amounts of st. john’s wort (*Hypericum perforatum*) and canada goldenrod. The topography is quite flat with extensive micro-depressions and dug out trenches throughout the wetland. Ditches along the abandoned ATV trail are present. The PI was observed to be 2.05. Underneath 20 cm or organic matter is a 20 cm (21 – 40 cm) layer of sandy clay Histic Epipedon (5YR/7/1). A restrictive layer of water was present at 30 cm.

The immediately adjacent upland is a regenerating hard wood stand without a forest canopy. The dominating shrub layer includes a lush population of trembling aspen with lesser amounts of grey birch, grey alder and red maple. An extensive herbaceous layer exists with modest populations of bunchberry, bracken fern (*Pteridum aquillinum*) and scattered amounts of red raspberry (*Rubus idaeus*), canada goldenrod and wild sarsaparilla. The topography is mostly flat surrounding the wetland with extensive dug out trenches. The PI was observed to be 3.06. The soils are a well-drained silty loam.

The wetland boundary was established utilizing changes in vegetation and a mostly broad transition zone, while noting changes in hydrology.

Although no water courses were observed during the survey, extensive dug out trenches containing standing water was seen. Surface inflow and outflow is slow with the drug out trenches. The wetland also receives intermittent surface runoff from the adjacent abandoned ATV trail and possible groundwater input from the upgradient forest. No SAR species were observed in the wetland or adjacent upland at the time of survey.

The Wetland Functional Assessment revealed that WL16 provides higher functional grouped values for water quality support, transition habitat, and the hydrologic group, in descending order. Higher functional grouped values for water quality support are possibly due to an extensive micro-topography, large upland edge contact, fine and coarse organic soils, absence of natural channel outlet, a low fluctuation of water, an almost flat internal gradient, and moderate wetland functionality for carbon sequestration.

Higher functional grouped values for transition habitat is likely due to the proximity of bare pervious surfaces, distance to public roads, diversity of wood height dispersion and form, an extensive microtopography, lots of downed wood, plenty of bare ground, and small areas of open water. Other factors include active beaver habitat, balanced ratio of surface water to areas never containing surface water, vegetated upland perimeter, lack of invasive plants, fine coarse soils with thick organic layers, and lack of human activity.

Higher functional grouped values for the hydrologic group are likely due to an extensive micro-topography, fine and coarse soils with thick organic layers, no channel outlet, and an almost flat internal gradient.

Wetland 17

Wetland 17 (WL17 – Figure 4) on PID 747337 is a Shrub Seepage Swamp dominated by grey alder. The area mapped is approximately 0.16 hectares. The wetland is bounded on the northeastern boundary by an abandoned ATV trail, aligning with the Proposed Access Road as shown on Figure 4. No water courses were observed during the time of survey. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. The upland area surrounding the wetland is mature mixed wood forest.

In the wetland, a mild forest canopy layer includes a moderate population of trembling aspen and a scattered population of red maple. The dominating shrub layer contains a healthy population of grey alder and scattered amounts of mountain holly, interrupted fern, wood horsetail and whorled wood aster (*Oclemena acuminata*). The topography is quite flat in the wetland with ditches along the abandoned ATV trail. The PI was observed to be 2.18. A silty sand Depleted Matrix (5YR/7/1) with 7% redox features (5YR/6/6) was observed at 11 – 18 cm of soil, over a layer of sandy red parent material (2.5YR/2/4) that had too high color variability to determine colors of present redox features.

The immediately adjacent upland is a mature mixed wood forest and an abandoned ATV trail. The dominating forest canopy contains moderate amounts of balsam fir and trembling aspen, with lesser amounts of white spruce, and paper birch. And a scattered population of grey birch. A shrub layer exists containing a small amount of balsam fir and a scattered population of red maple. The bare herbaceous layer contains scattered amounts of bunchberry, low-bush blueberry and wild sarsaparilla. The topography is mostly flat surrounding the wetland with ditches along the abandoned ATV trail. The PI was observed to be 3.09. The soils are a well-drained silty clay.

The wetland boundary was established utilizing changes in vegetation and topography, while noting changes in hydrology.

No surface inflow or outflow was observed. The wetland receives intermittent runoff and possible groundwater input from the upgradient forest and abandoned ATV trail. No SAR species were observed in the wetland or adjacent upland at the time of survey.

The Wetland Functional Assessment revealed that WL17 provides higher functional values for the hydrologic group and water quality support, in descending order. Higher functional values for the hydrologic group are possibly due to southward flowing water, lack of channel outflow, and an almost flat internal gradient.

Higher functional values for water quality support are likely due to the lack of an outflow channel, large upland edge contact, almost flat internal gradient, continuously saturated, and no anthropogenic actions causing expansions of wetland.

Wetland 18

Wetland 18 (WL18 – Figure 4) on PID 1002351 is a Regenerating Herbaceous Seepage Swamp dominated by a blanket of rough bent grass (*Agrostis scabra*). The area mapped is approximately 0.06 hectares. No water courses were observed during the time of survey. One paired sampling site was recorded. The wetland was determined to have normal site conditions/hydrology within it. The upland area surrounding the wetland is a mature hardwood forest and abandoned ATV trailing aligned with the Proposed Access Road as shown on Figure 4.

In the wetland, the forest canopy includes scattered populations of red maple and paper birch. A shrub layer exists containing small amounts of trembling aspen, grey birch, and a small amount of red maple. The dominating herbaceous layer includes a healthy amount of rough bent grass, smaller populations of wood bulrush, canada goldenrod, and softrush. Including a scattered population of white meadowsweet (*Spira alba*). The topography has a discrete slop with a large amount of dug out trenches in the wetland. The PI was observed to be 2.80. A silty clay Depleted Matrix (5YR/7/2) with 7% redox features (5YR/5/8) was observed at 6 – 18 cm of soil, over a restrictive root layer at 18 cm.

The immediately adjacent upland is a mature hard wood forest with an abandoned ATV trail. The forest canopy includes a moderate population of red maple, a lesser amount of trembling aspen and a scattered population of grey birch. The shrub layer contains a small population of american mountain ash, and scattered amounts of grey alder, balsam fir, black cherry (*Prunus serotina*) and mountain holly. A bare herbaceous layer includes scattered populations of red raspberry, wild sarsaparilla, and canada goldenrod. The topography is a discrete slope and flat abandoned ATV trail with dug out trenches. The PI was observed to be 2.94. Although the area presented a PI of 2.94 and a dark silty layer (2.5YR/3/3) observed at 8 – 35 cm, hydrology was not present, and the area was determined to not be a wetland.

The wetland boundary was established utilizing changes in vegetation and topography, while noting changes in hydrology.

No surface inflow or outflow was observed. The wetland receives intermittent runoff and possible groundwater input from the upgradient forest and abandoned ATV trail. No SAR species were observed in the wetland or adjacent upland at the time of survey.

The Wetland Functional Assessment revealed that WL18 provides higher functional grouped values for water quality support and hydrologic group, in descending order. Higher functional group values for water quality support are likely due to being a herbaceous type wetland, lack of visible bare ground, large upland edge contact, consistent soil saturation, lack of a channel outlet, an almost flat internal gradient, and higher wetland functionality for carbon sequestration.

Higher functional values for the hydrologic group are possibly due to lack of channel outlet and an almost flat internal gradient.

Wetland 19

Wetland 19 (WL19 – Figure 4) on PIDs 1002351 and 88617 is a Shrub Seepage Swamp dominated by grey alder. The area mapped is approximately 1.80 hectares. The wetland continues for an unknown length on both the northeastern and southwestern boundaries. One mapped water course is shown by the Government of PEI, but no water course was observed during the time of survey. A dirt road runs through the wetland aligning with the Proposed Access Road as shown on Figure 4. The wetland was determined to have normal site conditions/hydrology within it. The upland area surrounding the wetland is a regenerating clearcut and dirt road.

In the wetland, the bare forest canopy contains scattered amounts of red maple and trembling aspen. The dominating shrub layer includes a lush population of grey alder, a small amount of bebb's willow and scattered populations of american mountain ash and red maple. An herbaceous layer exists containing a small population of bunchberry and infrequent populations of st. john's wort, wood horsetail and interrupted fern. The topography is quite flat with a decent number of micro-depressions and concaved passageway where the dried-up water course is mapped and a ditch adjacent to the dirt road. The PI was observed to be 2.50. A silty Depleted Matrix (5YR/8/1) with 10% redox features (5YR/5/6) was observed at 13 – 35 cm.

The immediately adjacent upland is a regenerating clear-cut stand. An infrequent number of red maples are the sole species of the forest canopy. The shrub layer includes a moderate population of trembling aspen with lesser amounts of red maple, wild raisin, and paper birch, and scattered amounts of american mountain ash and grey alder. The bare herbaceous layer contains scattered populations of bunchberry and wild lily-of-the-valley. The topography is mostly flat with some discrete slopes moving into the wetland, and a ditch adjacent to the dirt road. The PI was observed to be 3.06. The soil is well-drained sand.

The wetland boundary was established utilizing changes in vegetation and a mostly broad transition zone, while noting changes in hydrology.

One mapped water course was given by the Government of PEI; however, no flowing water was present during the time of survey. The wetland receives intermittent surface runoff and possible groundwater input from the upgradient forest. No SAR was observed in the wetland or adjacent forest at the time of survey.

The Wetland Functional Assessment revealed that WL19 has higher functional group values for transition habitat. This is likely due to the proximity of bare pervious surfaces, longer distance to public roads, diversity of wood height and form, lack of visible bare ground, an extensive micro-topography, and small patches of surface water. Other factors include lots of downed wood, well vegetated upland perimeter, lack of invasive plants, shallow surface water for plants, fine soils with shallow organic layer, and lack of human activity.

Wetland 20

Wetland 20 (WL20 – Figure 2) on PID 10132 is a Shrub Seepage Swamp dominated by grey alder. The area mapped is approximately 0.51 hectares. The wetland continues for an unknown length at the northeastern boundaries. No water courses were observed. An abandoned ATV trail aligns with the Proposed Access Road as shown on Figure 2. The wetland was determined to have normal site conditions/hydrology within it. The upland area surrounding the wetland is a regenerating clearcut.

In the wetland, the forest canopy includes a small population of red maple and a scattered amount of black spruce. The shrub layer contains a modest population of grey alder, a lesser amount of red-osier dogwood and scattered amounts of mountain holly. An herbaceous layer exists that includes moderate amounts of bladder sedge and interrupted fern with scattered populations of white meadowsweet and flat-top white aster. The topography is quite flat throughout the wetland with minor ditches adjacent to the abandoned ATV trail. The PI was observed to be 2.57. Red Parent Material (2.5YR/4/4) was observed at 6 – 45 cm; however, due to oversaturation of soils the redox features could not be determined. The water table was observed at 40cm.

The immediately adjacent upland is a regenerating clear-cut stand. A trace amount of red maples are the sole species of the forest canopy. The shrub layer includes a moderate amount of balsam popular (*Populus balsameifera*) and trace amounts of red maple and american mountain ash. An herbaceous layer exists that includes a small population of flat-top white aster and scattered amounts of new york aster (*Symphyotrichum novi-belgii*), spotted joe-pye weed (*Eupatorium maculatum*) and canada goldenrod. The topography is quite flat with minor ditches adjacent to the abandoned ATV trail. The PI was observed to be 2.53. The soil is a well-drained sandy loam.

The wetland boundary was established utilizing changes in vegetation and a mostly broad transition zone, while noting changes in hydrology.

No surface inflow or outflow was observed. The wetland receives intermittent runoff and possible groundwater input from the upgradient forest and abandoned ATV trail. No SAR species were observed in the wetland or adjacent upland at the time of survey.

The Wetland Functional Assessment revealed that WL20 does not provide higher functional group values for any of the 5 grouped functions. Although, WL20 does provide high wetland functional value for songbird, raptor, and mammal habitat. This would likely be due to the proximity to bare pervious surfaces, longer distance to public roads, lots of downed wood, some bare ground, a well vegetated upland perimeter, and lack of human activity.

Wetland 21

Wetland 21 (WL21 – Figure 4) on PID 10132 is an Herbaceous Seepage Swamp dominated by bebb's willow. The area mapped is approximately 0.79 hectares. The wetland continues for an unknown length at the northern boundaries. The wetland is bounded on the southern boundaries by Highway 156. No water courses were observed, but a water filled dug out trench was noted. The wetland was determined to have normal site conditions/hydrology within it. The upland area surrounding the wetland is a mature mixed wood forest and dirt road.

In the wetland, the bare forest canopy includes infrequent amounts of tamarack and black spruce. The shrub layer contains a modest population of bebb's willow and lesser amounts of red-osier dogwood. The dominating herbaceous layer includes moderate populations of flat-top white aster, sensitive fern, cinnamon fern, and common cattail, with lesser amounts of canada goldenrod and wood horsetail. The topography is quite flat with abrupt slopes adjacent to Highway 156. The PI was observed to be 2.48.

The immediately adjacent upland is a mature mixed wood forest and dirt road. The dominating forest canopy includes a lush population of white spruce, a lesser amount of paper birch and an infrequent population of bebb's willow. A bare shrub layer contains scattered populations of white spruce, white ash, and grey alder. The herbaceous layer is non-existent. The topography is mostly flat surrounding the wetland with the abrupt sloped ditches from Highway 156. Histosol (7.5YR/2.5/1) soils were observed up to 4 cm.

The wetland boundary was established utilizing changes in vegetation and topography, while noting changes in hydrology.

No mapped water courses were observed; however, a dug-out trench was observed at the eastern boundary. The trench also flowed from a culvert through Highway 156. The very slow flow of water appeared to be moving southeast to northwest. The wetland also receives intermittent runoff and possible groundwater input from the upgradient forest and Highway 156. No SAR species were observed in the wetland or adjacent upland at the time of survey.

The Wetland Functional Assessment revealed that WL21 provides higher functional grouped values for transition habitat. This is likely due to the proximity of bare pervious surfaces, diversity of wood height and form, decent number of large snags and downed trees, a diverse herbaceous layer, lack of invasive plants, a well vegetated upland perimeter, an extensive micro-topography, and absence of human activity for a majority of the wetland.

Wetland 22

Wetland 22 (WL22 – Figure 3) on PIDs 12070 and 10322 is a Hard Wood Forest Riverine Swamp dominated by sensitive and cinnamon fern. The area mapped is approximately 0.41 hectares. The wetland continues for an unknown length at both the northern and southern boundaries. One mapped water course was observed. The wetland was determined to have normal site conditions/hydrology within it. The upland area surrounding the wetland is a mature mixed wood forest and agricultural fields.

In the wetland, the forest canopy includes small populations of paper birch, white ash, red maple and a scattered amount of yellow birch (*Betula alleghaniensis*). A shrub layer exists containing a modest population of bebb's willow and lesser amounts of grey alder and red maple. An extensive herbaceous layer includes moderate populations of sensitive fern and cinnamon fern with a lesser amount of flat-top white aster and infrequent populations of interrupted fern, wood horsetail and fowl manna grass. The topography is slightly sloped into the water course. The PI was observed to be 2.75. A sandy loam Red Parent Material (5YR/3/3) with redox features was observed at 3 – 35 cm; however, due to oversaturation of the soils, colors of the redox features could not be determined. The water table was observed to be 15 cm.

The immediately adjacent upland is a mature hard wood forest and Highway 156 at the southern boundary. The dominating forest canopy includes modest populations of paper birch, red maple, a lesser amount of balsam fir and infrequent populations of sugar maple (*Acer saccharum*) and white spruce. A shrub layer exists containing a modest amount of balsam fir and trace amounts of white spruce. Agricultural fields are approximately 40 m southwest of the wetland. Agricultural fields are immediately north of the wetland. Plowed fields were observed over the wetland at the time of survey (Figure 3). The topography is quite flat surrounding the wetland. The PI was observed to be 3.38. The soil is a well-drained sandy silt.

The wetland boundary was established utilizing changes in vegetation and topography, while noting changes in hydrology.

One mapped water course was observed flowing southeast to northwest. The wetland also receives intermittent runoff and possible groundwater input from the upgradient forest and agricultural fields. No SAR was observed in the wetland or adjacent upland at the time of survey.

The Wetland Functional Assessment revealed that WL22 provides higher functional grouped values for transition habitat, aquatic habitat, and aquatic support, in descending order. Higher functional grouped values for transition habitat are likely due to the proximity of bare pervious surfaces, distance to public roads, a diverse wood height and form, good number of large snags and downed logs, small amounts of bare ground, and an extensive micro-topography. Other factors include small areas of persistent surface water, balanced natural annual water fluctuation, well vegetated upland perimeter, lack of invasive plants, and lack of nearby human activity.

Higher functional grouped values for aquatic support are likely due to the persistent flowing brook, with a small amount of ponded water, lack of impervious surfaces, a herbaceous type wetland, and an extensive micro-topography. Other factors include a small area that is inundated only seasonally, with a dynamic water annual fluctuation and depths, an extensive ground cover, and no new expansion of the wetland.

Higher functional grouped values for aquatic habitat is possibly due to the lack of impervious surfaces, WL12 being a herbaceous type wetland, lots of shaded water, balanced water depth classes, some large trees and large snags for waterbirds, and a small area flooded annually. Other factors include lack of fish for amphibians, a persistent flowing brook, an extensive micro-topography, upland bare pervious surfaces around wetland perimeter, an almost flat internal gradient, and lack of nearby human activity.

Wetland 23

Wetland 23 (WL23 – Figure 3) on PIDs 10314, 537621, and 460261 is a Shrub Riverine Swamp with a Beaver Pond, dominated by grey alder. The area mapped is approximately 1.00 hectares. The wetland continues for an unknown length at the northwestern and southeastern boundaries. One mapped water course was observed, that had been dammed up by Beavers. A Beaver Pond had been established. The wetland was determined to have normal site conditions/hydrology within it. The upland area surrounding the wetland is a mature mixed wood forest and agricultural field.

In the wetland, the forest canopy includes a small population of paper birch and infrequent amounts of black spruce and eastern white cedar. A healthy amount of grey alder is the sole species for the shrub layer. An herbaceous layer exists containing small populations of interrupted fern, sensitive fern and dwarf raspberry. The topography is mostly flat with extensive micro-depressions within the wetland. A concave path follows the water course and slopes into the wetland at both southern and northern boundaries. The PI was observed to be 2.36. A sandy silt Red Parent Material (5YR/3/4) was observed at 3 – 25 cm over another layer of Red Parent Material (5YR/4/4) up to 40 cm. Due to over saturation of soils, the redox features in the upper Red Parent Material could not be determined. The water table was observed at 25 cm.

The immediately adjacent upland is a mature mixed wood forest, with an agricultural field approximately 25 m southwest from the wetland. The dominating forest canopy includes moderate populations of paper birch and white spruce, a lesser amount of tamarack and a trace amount of red maple. A shrub layer contains an infrequent amount of paper birch and trace amount of red maple. Scattered amounts of interrupted fern is the sole species for the herbaceous layer. The topography slopes into the wetland and flattens out by the agricultural fields. The PI was observed to be 3.41. Soils are a well-drained sandy silt.

The wetland boundary was established utilizing changes in vegetation and topography, while noting changes in hydrology.

One mapped water course was observed that had been dammed up by beavers. A beaver lodge is established in the central area of the mapped wetland, including a pool. No beavers were observed, but signs of recent foraging was observed, indicating the presence of active beavers. The wetland also receives intermittent runoff and possible groundwater input from the upgradient forest and agricultural field. No SAR was observed in the wetland or adjacent upland at the time of survey.

The Wetland Functional Assessment revealed that WL23 provides higher functional grouped values for transition habitat, and aquatic habitat, in descending order. Higher functional grouped values for transition habitat is likely due to the proximity of bare pervious surfaces, distance to public roads, good number of large snags and downed wood, lack of bare ground, and an extensive microtopography. Other factors include a small area with persistent surface water, active beaver habitat, well vegetated upland perimeter, lack of invasive plants, and lack of nearby human activity.

Higher functional grouped values for aquatic support is likely due to the persistent flowing brook running through the wetland, only small areas of ponded water, lack of nearby impervious surfaces, and an extensive microtopography. Other factors include a small area only flooded annually with a dynamic fluctuation range and shallow water depth, an extensive ground cover, and no new wetland expansion.

HISTORIC LAND USE

A review of historical imagery from the last 33 years reveals that in 1990 (Figure 7), a clearing was visible for the abandoned road adjacent to WL8. A clearing could also be seen at a portion of WL11 in the northern section. By 2000 (Figure 8), a larger clearing is seen north of WL11 and a larger section of the wetland. Clearings can also be seen within WL15 (Figure 9), the southwestern section of WL12 (Figure 9), and adjacent to WL16. By 2010, larger clear cuts for the majority of WL16 and a good portion of WL12 (Figure 10) can be seen. Imagery from 2010 additionally displays more forested areas in WL19 and WL17 (Figure 11) that do not show on contemporary imagery. More forested areas can also be seen adjacent to WL3 (Figure 12). The Study Area has historic agricultural use throughout the region, many fields that were once present 30 years ago are no longer there. New fields are present now that were no there before. Tracking agricultural activity within the Study Area is beyond the scope of this wetland delineation report.

CLOSURE

We appreciate the opportunity to submit this wetland delineation survey report and have endeavored to be thorough in our assessment of the Study Area for the Skinners Pond Wind Energy Center. In total, 40.08 ha of wetland had been mapped with a majority of wetlands area diverse set of seepage swamps, 2 riverine swamps, 1 channel swamp and 4 wetlands with beaver ponds. All wetlands are in good ecological standing. The wetlands delineated in the Study Area are representative to the surrounding areas. Should you have any questions, would like to clarify anything with this report or require any additional information, please do not hesitate to contact the undersigned.

Regards,

Maqamigew Anqotumeg Inc.

Lyle Vicaire, Terrestrial Biologist, BSc

CEO/President, Maqamigew Anqotumeg Inc.

References

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U. S. Army Engineer Waterways Experiment Station. Vicksburg, Mississippi.

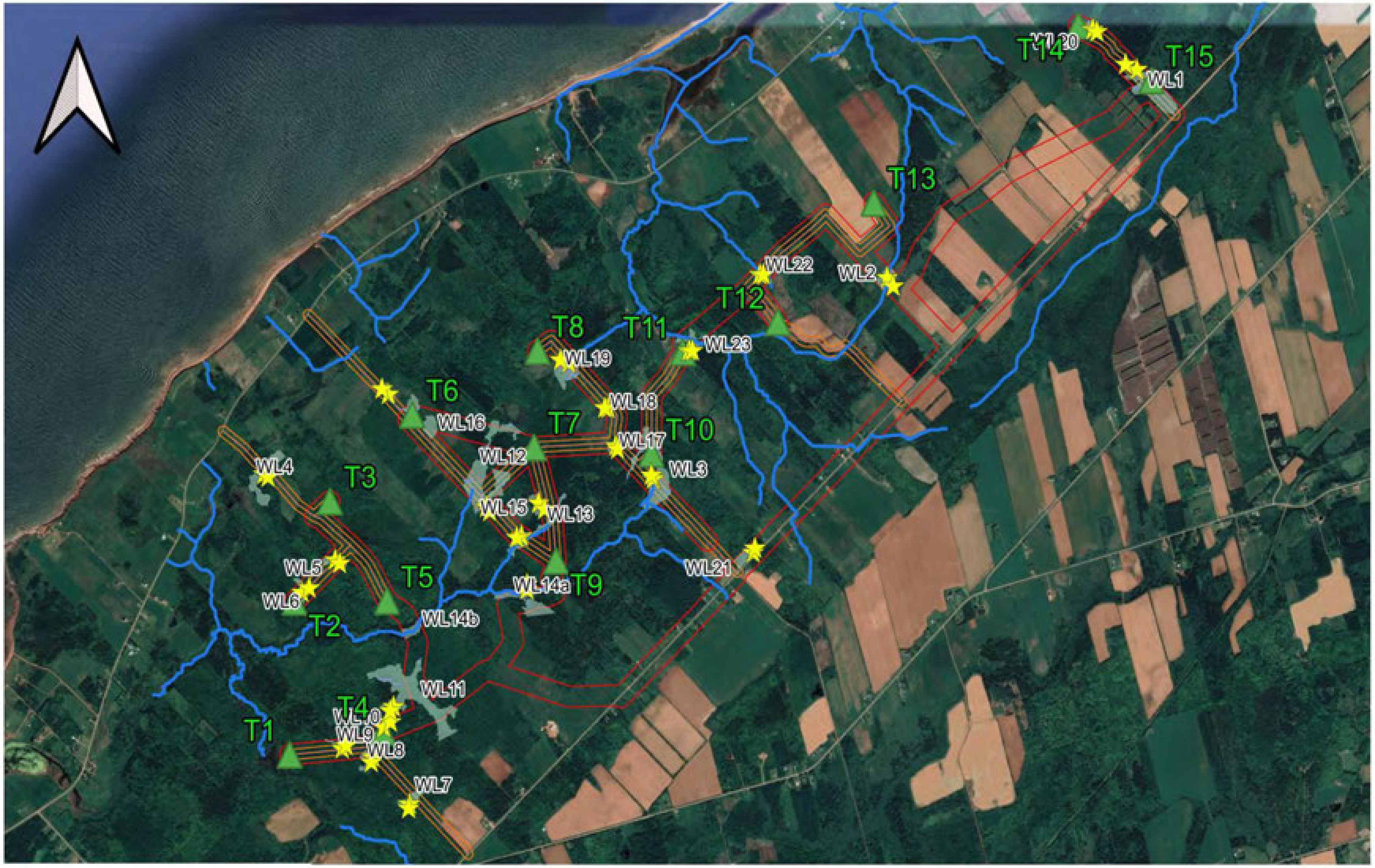
U.S. Army Corps of Engineers. 2008. Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Draft), ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Bond, W.K., K.W. Cox, T. Heberlein, E.W. Manning, D.R. Witty and D.A. Young. 1992. Wetland Evaluation Guide. Final Report of the Wetlands are Not Wastelands Project. North American Wetlands Conservation Council (Canada). Issues Paper, No. 1992-1. 121 p.

Hanson, A.R. and L. Calkins. 1996. Wetlands of the Maritime Provinces: Revised Documentation for Wetlands Inventory. Technical Report No. 267. Canadian Wildlife Service. Atlantic Region.

GIS Data Layers. The Government of Prince Edward Island. http://www.gov.pe.ca/gis/. Last Access: Jan 2023

LIST OF FIGURES



Proposed Turbine Location
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Proposed Access Road Corridors
Proposed Collection Corridors
Hydro Network
Wetland Extension
Veg Plots

Maqamigew Anqotumeg

Invenergy

0 500 m

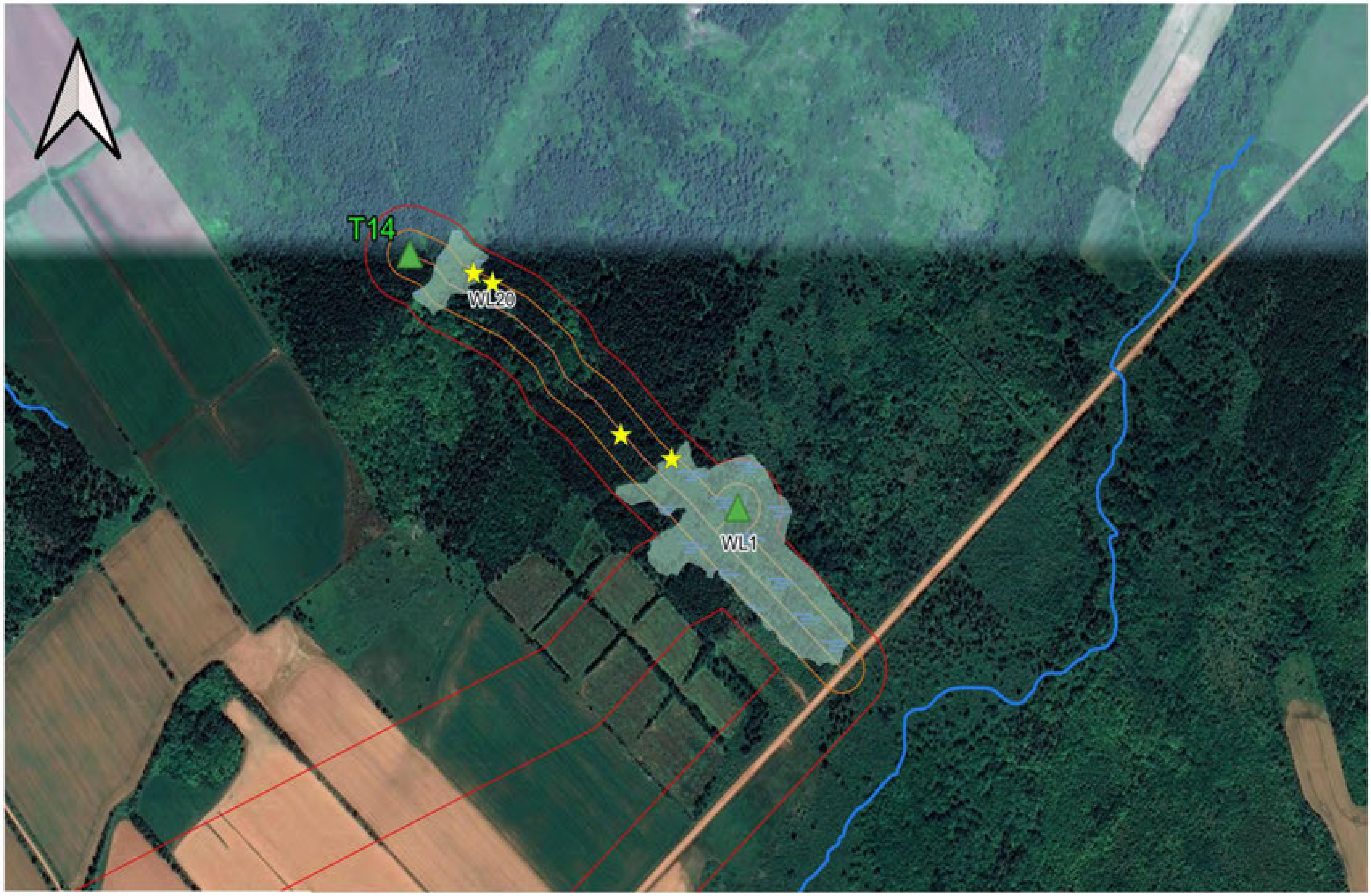
SKINNERS POND WIND ENERGY CENTER

Prepared by: Lyle Vicaire

November 11, 2022

Figure 1 Scale: 1:45,000

Datum: WGS 84



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Proposed Collection Corridors
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Wetland Extension
Veg Plots

Maqamigew Anqotumeg

wsp Invenergy

0 500 m

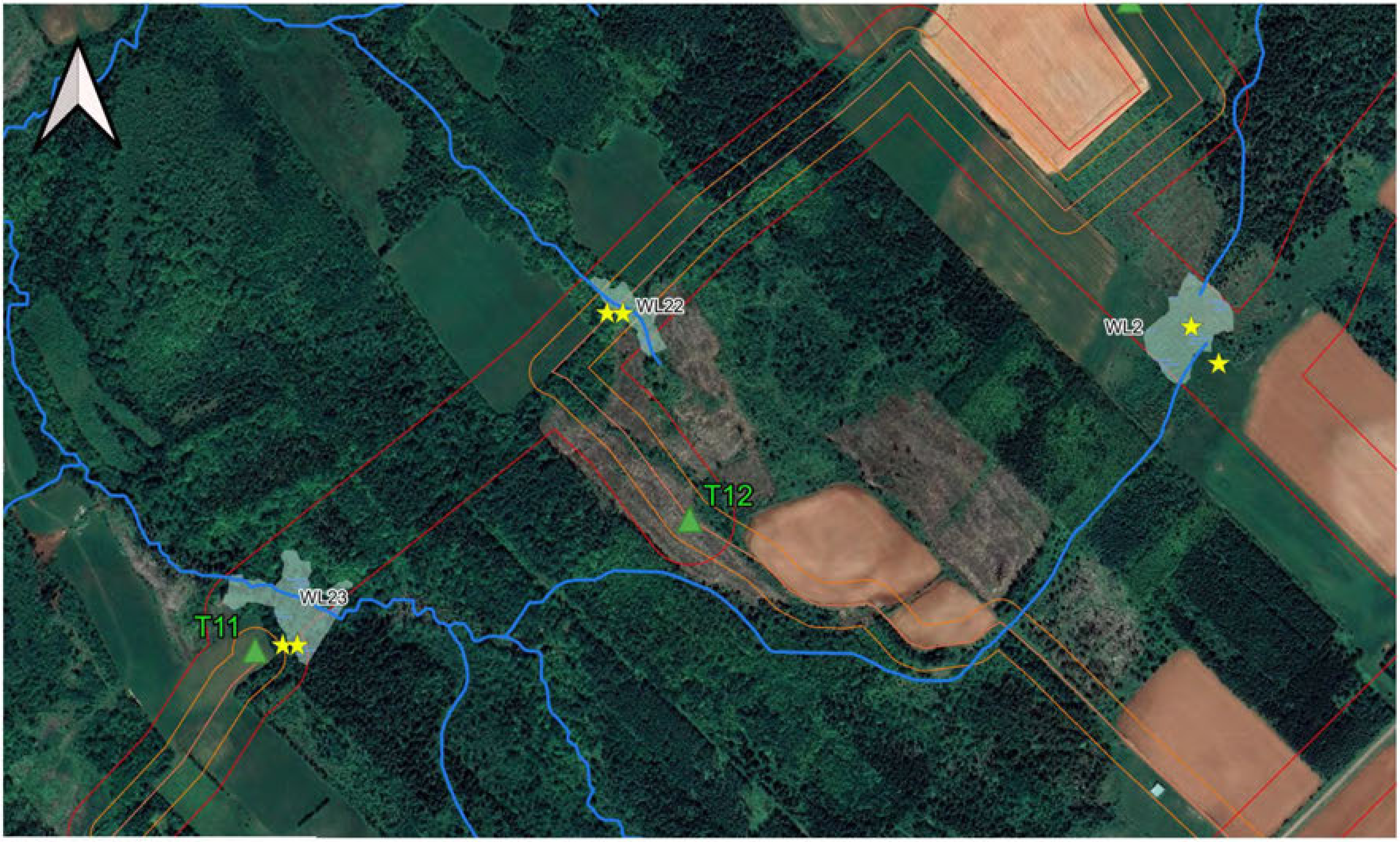
SKINNERS POND WIND ENERGY CENTER

Prepared by: Lyle Vicaire

November 11, 2022

Figure 2 Scale: 1:10,000

Datum: WGS 84



▲	Proposed Turbine Location
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	Wetland Extension
☆	Veg Plots

Maqamigew Anqotumeg

Invenergy

0 500 m

SKINNERS POND WIND ENERGY CENTER

Prepared by: Lyle Vicaire

November 11, 2022

Figure 3 Scale: 1:10,000

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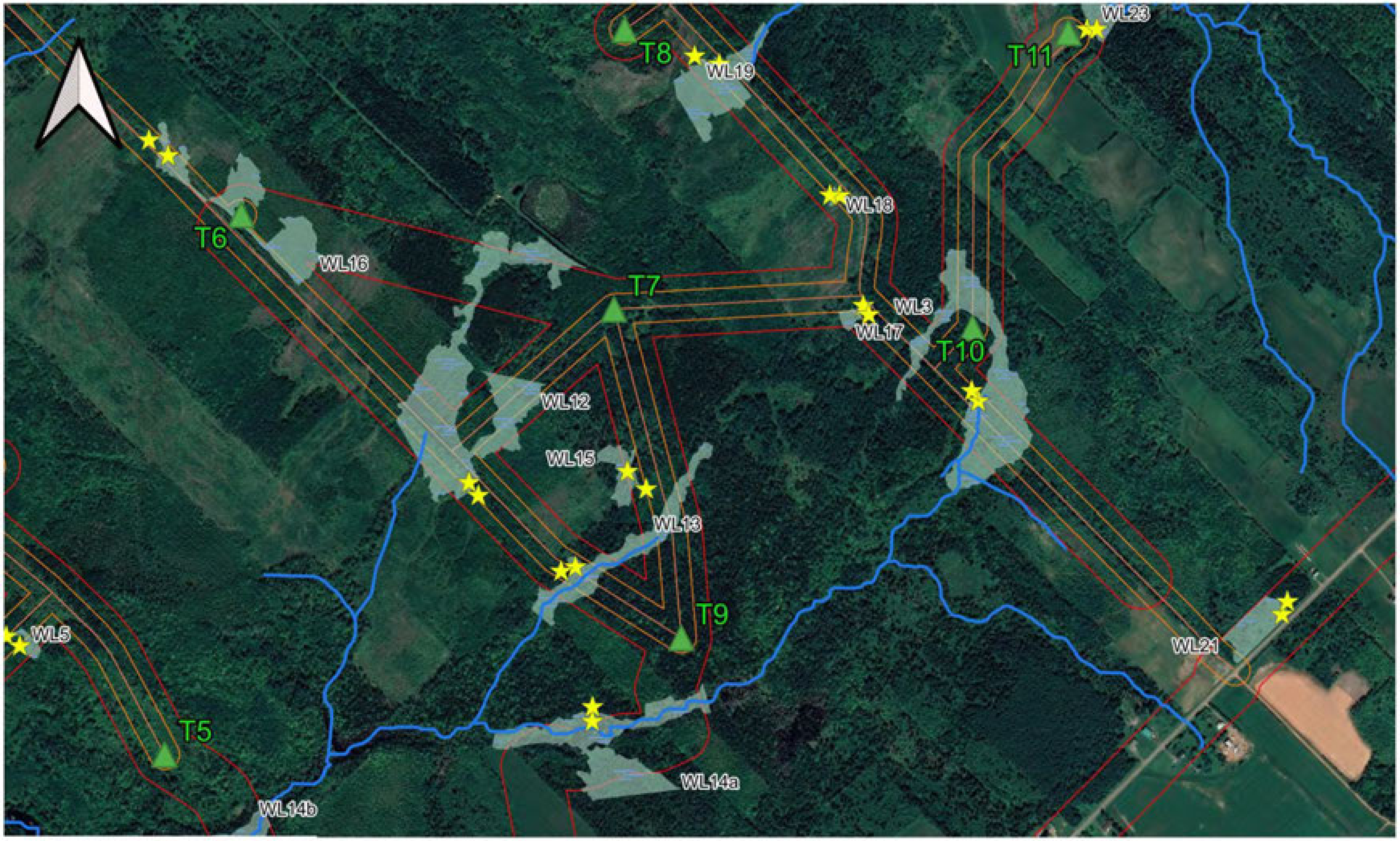

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SKINNERS POND WIND ENERGY CENTER

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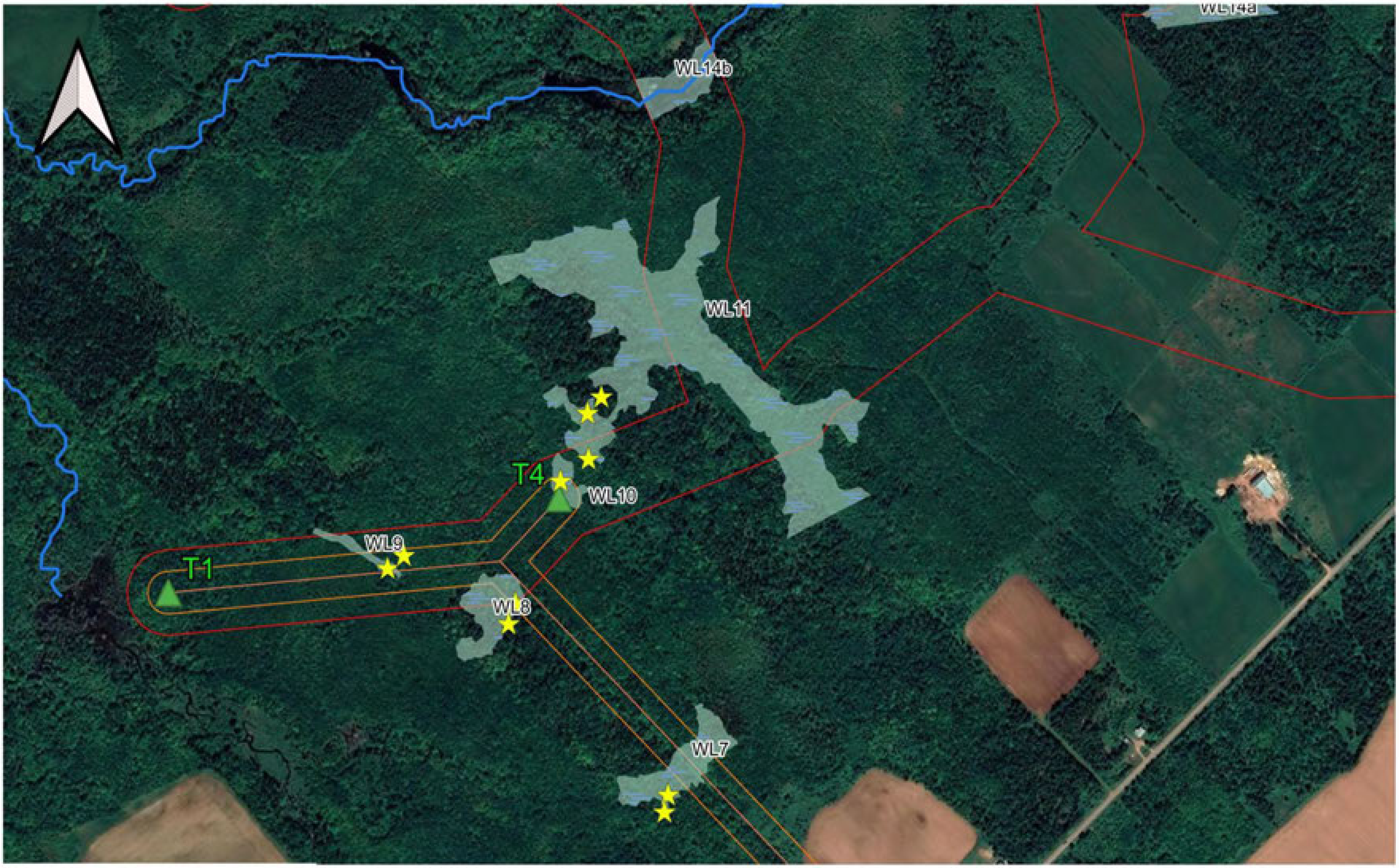

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Figure 5 Scale: 1:11,000

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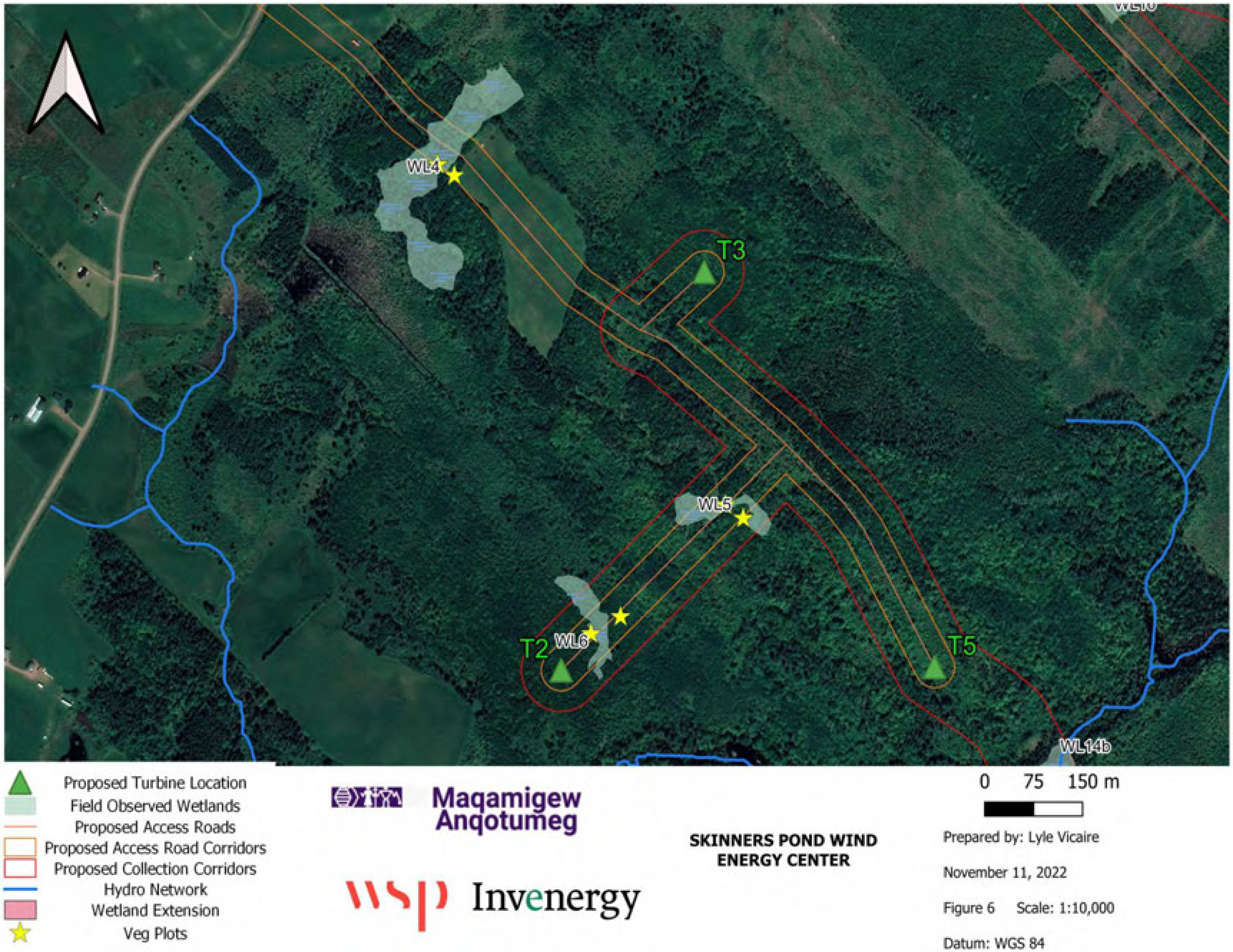

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0 75 150 m
Prepared by: Lyle Vicaire
November 11, 2022
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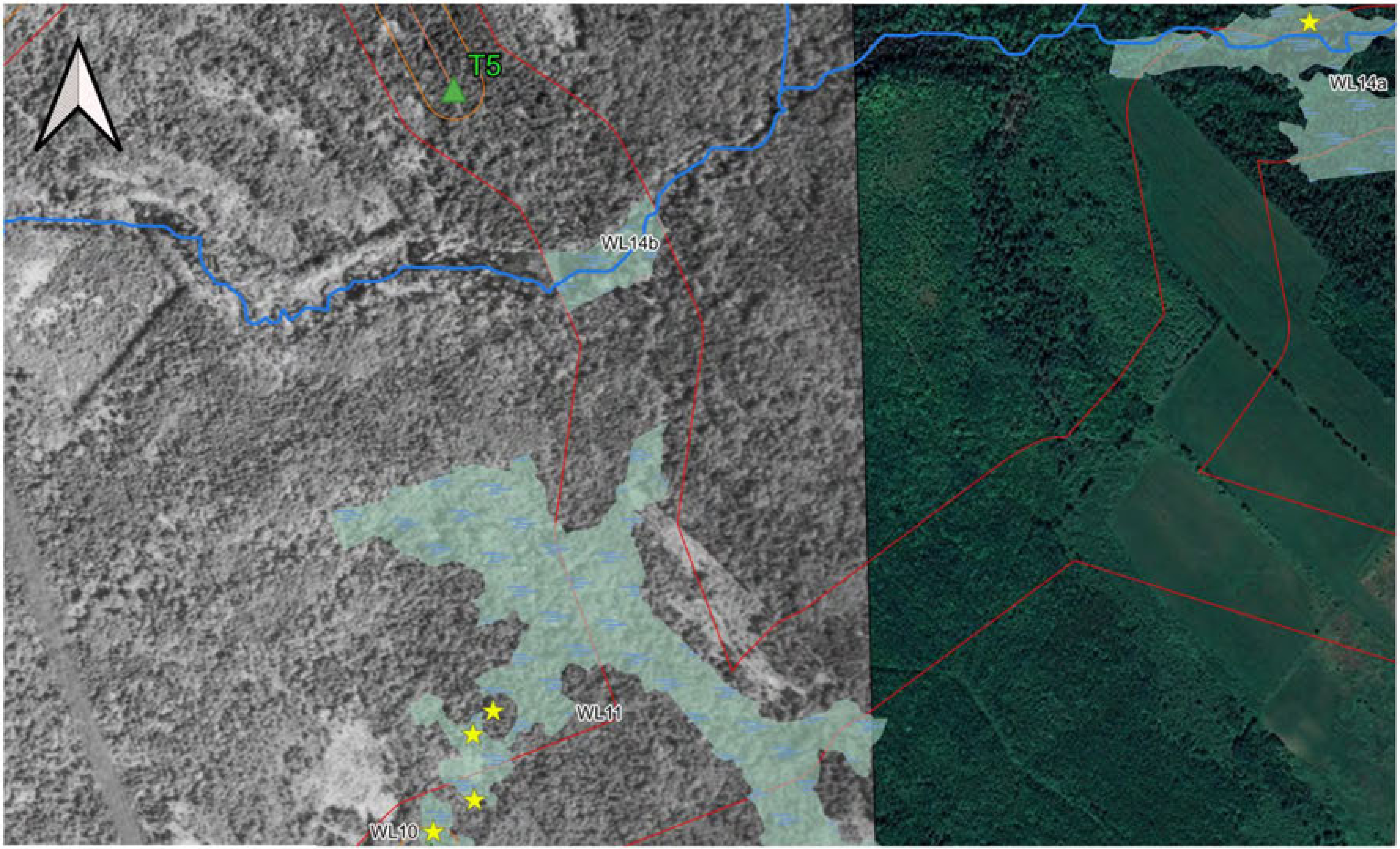

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SKINNERS POND WIND ENERGY CENTER

0 75 150 m

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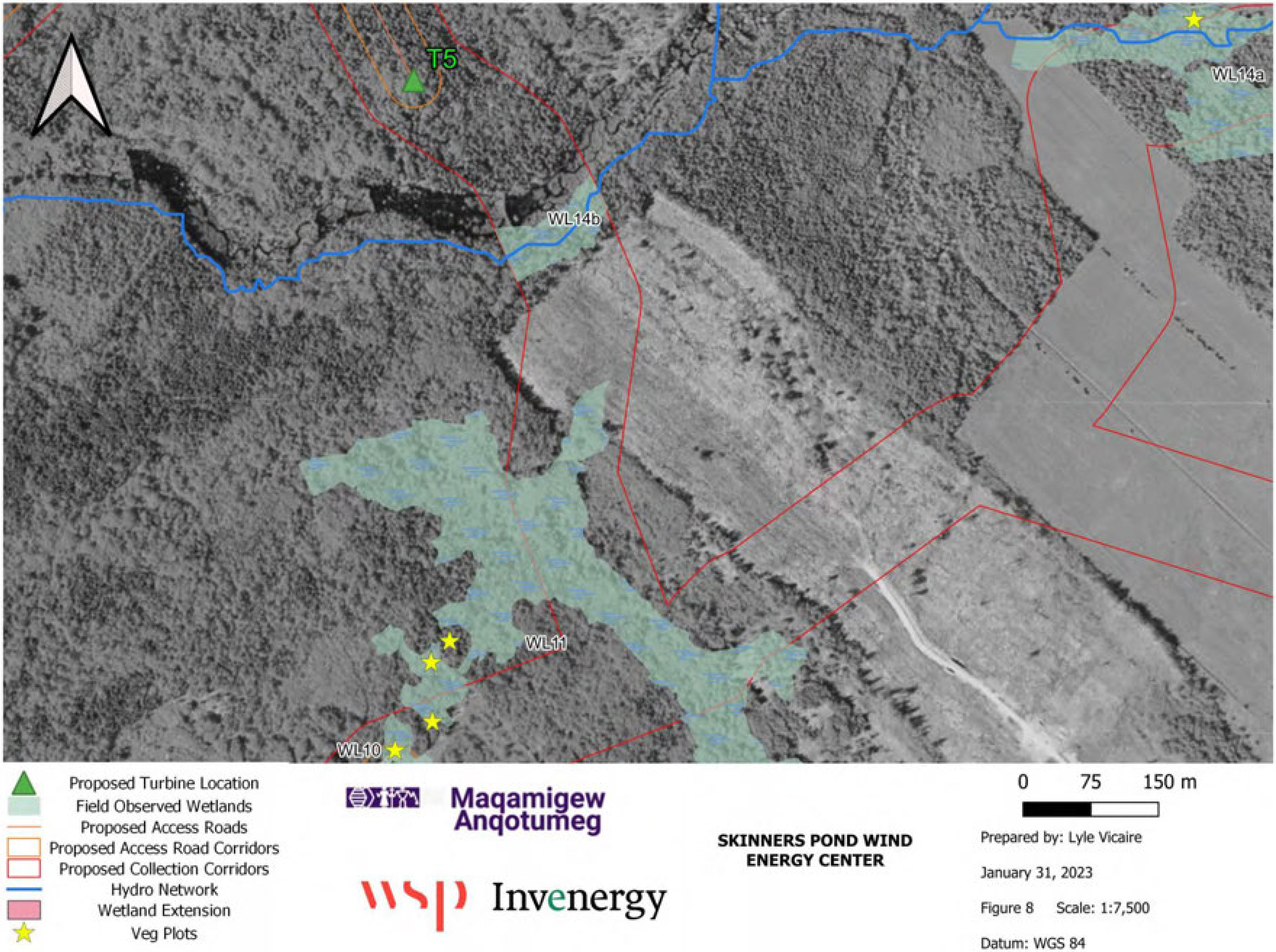
January 31, 2023

Figure 7 Scale: 1:7,500

Datum: WGS 84



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Prepared by: Lyle Vicaire
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Figure 8 Scale: 1:7,500
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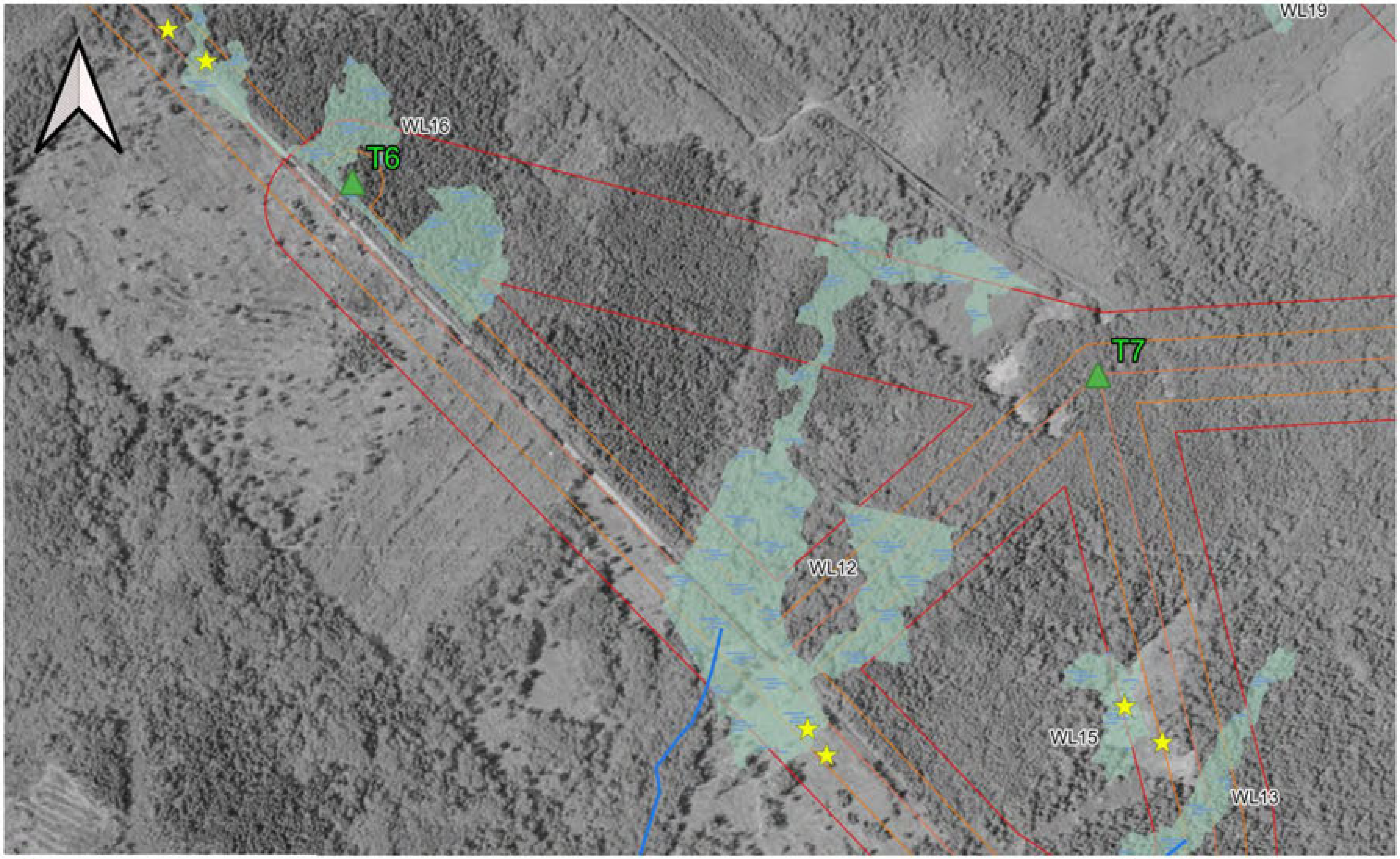

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SKINNERS POND WIND ENERGY CENTER

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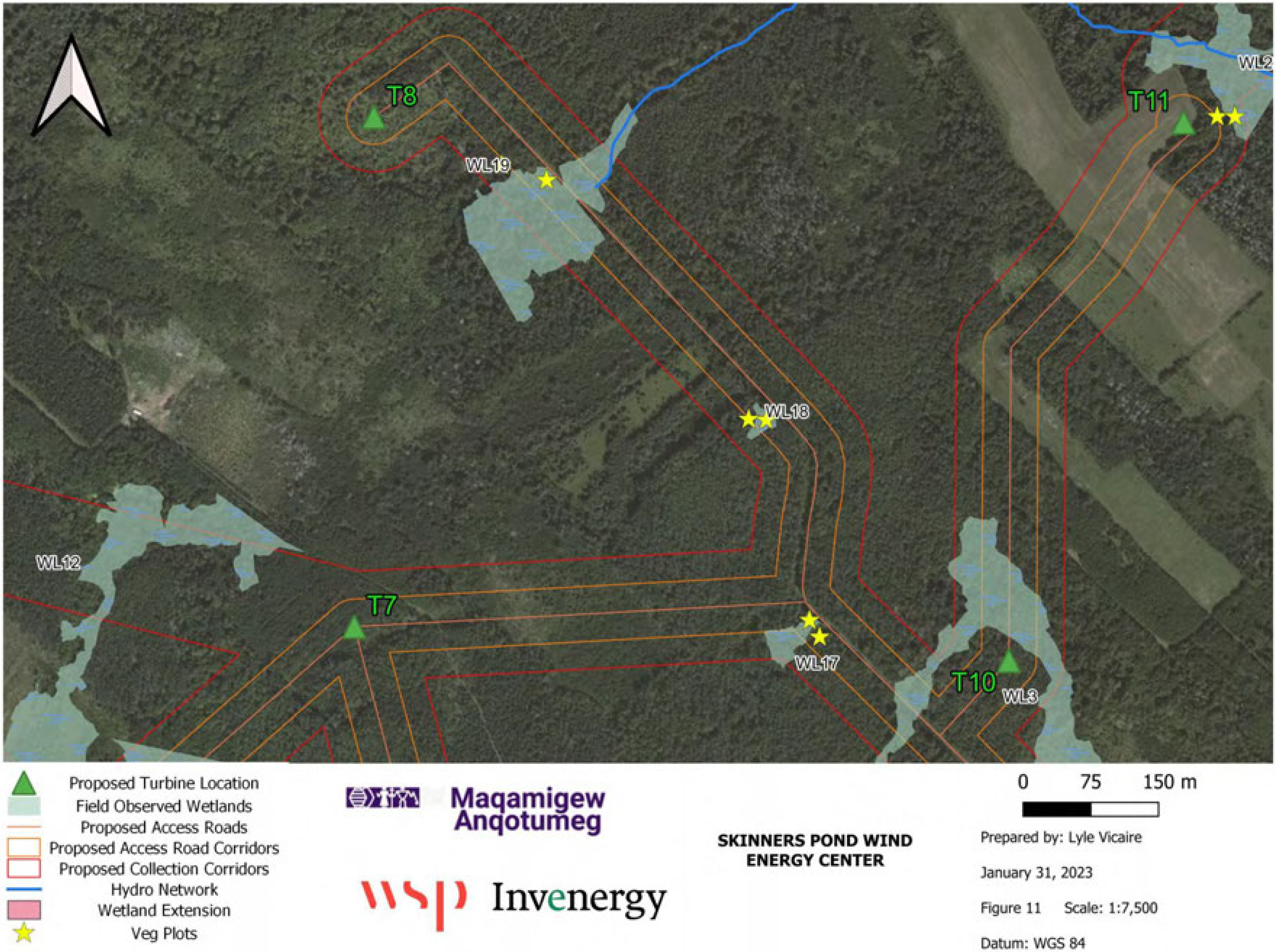
Prepared by: Lyle Vicaire

January 31, 2023

Figure 9 Scale: 1:7,500

Datum: WGS 84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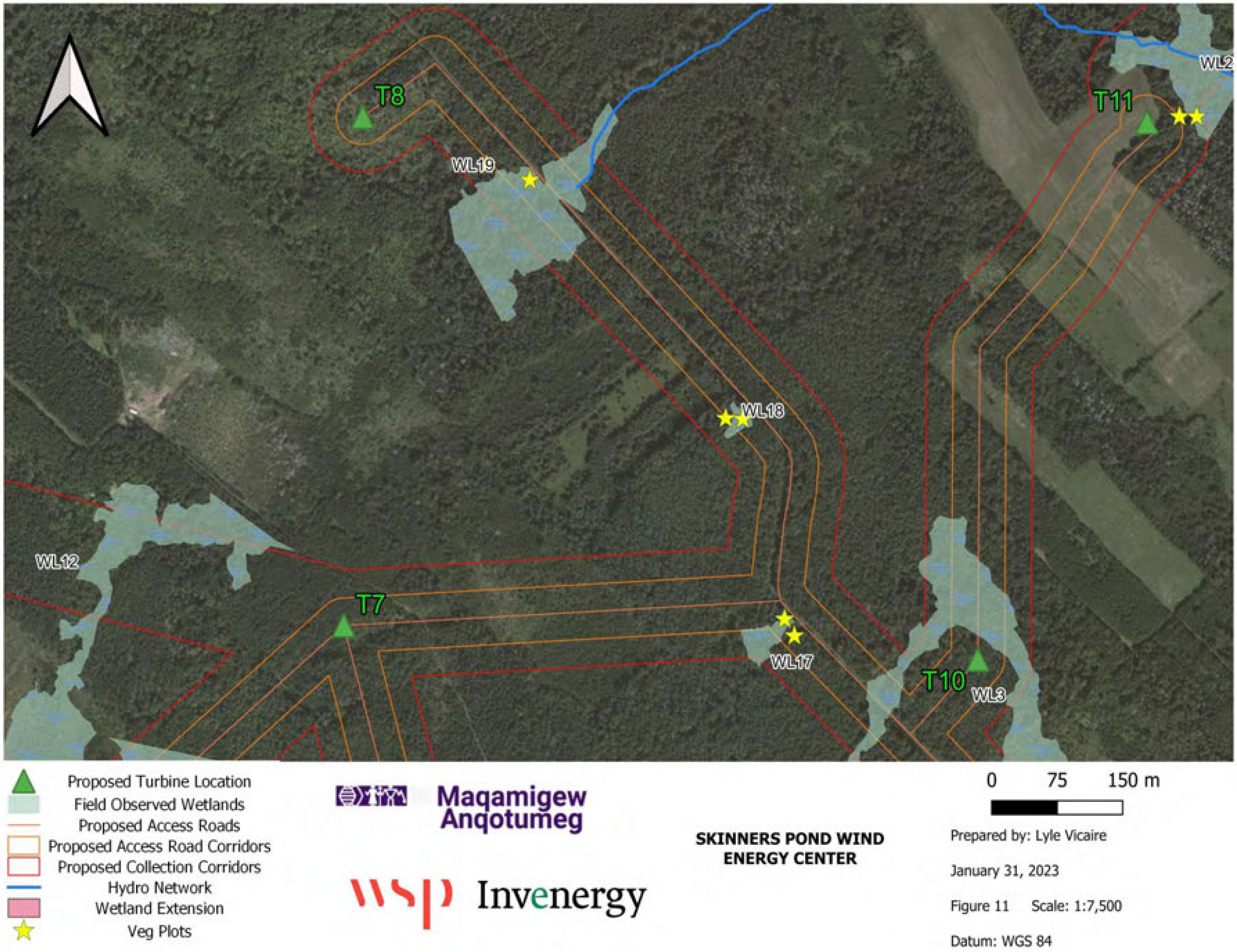
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SKINNERS POND WIND ENERGY CENTER

0 75 150 m

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January 31, 2023

Figure 12 Scale: 1:5,000

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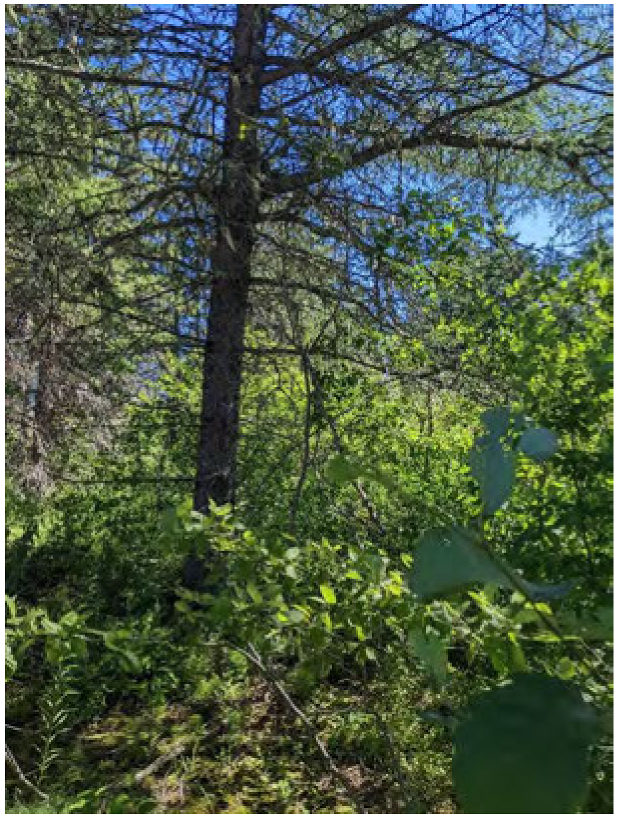
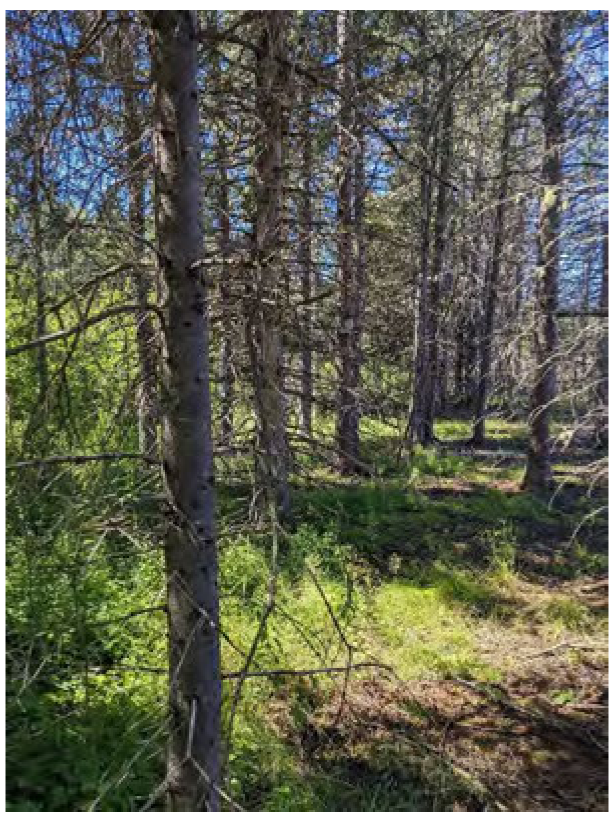
LIST OF PHOTOS

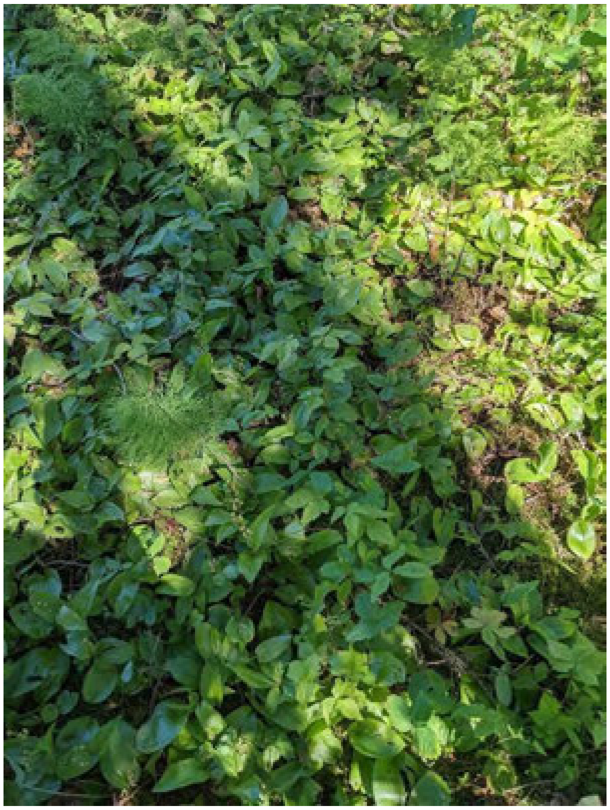


WL1 Photo 1 – Displaying typical wetland shrub and tree vegetation for WL1.



WL1 Photo 2 – Displaying typical wetland shrub and tree vegetation for WL1.

WL1 Photo 3 – Displaying typical wetland herbaceous vegetation for WL1.



WL1 Photo 4 – Displaying typical wetland herbaceous vegetation for WL1.

WL1 Photo 5 – Displaying Depleted Matrix (F3) soils (13-28cm 10YR4/2) with 10% redox features(5YR/4/6) over Red Parent Material (29-37cm 5YR/4/6)

WL1 Photo 6 – Displaying typical upland shrub and tree vegetation surrnounding WL2

WL1 Photo 7 – Displaying typical upland shrub and tree vegetation surrounding WL2

WL1 Photo 8 – Displaying typical upland herbaceous vegetation surrounding WL2

WL1 Photo 9 - Displaying upland soils (16-40 cm 5YR/4/6) surrounding WL1

WL2 Photo 1 – Displaying typical wetland shrub vegetation for WL2

WL2 Photo 2 – Displaying typical wetland shrub vegetation for WL2

WL2 Photo 3 – Displaying typical wetland herbaceous vegetation for WL2

WL2 Photo 4 – Displaying Depleted Matrix (F3) soils (6-40 cm 7.5YR/3/1) with 20% redox features(7.5YR/4/4), and water table at 25 cm

WL2 Photo 5 – Displaying typical upland shrub vegetation surrounding WL2

WL2 Photo 6 – Displaying typical upland herbaceous vegetation surrounding WL2

WL2 Photo 7 – Displaying upland soils (6-25 cm 7.5YR/4/2, 26-35cm 7.5YR/4/4) surrounding WL2

WL3 Photo 1 – Displaying typical shrub and tree vegetation for WL2

WL3 Photo 2 – Displaying typical shrub and tree vegetation for WL2

WL3 Photo 3 – Displaying typical herbaceous vegetation for WL3

WL3 Photo 4 – Displaying oversaturation of soils, unable to visually display soils

WL3 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL3

WL3 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL3

WL3 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL3

WL3 Photo 8 – Displaying upland soils (6-25cm 5YR/4/6) surrounding WL3

WL4 Photo 1 – Displaying typical shrub and tree vegetation of WL4

WL4 Photo 2 – Displaying typical shrub and vegetation of WL4

WL4 Photo 3 – Displaying typical herbaceous vegetation for WL4

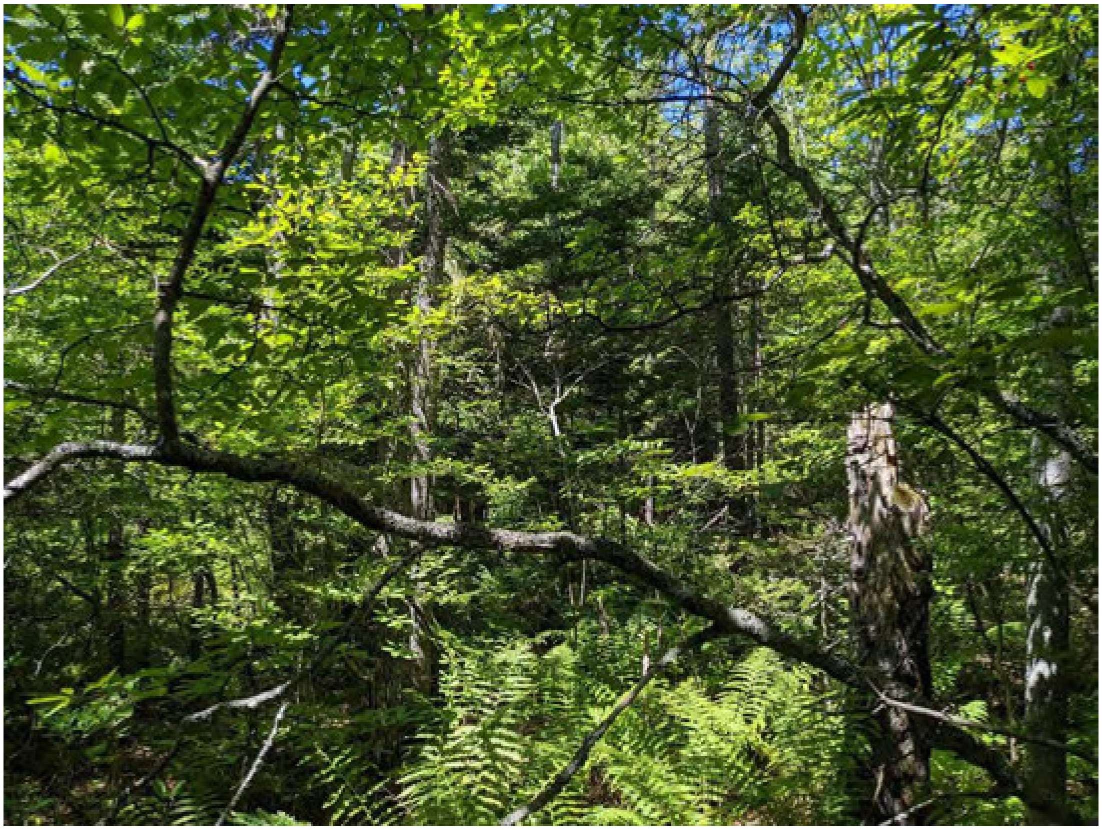
WL4 Photo 4 – Displaying Histic Epipedon (A2) soils (21-22 cm 5YR/4/2) with 2% redox features (5YR/6/8) over Red Parent Material (23-55 cm 7.5YR/4/4

WL4 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL4

WL4 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL4

WL4 Photo 7 – Displaying typical upland sherbaceous vegetation surrounding WL4

WL4 Photo 6 – Displaying upland soils (7-50 2.5YR/4/6) surrounding WL4



WL5 Photo 1 – Displaying typical shrub and tree vegetation for WL5

WL5 Photo 2 – Displaying typical shrub and tree vegetation for WL5

WL5 Photo 3 – Displaying typical herbaceous vegetation for WL5

WL5 Photo 4 – Displaying Depleted Matrix (F3) soils (18-26 cm 5YR/8/1) with 3% redox features (5YR/6/8) over Red Parent Material (27-40 cm 2.5YR/4/3)

WL5 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL5

WL5 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL5

WL5 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL5

WL5 Photo 4 – Displaying upland soils (6-16 cm 2.5YR/4/6) with restrictive layer of roots at 16 cm

WL6 Photo 1 – Displaying typical shrub and tree vegetation for WL6

WL6 Photo 2 – Displaying typical shrub and tree vegetation for WL6

WL6 Photo 3 – Displaying typical herbaceous vegetation for WL6

WL5 Photo 4 – Displaying Depleted Matrix (F3) soils (10-17 cm 2.5YR/6/1) with 20% redox features (5YR/6/8) over Red Parent Material (18-33 cm 2.5YR/4/3) with 2% redox features (2.5YR/6/8)

WL6 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL6

WL6 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL6

WL6 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL6

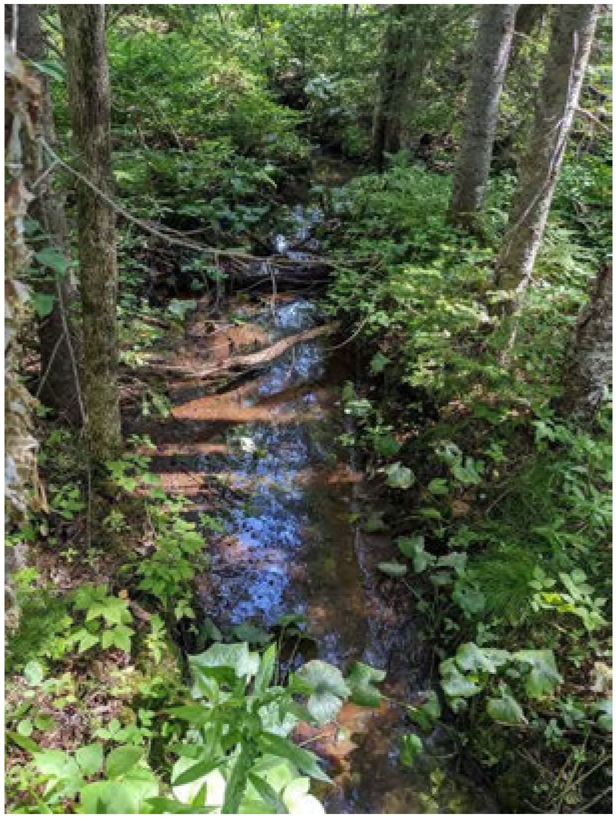
WL6 Photo 8 – Displaying upland soils (0-16cm 5YR/4/6), (17-27cm 5YR/5/6), (28-45cm 2.5YR/3/6)

WL7 Photo 1 – Displaying typical shrub and tree vegetation for WL7

WL7 Photo 2 – Displaying typical shrub and tree vegetation for WL7

WL7 Photo 3 – Displaying typical herbaceous vegetation for WL7

WL7 Photo 4 – Displaying Dark Surface (S7) soils (6-26cm 5YR/2.5/1)



WL7 Photo 5 – Displaying channel flowing West for WL7

WL7 Photo 6 – Displaying typical pooled area from Beaver impoundment in WL7

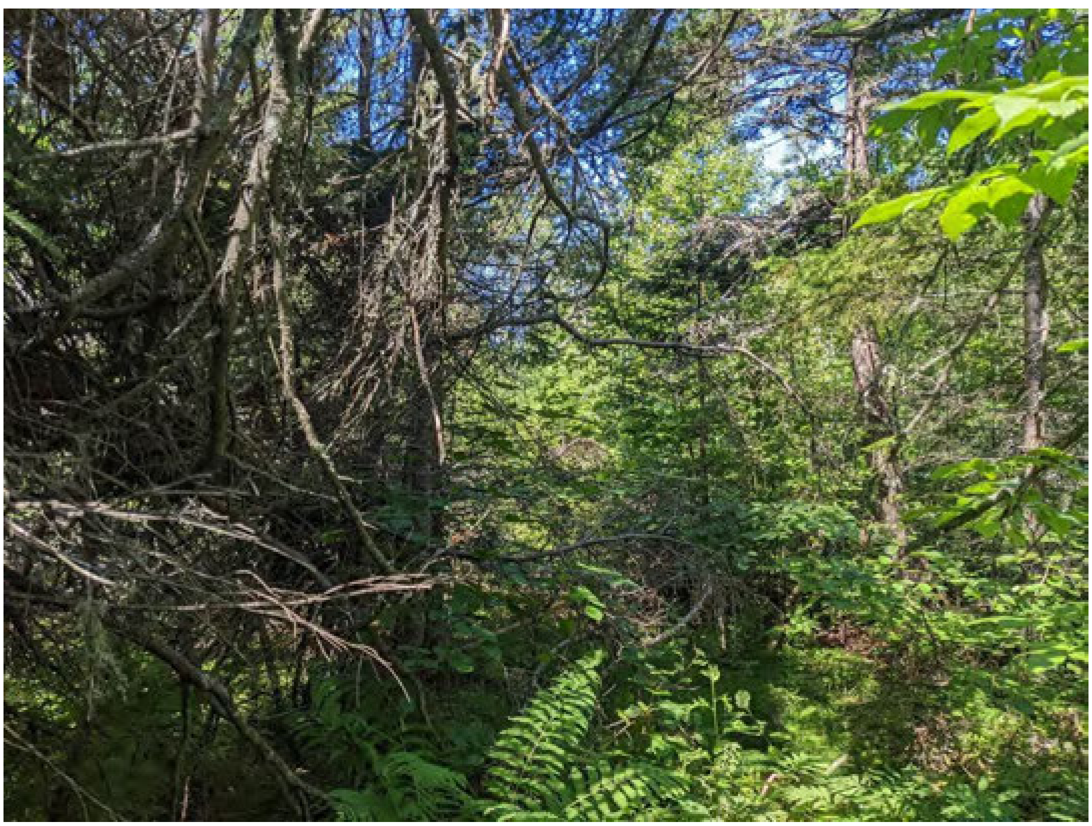
WL7 Photo 7 – Displaying typical upland shrub and tree vegetation surrounding WL7

WL7 Photo 8 – Displaying typical upland shrub and tree vegetation surrounding WL7


WL7 Photo 9 – Displaying typical upland herbaceous vegetation surrounding WL7


WL7 Photo 10 – Displaying upland soils (10-47cm 2.5YR/4/6)

WL8 Photo 1 – Displaying typical shrub and tree vegetation for WL8



WL8 Photo 2 – Displaying typical shrub and tree vegetation for WL8

WL8 Photo 3 – Displaying typical herbaceous vegetation for WL8

WL8 Photo 4 – Displaying Depleted Matrix (F3) soils (14-19cm 5YR/3/1) with 7% redox features (5YR/7/8) over 20-30 cm 5YR/4/4 with 2% redox features (7.5YR/6/6) over Red Parent Material (31-43cm 2.5YR/4/4)

WL8 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL8

WL8 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL8

WL8 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL8

WL8 Photo 8 – Displaying upland soils (08-17cm 5YR/5/6)

WL9 Photo 1 – Displaying typical shrub and tree vegetation for WL9

WL9 Photo 2 – Displaying typical shrub and tree vegetation for WL8

WL9 Photo 3 – Displaying typical herbaceous vegetation for WL9

WL9 Photo 4 – Displaying Depleted Matrix (F3) soils (14-22cm 5YR/7/1) with 2% redox features (5YR/7/8) over Red Parent Material (23-36cm 2.5YR/4/4) with 3% redox features (2.5YR/7/8)

WL9 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL9

WL9 Photo 6 – Displaying upland soils (9-20 2.5YR/8/1) over 21-40cm 2.5YR/4/6

WL10 Photo 1 – Displaying typical shrub and tree vegetation for WL10

WL10 Photo 2 – Displaying typical shrub and tree vegetation for WL10

WL10 Photo 3 – Displaying typical herbaceous vegetation for WL10

WL10 Photo 4 – Displaying Histic epipedon (A2) soils (21-25cm 5YR/7/1) with 25% redox features (5YR/6/8) over Red Parent Material (26-36cm 2.5YR/3/4) with 10% redox features (2.5YR/5/8)

WL10 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL10

WL10 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL10

WL10 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL10

WL10 Photo 8 – Displaying upland soils (15-30cm 7.5YR6/6) surrounding WL10

WL11 Photo 1 – Displaying typical shrub and tree vegetation for WL11

WL11 Photo 2 – Displaying typical shrub and tree vegetation for WL11

WL11 Photo 3 – Displaying typical herbaceous vegetation for WL11

WL11 Photo 4 – Displaying Red Parent Material (2.5YR/3/5) with 7% redox features (2.5YR/4/8) with water table at 40cm

WL11 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL11

WL11 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL11

WL11 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL11

WL11 Photo 8 – Displaying upland soils (11-20cm 5YR/8/1) surrounding WL11

WL12 Photo 1 – Displaying typical shrub and tree vegetation for WL12

WL12 Photo 2 – Displaying typical shrub and tree vegetation for WL12

WL12 Photo 3 – Displaying typical herbaceous vegetation for WL12

WL12 Photo 4 – Displaying Depleted Matrix (F3) soils (6-18cm 5YR/8/1) with 2% redox features (5YR/6/8) over Red Parent Material (F21) (19-40cm 2.5YR/4/4) with 6 % redox features (5YR/5/8)

WL12 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL12

WL12 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL12

WL12 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL12

WL12 Photo 8 – Displaying upland soils (11-24cm 2.5YR/3/1) over (25-33cm 2.5YR/6/8) surrounding WL12

WL13 Photo 1 – Displaying typical shrub and tree vegetation for WL13

WL13 Photo 2 – Displaying typical shrub and tree vegetation for WL13

WL13 Photo 3 – Displaying typical herbaceous vegetation for WL13

WL13 Photo 4 – Displaying Depleted Matrix (F3) soils (10-19cm 5YR/6/1) with 3% redox features (5YR/5/8) over 20-26cm 5YR/7/2 with 15% redox features (5YR/7/8), over Red Parent Material (F21) (27-40cm 2.5YR/3/4) with 10% redox features (2.5YR/5/8) for WL13

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WL13 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL13

WL13 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL13

WL13 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL13

WL13 Photo 8 – Displaying an eluviated upland layer (11-17cm 2/YR/8/1) over 18-40cm 2.5YR/4/4 surrounding WL13

WL14 Photo 1 – Displaying typical shrub and tree vegetation for WL14

WL14 Photo 2 – Displaying typical shrub and tree vegetation for WL14

WL14 Photo 3 – Displaying typical herbaceous vegetation for WL14

WL14 Photo 4 – Displaying Depleted Matrix (F3) soils at 13-26 cm with difficult redox features to determine, over Red Parent Material (F21) (27-43cm 2.5YR/2.5/4)

WL14 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL12

WL14 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL14

WL14 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL14

WL14 Photo 8 – Displaying upland soils (13-32cm 5YR/7/2; 33-40cm 2.5YR/4/4) surrounding WL14

WL15 Photo 1 – Displaying typical shrub and tree vegetation for WL15

WL15 Photo 2 – Displaying typical shrub and tree vegetation for WL15

WL15 Photo 3 – Displaying typical herbaceous vegetation for WL15

WL15 Photo 4 – Displaying Depleted Matrix (F3) (10-20cm 5YR/6/1) with 5% redox features (5YR/6/8) over Red Parent Material (21-40cm 2.5YR/5/4)

WL15 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL15

WL15 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL15

WL15 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL15

WL15 Photo 8 – Displaying upland soils (6-40cm 2.5YR/5/6) surrounding WL15

WL16 Photo 1 – Displaying typical shrub and tree vegetation for WL16

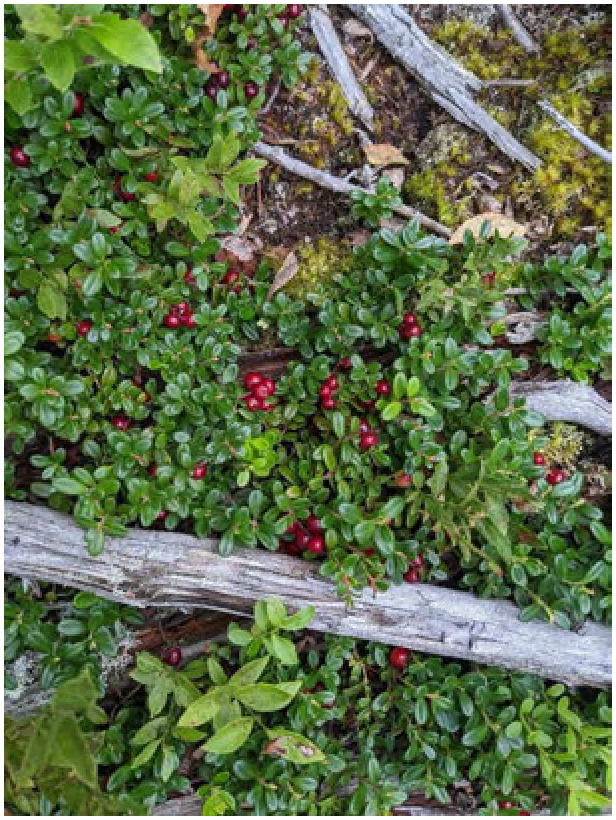
WL16 Photo 2 – Displaying typical shrub and tree vegetation for WL16


WL16 Photo 3 – Displaying typical herbaceous vegetation for WL16


WL16 Photo 4 – Displaying Histic Epipedon (A2) soils (21-40cm 5YR/7/1) with water table at 30cm

WL16 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL16

WL16 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL16



WL16 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL16

WL16 Photo 8 – Displaying upland soils (10-20cm 5YR/5/6; 21-28cm 5YR/5/6) surrounding WL16

WL17 Photo 1 – Displaying typical shrub and tree vegetation for WL17

WL17 Photo 2 – Displaying typical shrub and tree vegetation for WL17

WL17 Photo 3 – Displaying typical herbaceous vegetation for WL17

WL17 Photo 4 – Displaying Depleted Matrix (F3) (11-18cm 5YR/7/1) with 7% redox features (5YR/6/6) over Red Parent Material (19-40cm 2.5YR/5/4)

WL17 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL17

WL17 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL17

WL17 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL17

WL17 Photo 8 – Displaying upland soils (11-22cm 5YR/8/2; 23-40cm 2.5YR/4/6) surrounding WL17

WL18 Photo 1 – Displaying typical shrub and tree vegetation for WL18

WL18 Photo 2 – Displaying typical shrub and tree vegetation for WL18

WL18 Photo 3 – Displaying typical herbaceous vegetation for WL18

WL18 Photo 4 – Displaying Depleted Matrix (F3) (06-18cm 5YR/7/2) with 7% redox features (5YR/5/8) with a restrictive root layer at 18cm

WL18 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL18

WL18 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL18

WL18 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL18

WL18 Photo 8 – Displaying upland soils (08-35cm 2.5YR/3/3) surrounding WL18

WL19 Photo 1 – Displaying typical shrub and tree vegetation for WL19

WL19 Photo 2 – Displaying typical shrub and tree vegetation for WL19

WL19 Photo 3 – Displaying typical herbaceous vegetation for WL19

WL19 Photo 4 – Displaying Depleted Matrix (F3) (13-35cm 5YR/5/6) with 10% redox features (5YR/5/6) with water table at 12cm

WL19 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL19

WL19 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL19

WL19 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL19

WL19 Photo 8 – Displaying upland soils (11-17cm 5YR/7/2: 18-40cm 2.5YR/4/6) surrounding WL19

WL20 Photo 1 – Displaying typical shrub and tree vegetation for WL20

WL20 Photo 2 – Displaying typical shrub and tree vegetation for WL20

WL20 Photo 3 – Displaying typical herbaceous vegetation for WL20

WL20 Photo 4 – Displaying Red Parent Material (F21) soils (2.5YR/4/4) with 5% undetermined redox features and water table at 40cm for WL20

WL20 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL20

WL20 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL20

WL20 Photo 7 – Displaying typical upland herbaceous vegetation for WL20

WL20 Photo 8 – Displaying upland soils (6-40cm 2.5YR/4/4) surrounding WL20

WL21 Photo 1 – Displaying typical shrub and tree vegetation for WL21

WL21 Photo 2 – Displaying typical shrub and tree vegetation for WL21

WL21 Photo 3 – Displaying typical herbaceous vegetation for WL21

WL21 Photo 4 – Displaying Histosol (A1) soils (0-40cm 7.5YR/2.5/1) with water table at 30cm

WL21 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL21

WL21 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL21

WL21 Photo 7 – Displaying typical upland herbaceous vegetation for WL21

WL21 Photo 8 – Displaying upland soils (03-25cm 7.5YR/3/4; 26-40cm 2.5YR/4/4) surrounding WL21

WL22 Photo 1 – Displaying typical shrub and tree vegetation for WL22

WL22 Photo 2 – Displaying typical shrub and tree vegetation for WL22


WL22 Photo 3 – Displaying typical herbaceous vegetation for WL21


WL22 Photo 4 – Displaying Red Parent Material (F21) soils (03-25cm 5YR/3/3 with 5% undetermined redox features with water table at 15 cm

WL22 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL22

WL22 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL22

WL22 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL22

WL22 Photo 8 – Displaying upland soils (03-20cm 7.5YR/3/4; 21-35cm 2.5YR/3/5) surrounding WL22


WL23 Photo 1 – Displaying typical shrub and tree vegetation for WL23


WL23 Photo 2 – Displaying typical shrub and tree vegetation for WL23

WL23 Photo 3 – Displaying typical herbaceous vegetation for WL23

WL23 Photo 4 – Displaying Red Parent Material (F21) soils (03-25cm 5YR/3/4 with 5% undetermined redox features with water table at 25 cm

WL23 Photo 5 – Displaying typical upland shrub and tree vegetation surrounding WL23

WL23 Photo 6 – Displaying typical upland shrub and tree vegetation surrounding WL23

WL23 Photo 7 – Displaying typical upland herbaceous vegetation surrounding WL23

WL23 Photo 8 – Displaying upland soils (03-40cm 5YR/4/4) surrounding WL22

APPENDIX A – WETLAND DELINEATION FORMS

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: July 26, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): none Slope (%): ____ X coord: -64.095943 Y coord 46.959671

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Mature Mix Wood Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?** **Yes X No ____**
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: Wetland 1

Remarks: (Explain alternative procedures here or in a separate report.)

Red Parent Material

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Larix laricina*	30		FAC
2. *Picea glauca*	10		FAC
3.			
4.			
5.			
	40 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Alnus icana*	30		FACW
2. *Picea glauca*	5		FAC
3. *Acer rubrum*	3		FAC
4.			
5.			
6.			
	38 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Carex intumescens*	10		FAC
2. *Rubus pubescens*	30		FAC
3. *Maianthemum canadense*	40		FAC
4. *Solidago canadesis*	5		FAC
5. *Lysimachia borealis*	5		FAC
6.			
7.			
8.			
9.			
10.			
	90 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species9 That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 1(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	30	x 2 = 60
FAC species	138	x 3 = 414
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	168 (A)	474 (B)

Prevalence Index = B/A = 2.82

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	Organic							
13-28	10YR/4/2	90	5YR/4/6	10			san/loam	
29-37	5YR/4/6	100					san/loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)

___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
X__ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
X__ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes X____ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)

X__ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
X__ Drainage Patterns (B10)
X__ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X_____ No _____ Depth (cm): 5cm

Water Table Present? Yes ______ No X_____ Depth (cm): _______

Saturation Present? Yes ______ No X_____ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No _______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: July 26, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): none Slope (%): ____ X coord: -64.096861 Y coord 46.959945

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?** **Yes ____ No X**
Hydric Soil Present?	Yes ____ No X	
Wetland Hydrology Present?	Yes ____ No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer Rubrum*	5		FAC
2. *Betula papyrifera*	5		FACU
3.			
4.			
5.			
	10 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus trumloides*	10	Y	FAC
2. *Betula papyrifera*	5		FACU
3.			
4.			
5.			
6.			
	15 = Total Cover		

Herb Stratum (Plot size: 1)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Vacciniuim angustifolium*	10		FAC
2. *Chamerion angustifolium*	5		FAC
3. *Solidago canadensis*	5		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	____ = Total Cover		

Woody Vine Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	35	x 3 = 105
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	45 (A)	145 (B)

Prevalence Index = B/A = 3.22

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ____ No X**

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-15	Organic							
16-40	5YR/4/6	100					Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **Rock**

Depth (cm): **40cm**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No X Depth (cm): _______
Water Table Present? Yes ______ No X Depth (cm): _______
Saturation Present? Yes ______ No X Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Clear-cut

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: July 27, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Anqotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): none Slope (%): ____ X coord: -64.116218 Y coord 46.948709

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Shrub Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?** **Yes X No ____**
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: Wetland 2

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 15m)			
1. NA			
2.			
3.			
4.			
5.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Salix bebbiana*	60		FAC
2. *Alnus incana*	10	Y	FACW
3.			
4.			
5.			
6.			
= Total Cover	70		
Herb Stratum (Plot size: 1m)			
1. *Typha latifolia*	10		OBL
2. *Calamagrostis canadensis*	5		FACW
3. *Galium palustre*	15		FACW
4. *Eutrochium macalatum*	5		FACW
5. *Glyceria striata*	15		FACW
6. *Carex stipata*	15		OBL
7. *Carex pseudocyperus*	5		OBL
8.			
9.			
10.			
= Total Cover	60		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
= Total Cover			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species 30	x 1 = 30
FACW species 50	x 2 = 100
FAC species 60	x 3 = 180
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: 140 (A)	310 (B)

Prevalence Index = B/A = 2.21

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	Organic							
6 - 40	7.5YR/3/1	80	7.5YR/4/4	20	D	M	san/cla	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **Water**

Depth (cm): 25

Hydric Soil Present? Yes X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (cm): ___
Water Table Present? Yes ___ No X Depth (cm): ___
Saturation Present? Yes X No ___ Depth (cm): 25 (includes capillary fringe)

Wetland Hydrology Present? Yes X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: July 27, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Anqotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): none Slope (%): ____ X coord: -64.115730 Y coord 46.948265

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No ____ Hydric Soil Present? Yes ____ No ____ Wetland Hydrology Present? Yes ____ No ____	**Is the Sampled Area within a Wetland?** **Yes ____ No ____** If yes, optional Wetland Site ID: ____
Remarks: (Explain alternative procedures here or in a separate report.)	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. NA			
2.			
3.			
4.			
5.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Cornus sericea*	5		FACW
2.			
3.			
4.			
5.			
6.			
	5 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Phleum pratense*	40		FACU
2. *Solidago canadensis*	30		FAC
3. *Vicia cracca*	10		FAC
4. *Bellis perennis*	5		UPL
5. *Daucus carota*	15		FACU
6.			
7.			
8.			
9.			
10.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	= Total Cover		

Remarks: (Include photo numbers here or on a separate sheet.)

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	5	x 2 = 10
FAC species	40	x 3 = 120
FACU species	55	x 4 = 220
UPL species	5	x 5 = 25
Column Totals:	105 (A)	375 (B)

Prevalence Index = B/A = 3.57

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ____ No X**

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 5	Organic							
6 -25	7.5YR/4/2	100					san/loa	
26 – 35	7.5YR/4/4	100					san/loa	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No X Depth (cm): _______
Water Table Present? Yes ______ No X Depth (cm): _______
Saturation Present? Yes ______ No X Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: July 27, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Anqotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.135173 Y coord 46.938117

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Shrub Channel Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ________ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?** **Yes X No ____**
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: Wetland 3

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 15m)			
1. *Abies balsamea*	5		FAC
2. *Picea glauca*	5		FAC
3. *Populus tremuloides*	5		FAC
4.			
5.			
	15 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Salix bebbenia*	25		FAC
2. *Alnus incana*	50		FACW
3.			
4.			
5.			
6.			
	75 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Typha latifolia*	15		OBL
2. *Onoclea sensibilis*	10		FACW
3. *Galium palustre*	5		FACW
4. *Carex pseudocyperus*	5		OBL
5.			
6.			
7.			
8.			
9.			
10.			
	35 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)

Total Number of Dominant Species Across All Strata: ________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	15	x 1 = 15
FACW species	65	x 2 = 130
FAC species	40	x 3 = 120
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	120 (A)	265 (B)

Prevalence Index = B/A = 2.20

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
NA								

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **Water**

Depth (cm): **0**

Hydric Soil Present? Yes X____ No ________

Remarks: Water too high for proper soil pit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

X__ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X__ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X_____ No _____ Depth (cm): 10

Water Table Present? Yes ______ No ______ Depth (cm): _______

Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes X_____ No _______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: July 27, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ____

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.135322 Y coord 46.938285

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? **Yes ____ No X**

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Abies balsamea*	20		FAC
2. *Populus tremuloides*	25		FAC
3. *Picea glauca*	20		FAC
4.			
5.			
	65 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Abies balsamea*	10		FAC
2. *Acer rubrum*	5		FAC
3.			
4.			
5.			
6.			
	15 = Total Cover		
Herb Stratum (Plot size: 1m)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant1 Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	80	x 3 = 240
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	80 (A)	160 (B)

Prevalence Index = B/A = 3

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ____ No X**

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	Organic							
6-25	7.5YR/4/6	80					san/loa	
	5YR/5/4	20					san/loa	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______

Water Table Present? Yes ______ No ______ Depth (cm): _______

Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 3, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.166799 Y coord 46.938358

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Mature Mix Wood Discharge Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____ Hydric Soil Present? Yes X No ____ Wetland Hydrology Present? Yes X No ____	**Is the Sampled Area within a Wetland? Yes X No ____** If yes, optional Wetland Site ID: Wetland 4
Remarks: (Explain alternative procedures here or in a separate report.)	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Thuja occidentalis*	70		FACW
2. *Betula papyrifera*	10		FACU
3.			
4.			
5.			
	80 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Thuja occidentalis*	15		FACW
2. *Alnus incana*	05		FACW
3.			
4.			
5.			
6.			
	20 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Onoclea snesibilis*	10		FACW
2. *Circaea alpina*	05		FAC
3. *Rubus pubescens*	05		FAC
4. *Dryopteris intermedia*	05		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	25 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	100	x 2 = 200
FAC species	15	x 3 = 45
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	125 (A)	285 (B)

Prevalence Index = B/A = 2.28

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	Organic							
21-22	5YR/4/2	98	5YR/6/8	2	D	PL	san/loa	
23-55	7.5YR/4/4	100					sand	red parent material

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- X Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- X Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- **X** Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (cm): ___

Water Table Present? Yes ___ No ___ Depth (cm): ___

Saturation Present? (includes capillary fringe) Yes **X** No ___ Depth (cm): 30

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 3, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.166462 Y coord 46.938213

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: ________

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ________ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are “Normal Circumstances” present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** ____
Hydric Soil Present?	Yes ____ No X	
Wetland Hydrology Present?	Yes ____ No X	If yes, optional Wetland Site ID: ________

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	30		FAC
2. *Betula papyrifera*	30		FACU
3. *Populus tremuloides*	10		FAC
4.			
5.			
	70 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Abies balsamea*	20		FAC
2. *Acer rubrum*	05		FAC
3. *Rosa virginiana*	05		FAC
4.			
5.			
6.			
	30 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Cornus canadensis*	25		FAC
2. *Rubus pubescens*	10		FAC
3. *Linnaea borealis*	10		FAC
4. *Trientalis borealis*	10		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	55 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)

Total Number of Dominant Species Across All Strata: ________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	125	x 3 = 375
FACU species	30	x 4 = 120
UPL species		x 5 =
Column Totals:	155 (A)	495 (B)

Prevalence Index = B/A = 3.19

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	Organic							
7-50	2.5YR/4/6						san/loa	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 3, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.161004 Y coord 46.933856

Datum: WGS 84 Soil Map Unit Name/Type: ________ Wetland Type: Mature Mixed Wood Discharge Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ________ (If no, explain in Remarks.)

Are Vegetation ______, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation ______, Soil X, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?** **Yes X No ____**
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: Wetland 5

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Abies balsamea*	30		FAC
2. *Betula papyrifera*	05		FACU
3. *Acer rubrum*	10		FAC
4.			
5.			
	45 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Ilex mucronatus*	20		FAC
2. *Acer rubrum*	05		FAC
3. *Picea glauca*	10		FAC
4.			
5.			
6.			
	35 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Osmunda cinnamomea*	05		FAC
2. *Trientalis borrealis*	10		FAC
3. *Maianthemum canadense*	05		FAC
4. *Cornus canadensis*	05		FAC
5. *Carex disperma*	15		FACW
6. *Linnaea borrealis*	05		FAC
7.			
8.			
9.			
10.			
	45 = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)

Total Number of Dominant Species Across All Strata: ________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	15	x 2 = 30
FAC species	105	x 3 = 315
FACU species	05	x 4 = 20
UPL species		x 5 =
Column Totals:	125 (A)	365 (B)

Prevalence Index = B/A = 2.92

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- X Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-17	Organic							
18-26	5YR/8/1	97	5YR/6/8	3	D	PL	clay	
27-40	2.5YR/4/3	100					sand	red parent material

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
X Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **water**

Depth (cm): **40**

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (cm): ___
Water Table Present? Yes ___ No ___ Depth (cm): ___
Saturation Present? Yes X No ___ Depth (cm): 40 (includes capillary fringe)

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – NEW BRUNSWICK

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 3, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.160646 Y coord 46.933681

Datum: WGS 84 Soil Map Unit Name/Type: ________ Wetland Type: Forested Discharge Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ________ (If no, explain in Remarks.)

Are Vegetation ______, Soil X, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ______ No ______	**Is the Sampled Area within a Wetland?** **Yes ______ No ______**
Hydric Soil Present?	Yes ______ No ______	
Wetland Hydrology Present?	Yes ______ No ______	If yes, optional Wetland Site ID: ______

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Betula papyrifera*	15		FACU
2. *Sorbus americana*	10		FAC
3. *Abies balsamea*	30		FAC
4. *Acer rubrum*	15		FAC
5.			
	70 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Abies balamea*	10		FAC
2.			
3.			
4.			
5.			
6.			
	10 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Trientalis borealis*	10		FAC
2. *Athyrium filix-femina*	10		FAC
3. *Mainthemum canadense*	05		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	25 = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1. No woody vines			
2.			
	______ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)

Total Number of Dominant Species Across All Strata: ________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	90	x 3 = 270
FACU species	15	x 4 = 60
UPL species		x 5 =
Column Totals:	105 (A)	330 (B)

Prevalence Index = B/A = 3.14

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ____ No X**

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	Organic							
6-16	2.5YR/4/6	100					san/loa	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **Roots**

Depth (cm): **16**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 3, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.163710 Y coord 46.932152

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Hard Wood Forest Discharge Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ________ (If no, explain in Remarks.)

Are Vegetation ______, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ______, Soil X, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?** **Yes X No ____**
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: Wetland 6

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 15m)			
1. *Betula papyrifera*	20		FACU
2. *Acer rubrum*	20		FAC
3. *Populus tremuloides*	10		FAC
4. *Salix bebbiana*	10		FAC
5.			
	60 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Alnus incana*	20		FACW
2. *Cornus sericea*	10		FACW
3. *Salix bebbiana*	10		FAC
4. *Abies balsamea*	05		FAC
5.			
6.			
	45 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Doellingeria umbellata*	10		FAC
2. Glyceria striata	40		FACW
3. *Rubus pubescens*	15		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	55 = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)

Total Number of Dominant Species Across All Strata: ________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	70	x 2 = 140
FAC species	80	x 3 = 240
FACU species	20	x 4 = 80
UPL species		x 5 =
Column Totals:	170 (A)	460 (B)

Prevalence Index = B/A = 2.70

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-9	Organic							
10-17	2.5YR/6/1	80	5RY/6/8	20	D	PL	clay	
18-33	2.5YR/4/3	98	2.5YR/6/8	2	D	PL	loa/cla	red parent material

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- X Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes X____ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______

Water Table Present? Yes ______ No ______ Depth (cm): _______

Saturation Present? Yes **X** _____ No ______ Depth (cm): **33** (includes capillary fringe)

Wetland Hydrology Present? Yes X_____ No _______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 3, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.163115 Y coord 46.932378

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** ____
Hydric Soil Present?	Yes ____ No X	
Wetland Hydrology Present?	Yes ____ No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus tremuloides*	40	Y	FAC
2. *Betula papyrifera*	20	Y	FAC
3. *Acer rubrum*	40	Y	FAC
4.			
5.			
	100 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Iliex mucronata*	20	Y	FAC
2. *Viburnum lantanoides*	10	Y	FAC
3. *Abes balsamea*	10	Y	FAC
4. *Acer rubrum*	15	Y	FAC
5.			
6.			
	55 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Rubus pubescens*	05	Y	FAC
2. *Doellingeria umbellata*	15	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	20 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	175	x 3 = 525
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	175 (A)	525 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	5YR/4/6	100					san/loa	
17-27	5YR/5/6	100					san/loa	
28-45	2.5YR/3/6	100					san/loa	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ______ Depth (cm): ______
Water Table Present? Yes ______ No ______ Depth (cm): ______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 3, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.154973 Y coord 46.920995

Datum: WGS 84 Soil Map Unit Name/Type: ________ Wetland Type: Mature Mixed Wood Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ________ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ____	**Is the Sampled Area within a Wetland?** **Yes ____ No ____**
Hydric Soil Present?	Yes ____ No ____	
Wetland Hydrology Present?	Yes ____ No ____	If yes, optional Wetland Site ID: ________

Remarks: (Explain alternative procedures here or in a separate report.)

BEAVER DAM

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus americana*	15		FAC
2. *Betula papyrifera*	20		FACU
3. *Larix laricina*	20		FAC
4. *Thuja occidentalis*	15		FACW
5. *Abies balsamea*	10		FAC
	80 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Thuja occidentalis*	15		FACW
2. *Abies balsamea*	10		FAC
3. *Fraxinus americana*	05		FAC
4.			
5.			
6.			
	40 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Caltha palustris*	15		OBL
2. *Impatiens capensis*	15		FAC
3. *Rubus pubescens*	20		FAC
4. *Viola cucullata*	10		FAC
5. *Onoclea sensibilis*	10		FACW
6. *Ribes lacaustre*	05		FACW
7.			
8.			
9.			
10.			
	75 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)

Total Number of Dominant Species Across All Strata: ________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	15	x 1 = 15
FACW species	45	x 2 = 90
FAC species	95	x 3 = 285
FACU species	20	x 4 = 80
UPL species		x 5 =
Column Totals:	175 (A)	470 (B)

Prevalence Index = B/A = 2.68

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5 cm	Organics							
6-26	5YR/2.5/1	100					loa/cla	
27-45	Organic							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
X Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
X Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes X_____ No ______ Depth (cm): 5 (includes capillary fringe)

Wetland Hydrology Present? Yes X_____ No _______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 3, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.155044 Y coord 46.920773

Datum: WGS 84 Soil Map Unit Name/Type: ________ Wetland Type: ________

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ________ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? **Yes X No ____**

If yes, optional Wetland Site ID: ________

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Abies balsamea*	20	Y	FAC
2. *Betula papyrifera*	25	Y	FACU
3. *Acer rubrum*	05	Y	FAC
4. *Picaea gluacua*	05	Y	FAC
5. *Fraxinus americana*	05	Y	FAC
	60 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Abies balsama*	20	Y	FAC
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Herb Stratum (Plot size: 1m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Viburnum nudum*	15	Y	FAC
2. *Maianthemum canadense*	05	Y	FAC
3. *Trientalis borealis*	10	Y	FAC
4. *Maianthemum racemosum*	10	Y	FACU
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Woody Vine Stratum (Plot size: ________)	Absolute % Cover	Dominant Species?	Indicator Status
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)

Total Number of Dominant Species Across All Strata: ________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	60	x 3 = 180
FACU species	35	x 4 = 140
UPL species		x 5 =
Column Totals:	95 (A)	320 (B)

Prevalence Index = B/A = 3.37

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ____ No X**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-9	Organics							
10-47	2.5YR/4/6	100					san/loa	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 3, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.157938 Y coord 46.923465

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Mixed Wood Forest Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ________ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes **X** No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes **X** No ____	
Wetland Hydrology Present?	Yes **X** No ____	If yes, optional Wetland Site ID: Wetland 8

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picea mariana*	15		FACW
2. *Abies balsamea*	25		FAC
3. *Fraxinus americana*	05		FAC
4. *Acer rubrum*	10		FAC
5.			
	50 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Alnus incana*	15		FACW
2. *Corylus cornuta*	20		FAC
3. *Viburnum nudum*	15		FAC
4. *Sorbus americana*	05		FAC
5.			
6.			
	55 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Rubus pubescens*	20		FAC
2. *Cornus canadense*	30		FAC
3. *Equisetum sylvaticum*	10		FAC
4. *Linnea borealis*	10		FAC
5. *Carex diserma*	10		FACW
6. *Onoclea sensibilis*	10		FACW
7. *Dryopteris intermedia*	05		FAC
8.			
9.			
10.			
	95 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

- Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)
- Total Number of Dominant Species Across All Strata: ________ (B)
- Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	50	x 2 = 10
FAC species	155	x 3 = 465
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	205 (A)	475 (B)

Prevalence Index = B/A = 2.32

Hydrophytic Vegetation Indicators:

- X Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- X Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-13	Organic							
14-19	5YR/3/1	93	5YR/7/8	7	D	PL	san/cla	
20-30	5YR4/4	97	7.5YR/6/6	3	D	PL	san/cla	red parent material
31-43	2.5YR4/4	100						red parent material

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
X Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No X Depth (cm): _______
Water Table Present? Yes ______ No X Depth (cm): _______
Saturation Present? (includes capillary fringe) Yes X No ______ Depth (cm): 05

Wetland Hydrology Present? Yes X No ________

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 3, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.158080 Y coord 46.923203

Datum: WGS 84 Soil Map Unit Name/Type: ________ Wetland Type: ________

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No ________ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?** **Yes ____ No X**
Hydric Soil Present?	Yes ____ No X	
Wetland Hydrology Present?	Yes ____ No X	If yes, optional Wetland Site ID: ________

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Thuja occidentalis*	20		FACW
2. *Betula papyrifera*	10		FACU
3. *Acer rubrum*	10		FAC
4. *Abies balsamea*	15		FAC
5.			
	55 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Populus tremuloides*	05		FAC
2. *Corylus cornuta*	10		FAC
3. *Abies balsamea*	05		FAC
4.			
5.			
6.			
	20 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Aralia nudicaulis*	05		FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	05 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)

Total Number of Dominant Species Across All Strata: ________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	20	x 2 = 40
FAC species	45	x 3 = 125
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	75 (A)	205 (B)

Prevalence Index = B/A = 2.73

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-7	Organics							
8-17	5YR/5/6	100					san/loa	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **Roots**

Depth (cm): **17**

Hydric Soil Present? **Yes** ______ **No** **X**

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______

Water Table Present? Yes ______ No ______ Depth (cm): _______

Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? **Yes** ______ **No** **X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 4, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.160433 Y coord 46.923918

Datum: WGS 84 Soil Map Unit Name/Type: ________ Wetland Type: Sloped Hard Wood Forest Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ________ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ____	**Is the Sampled Area within a Wetland?** **Yes X No ____**
Hydric Soil Present?	Yes ____ No ____	
Wetland Hydrology Present?	Yes ____ No ____	If yes, optional Wetland Site ID: Wetland 9

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	70		FAC
2. *Betula papyrifera*	10		FACU
3. *Populus tremuloides*	20		FAC
4.			
5.			
	100 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Alnus incana*	40		FACW
2. *Viburnum nudum*	10		FAC
3. *Abies balsamea*	10		FAC
4.			
5.			
6.			
	60 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Dollingeria umbellata*	10		FAC
2. *Maianthemum trifolium*	15		OBL
3. *Impatiens capensis*	10		FAC
4. *Rubus pubescens*	10		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	45 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)

Total Number of Dominant Species Across All Strata: ________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	15	x 1 = 15
FACW species	40	x 2 = 80
FAC species	140	x 3 = 420
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	205 (A)	555 (B)

Prevalence Index = B/A = 2.71

Hydrophytic Vegetation Indicators:

- X Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- X Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-13	Organics							
14-22	5YR/7/1	98	5YR/7/8	2	D	PL	san/cla	
23-36	2.5YR/4/4	97	2.5YR/7/8	3	D	PL	san/cla	red parent material

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
X Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes X_____ No ______ Depth (cm): 14 (includes capillary fringe)

Wetland Hydrology Present? Yes X_____ No _______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 4, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.160117 Y coord 46.924085

Datum: WGS 84 Soil Map Unit Name/Type: ________ Wetland Type: ________

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ________ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____ No ____	
Wetland Hydrology Present?	Yes ____ No ____	If yes, optional Wetland Site ID: ________

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Betula papyrifera*	20		FACU
2. *Populus tremuloides*	30		FAC
3. *Acer rubrum*	30		FAC
4. *Abies balsamea*	10		FAC
5.			
	90 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Abies balsamea*	20		FAC
2. *Viburnum nudum*	15		FAC
3. *Acer rubrum*	10		FAC
4.			
5.			
6.			
	45 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Cornus canadensis*	10		FAC
2. *Maianthemum canadense*	15		FAC
3. *Dollingeria umbellata*	05		FAC
4. *Vaccinium angustifolium*	10		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	40 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)

Total Number of Dominant Species Across All Strata: ________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	155	x 3 = 465
FACU species	20	x 4 = 80
UPL species		x 5 =
Column Totals:	175 (A)	545 (B)

Prevalence Index = B/A = 3.11

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	Organics							
9-20	2.5YR/8/1	100					silty	
21-40	2.5YR/4/6	100					loa/silt	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______

Water Table Present? Yes ______ No ______ Depth (cm): _______

Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 5, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.157067 Y coord 46.925040

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Hard Wood Forest Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____ Hydric Soil Present? Yes X No ____ Wetland Hydrology Present? Yes X No ____	**Is the Sampled Area within a Wetland? Yes X No ____** If yes, optional Wetland Site ID: Wetland 10
Remarks: (Explain alternative procedures here or in a separate report.)	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Betula papyrifera*	05		FACU
2. *Populus tremuloides*	40		FAC
3. *Acer rubrum*	15		FAC
4.			
5.			
	60 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Thuja occidentalis*	05		FACW
2. *Acer balsamea*	10		FAC
3. *Acer rubrum*	15		FAC
4. *Cornus sericea*	20		FACW
5.			
6.			
	50 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Ribes lacustre*	10		FACW
2. *Rubus pubescens*	10		FAC
3. *Carex disperma*	10		FACW
4. *Galium palustre*	05		FACW
5. *Maianthemum canadense*	05		FAC
6. *Solidago canadensis*	05		FAC
7.			
8.			
9.			
10.			
	____ = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	50	x 2 = 100
FAC species	100	x 3 = 300
FACU species	05	x 4 = 20
UPL species		x 5 =
Column Totals:	155 (A)	420 (B)

Prevalence Index = B/A = 2.70

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	Organics							
21-25	5YR/7/1	75	5YR/6/8	25	D	PL	san/cla	
26-36	2.5YR/3/4	90	2.5YR/5/8	10	D	PL	san/cal	red parent material

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
X Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
X Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes X No ______ Depth (cm): 16 (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No _______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: August 5, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Anqotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ________ X coord: -64.156522 Y coord 46.925325

Datum: WGS 84 Soil Map Unit Name/Type: ________ Wetland Type: ________

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ________ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are “Normal Circumstances” present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No ____ Hydric Soil Present? Yes ____ No ____ Wetland Hydrology Present? Yes ____ No ____	**Is the Sampled Area within a Wetland? Yes ____ No ____** If yes, optional Wetland Site ID: ________

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Betula papyrifera*	20		FACU
2. *Populus tremuloides*	20		FAC
3. *Salix bebbiana*	10		FAC
4. *Fraxinus americana*	15		FAC
5.			
	55 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Abies balsamea*	05		FAC
2. *Corylus cornuta*	20		FAC
3. *Populus tremuloides*	15		FAC
4. *Viburnum nudum*	10		FAC
5.			
6.			
	50 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Aralia nudicaulis*	10		FAC
2. *Rubus pubescens*	15		FAC
3. *Solidago canadansis*	15		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	40 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)

Total Number of Dominant Species Across All Strata: ________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	135	x 3 = 405
FACU species	20	x 4 = 80
UPL species	155	x 5 = 485
Column Totals:	____ (A)	____ (B)

Prevalence Index = B/A = 3.13

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: ____________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-14							Organics	
15-30	7.5YR/6/6	100						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No _______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 12, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.156542 Y coord 46.925915

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Mixed Wood Forest Seepage Swamp w/Beaver Pond

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology X naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?** **Yes X No ____**
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: Wetland 11

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Thuja occidentalis*	55		FACW
2. *Picea marinea*	15		FACW
3. *Betula papyrifera*	10		FACU
4.			
5.			
	80 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Ilex mucronatus*	05		FAC
2. *Cornus sericea*	05		FACW
3. *Abies balsamea*	10		FAC
4. *Acer rubrum*	05		FAC
5.			
6.			
	25 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Carex brunnescens*	20		FAC
2. *Equisetum sylvaticum*	05		FAC
3. *Carex intumescens*	10		FAC
4. *Calamagrostis canadensis*	05		FACW
5. *Carex trisperma*	05		OBL
6.			
7.			
8.			
9.			
10.			
	45 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	05	x 1 = 05
FACW species	80	x 2 = 160
FAC species	55	x 3 = 165
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	150 (A)	370 (B)

Prevalence Index = B/A = 2.47

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-9	Organics							
10-18	5YR/4/1	100					cla/loa	
19-27	5YR7/1	95	5YR/7/8	5	D	PL	clay	
28-40	2.5YR3/5	93	2.5YR/4/8	3	D	PL	clay	red parent material

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
X__ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **Water**

Depth (cm): **40**

Hydric Soil Present? Yes X____ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
X__ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X__ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes X_____ No _____ Depth (cm): 40
Saturation Present? Yes ______ No X_____ Depth (cm): 10 (includes capillary fringe)

Wetland Hydrology Present? Yes X_____ No _______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 12, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.156272 Y coord 46.926126

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?** **Yes ____ No X**
Hydric Soil Present?	Yes ____ No X	
Wetland Hydrology Present?	Yes ____ No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Abies balsamea*	15		FAC
2. *Thuja occidentalis*	10		FACW
3. *Acer rubrum*	05		FAC
4. *Populus tremuloides*	10		FAC
5. *Picea glauca*	10		FAC
	50 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Abies balsamea*	05		FAC
2. *Acer rubrum*	05		FAC
3.			
4.			
5.			
6.			
	10 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Cornus canadense*	05		FAC
2. *Maianthemum canadense*	05		FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	10 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	10	x 2 = 20
FAC species	60	x 3 = 180
FACU species	70	x 4 = 200
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = 2.86

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	Organics							
11-20	5YR/8/1	100					sil/cla	eluviated layer

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **Root**

Depth (cm): **20**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 12, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.148712 Y coord 46.936638

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Herbaceous Seepage Swamp w/Beaver Pond

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology X naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland? Yes X No ____**
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: Wetland 12

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	20		FAC
2. *Betula populifolia*	10		FAC
3.			
4.			
5.			
	30 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Abies balsamea*	05		FAC
2. *Ilex verticillata*	05		FACW
3. *Sorbus americana*	03		FAC
4. *Populus tremuloides*	05		FAC
5.			
6.			
	18 = Total Cover		

Herb Stratum (Plot size: 1m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Vacciniium angustifolium*	10		FAC
2. *Juncus effusus*	25		FACW
3. *Scirpus expansus*	20		OBL
4. *Cornus canadensis*	10		FAC
5. *Doellingeria umbellata*	05		FAC
6. *Trientalis borealis*	05		FAC
7. *Symphyotrichum lateriflorum*	05		FAC
8.			
9.			
10.			
	80 = Total Cover		

Woody Vine Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. No woody vines			
2.			
	= Total Cover		

Remarks: (Include photo numbers here or on a separate sheet.)

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	20	x 1 = 20
FACW species	30	x 2 = 60
FAC species	78	x 3 = 234
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	128 (A)	314 (B)

Prevalence Index = B/A = 2.45

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	Organics							
6-18	5YR/8/1	98	5YR/6/8	2	D	M	sil/cla	
19-40	2.5YR/4/4	94	5YR/5/8	6	D	M	sil/cla	red parent material

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
X Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (cm): ____________

Hydric Soil Present? Yes X No ____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ____ Depth (cm): ____
Water Table Present? Yes ____ No ____ Depth (cm): ____
Saturation Present? Yes X No ____ Depth (cm): 6 (includes capillary fringe)

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 12, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): _____ Slope (%): ________ X coord: -64.148462 Y coord 46.936404

Datum: WGS 84 Soil Map Unit Name/Type: _____ Wetland Type: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology X significantly disturbed? Are “Normal Circumstances” present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology X naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____ No X	
Wetland Hydrology Present?	Yes ____ No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	10		FAC
2. *Betula populifolia*	30		FAC
3. *Abies balsamea*	05		FAC
4.			
5.			
	45 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Acer rubrum*	20		FAC
2. *Alnus incana*	05		FACW
3. *Viburnum nudum*	10		FAC
4.			
5.			
6.			
	25 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Cornus canadensis*	10		FAC
2. *Maianthemum canadense*	05		FAC
3. *Vaccinium myrtilloides*	10		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	25 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	05	x 2 = 10
FAC species	90	x 3 = 270
FACU species	95	x 4 = 280
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = 2.95

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- X Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-10	Organics							
11-24	2.5YR/3/1	100					sil/cla	eluviated layer
25-33	2.5YR/6/8	100					sil/cla	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 13, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Anqotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): _____ Slope (%): ________ X coord: -64.145882 Y coord 46.935113

Datum: WGS 84 Soil Map Unit Name/Type: _____ Wetland Type: Shrub Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ________ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ____	**Is the Sampled Area within a Wetland?** **Yes X No ____**
Hydric Soil Present?	Yes ____ No ____	
Wetland Hydrology Present?	Yes ____ No ____	If yes, optional Wetland Site ID: Wetland 13

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picea glauca*	15		FAC
2. *Abies balsamea*	05		FAC
3. *Betula populifolia*	05		FAC
4. *Thuja occidentalis*	05		FACW
5. *Sorbus americanis*	05		FAC
	35 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Alnus incana*	60		FACW
2. *Abies balsamea*	05		FAC
3. *Thuja occidentalis*	05		FAC
4. *Sorbus americana*	05		FAC
5.			
6.			
	75 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Onoclea sensibilis*	60		FACW
2. *Carex intumescens*	05		FAC
3. *Rubus pubescens*	05		FAC
4. *Equisetum sylvaticum*	05		FAC
5. *Solidago canadensis*	05		FAC
6. *Dryopteris intermedia*	03		FAC
7. *Doellingeria umbellata*	05		FAC
8.			
9.			
10.			
	90 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ________ (A)

Total Number of Dominant Species Across All Strata: ________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ________ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species 125	x 2 = 250
FAC species 73	x 3 = 219
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: 198 (A)	469 (B)

Prevalence Index = B/A = 2.37

Hydrophytic Vegetation Indicators:

- X Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- X Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(cm)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-9	Organics							
10-19	5YR/6/1	97	5YR/5/8	3	D	M	silty	
20-26	5YR/7/2	85	5YR/7/8	15	D	M	sil/cla	
27-40	2.5YR/3/4	90	2.5YR/5/8	10	D	M	clay	red parent material

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
_X_ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
_X_ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes X____ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
_X_ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___X Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______

Water Table Present? Yes ______ No ______ Depth (cm): _______

Saturation Present? (includes capillary fringe) Yes X_____ No ______ Depth (cm): 10

Wetland Hydrology Present? Yes X_____ No _______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 13, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.146262 Y coord 46.935037

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No
Hydric Soil Present?	Yes	No X
Wetland Hydrology Present?	Yes	No X

Is the Sampled Area within a Wetland? **Yes ____ No X**

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	10		FAC
2. *Picea glauca*	15		FAC
3. *Larix laricina*	10		FAC
4. *Abies balsamea*	10		FAC
5. *Betula populifolia*	10		FAC
	55 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Betula populifolia*	05		FAC
2. *Abies balsamea*	20		FAC
3. *Vibrunum nudum*	05		FAC
4.			
5.			
6.			
	30 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Linnaea borealis*	15		FAC
2. *Kalmia angustifolia*	05		FAC
3. *Maianthemum canadense*	05		FAC
4. *Cornus canadensis*	05		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	30 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	115	x 3 = 345
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	115 (A)	345 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ____ No X**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	Organics							
11-17	2.5YR/8/1	100					silty	eluviated layer
18-40	2.5YR/4/4	100					sil/cla	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ______ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 14, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): _____ Slope (%): _____ X coord: -64.145433 Y coord 46.932311

Datum: WGS 84 Soil Map Unit Name/Type: _____ Wetland Type: Riverine Swamp w/Beaver Pond

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil X, or Hydrology X naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ___ Hydric Soil Present? Yes X No ___ Wetland Hydrology Present? Yes X No ___	**Is the Sampled Area within a Wetland? Yes X No ___** If yes, optional Wetland Site ID: Wetland 14

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Larix laricina*	10		FAC
2. *Acer rubrum*	05		FAC
3. *Picea glauca*	10		FAC
4. *Thuja occidentalis*	05		FACW
5.			
	30 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Betula papyrifera*	05		FACU
2. *Cornus sericea*	05		FACW
3. *Vibrunum nudum*	05		FAC
4.			
5.			
6.			
	15 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Impatiens capensis*	30		FAC
2. *Typha latifolia*	10		OBL
3. *Solidago canadensis*	10		FAC
4. *Carex stricta*	15		OBL
5. *Galium palustre*	05		FACW
6.			
7.			
8.			
9.			
10.			
	70 = Total Cover		
Woody Vine Stratum (Plot size: ___)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	25	x 1 = 25
FACW species	15	x 2 = 30
FAC species	60	x 3 = 180
FACU species	05	x 4 = 20
UPL species		x 5 =
Column Totals:	105 (A)	230 (B)

Prevalence Index = B/A = 2.19

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12	Organics							
13-26	2.5YR/8/1						sil/cla	depleted cannot find redox
27-43	2.5YR/2.5/4						clay	red parent material & depleted but cannot find redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
X Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

X Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ______ Depth (cm): 50

Water Table Present? Yes X No ______ Depth (cm): 30

Saturation Present? Yes X No ______ Depth (cm): 13 (includes capillary fringe)

Wetland Hydrology Present? Yes X No _______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 14, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.145426 Y coord 46.932574

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	X	
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? Yes ____ No X

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Abies balsamea*	20		FAC
2. *Thuja occidentalis*	20		FACW
3. *Picea glauca*	10		FAC
4. *Acer rubrum*	05		FAC
5.			
	55 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Abies balsamea*	10		FAC
2.			
3.			
4.			
5.			
6.			
	10 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Trientalis borealis*	05		FAC
2. *Coptis trifolia*	05		FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	____ = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	20	x 2 = 40
FAC species	55	x 3 = 165
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	75 (A)	205 (B)

Prevalence Index = B/A = 2.75

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- X Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	Organics							
13-32	5YR/7/2	100					sil/cla	eluviated layer
33-40	2.5YR/4/4	100					sil/cla	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 14, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.144498 Y coord 46.936840

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Mixed Wood Forest Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?** **Yes X No ____**
Hydric Soil Present?	Yes X	No	
Wetland Hydrology Present?	Yes X	No	If yes, optional Wetland Site ID: Wetland 15

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Thuja occidentalis*	40		FACW
2. *Populus tremuloides*	15		FAC
3. *Acer rubrum*	10		FAC
4. *Abies balsamea*	10		FAC
5.			
	75 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Thuja occidentalis*	05		FACW
2. *Acer rubrum*	05		FAC
3. *Abies balsamea*	05		FAC
4.			
5.			
6.			
	15 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Onoclea sensibilis*	15		FACW
2. *Dryopteris intermedia*	05		FAC
3. *Maianthemum canadense*	05		FAC
4. *Trientalis borealis*	05		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	30 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	60	x 2 = 120
FAC species	60	x 3 = 180
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	120 (A)	300 (B)

Prevalence Index = B/A = 2.50

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-9	Organics							
10-20	5YR/6/1	95	5YR/6/8	5	D	M	silt	
21-40	2.5YR/5/4							too saturated to see redox
								red parent material

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- X Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **Water**

Depth (cm): **38**

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (cm): ___

Water Table Present? Yes X No ___ Depth (cm): 38

Saturation Present? Yes X No ___ Depth (cm): 10 (includes capillary fringe)

Wetland Hydrology Present? Yes ___ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 14, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.143999 Y coord 46.936520

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?** **Yes ____ No X**
Hydric Soil Present?	Yes ____ No X	
Wetland Hydrology Present?	Yes ____ No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	40		FAC
2. *Abies balsamea*	15		FAC
3. *Betula papyrifera*	20		FACU
4.			
5.			
	65 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Abies balsamea*	20		FAC
2. *Sorbus americana*	05		FAC
3.			
4.			
5.			
6.			
	25 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Cornus canadensis*	15		FAC
2. *Linnaea borealis*	05		FAC
3. *Aralia nudicaulis*	05		FAC
4. *Vaccinium angustifolium*	05		FAC
5. *Maianthemum canadense*	05		FAC
6.			
7.			
8.			
9.			
10.			
	35 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	115	x 3 = 345
FACU species	20	x 4 = 80
UPL species		x 5 =
Column Totals:	135 (A)	425 (B)

Prevalence Index = B/A = 3.14

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	Organics							
6-40	2.5YR/5/6	100					sil/san	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ______ Depth (cm): _______

Water Table Present? Yes ______ No ______ Depth (cm): _______

Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 15, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): _____ Slope (%): _____ X coord: -64.156701 Y coord 46.942570

Datum: WGS 84 Soil Map Unit Name/Type: _____ Wetland Type: Forested Seepage Swamp w/regen clearcuts

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil X, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No _____	**Is the Sampled Area within a Wetland?** **Yes X No _____**
Hydric Soil Present?	Yes X No _____	
Wetland Hydrology Present?	Yes X No _____	If yes, optional Wetland Site ID: Wetland 16

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus tremuloides*	05		FAC
2. *Acer rubrum*	05		FAC
3. *Betula populifolia*	05		FAC
4.			
5.			
	15 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Betula populifolia*	30		FAC
2. *Populus tremuloides*	10		FAC
3.			
4.			
5.			
6.			
	40 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Scirpus expansus*	30		OBL
2. *Calamagrostis canadensis*	10		FACW
3. *Hypericum perforatum*	05		FAC
4. *Solidago canadensis*	05		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	50 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species 30	x 1 = 30
FACW species 10	x 2 = 20
FAC species 65	x 3 = 195
FACU species	x 4 =
UPL species	x 5 =
Column Totals: 105 (A)	215 (B)

Prevalence Index = B/A = 2.05

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No _____**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	Organics							
21-40	5YR/7/1	100					san/cla	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- X Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **Water**

Depth (cm): **30**

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ___ Depth (cm): 80-100

Water Table Present? Yes X No ___ Depth (cm): 30

Saturation Present? Yes X No ___ Depth (cm): 5 (includes capillary fringe)

Wetland Hydrology Present? Yes ___ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 15, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Anqotumeg Landform (hillslope, terrace, etc.): NA

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.157202 Y coord 46.942852

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Regen Seepage Swamp w/forest

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No X	**Is the Sampled Area within a Wetland?** Yes ___ No X
Hydric Soil Present?	Yes ___ No X	
Wetland Hydrology Present?	Yes ___ No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. NA			
2.			
3.			
4.			
5.			
= Total Cover			

Sapling/Shrub Stratum (Plot size: 5m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus tremuloides*	60		FAC
2. *Betula populifolia*	15		FAC
3. *Alnus incana*	10		FACW
4. *Acer rubrum*	10		FAC
5.			
6.			
= Total Cover	95		

Herb Stratum (Plot size: 1m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Pteridium aquilinum*	20		FACU
2. *Rubus idaeus*	05		FAC
3. *Cornus canadensis*	30		FAC
4. *Solidago canadensis*	05		FAC
5. *Aralia nudicaulis*	05		FAC
6.			
7.			
8.			
9.			
10.			
= Total Cover	65		

Woody Vine Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. No woody vines			
2.			
= Total Cover			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	10	x 2 = 20
FAC species	130	x 3 = 390
FACU species	20	x 4 = 80
UPL species		x 5 =
Column Totals:	160 (A)	490 (B)

Prevalence Index = B/A = 3.06

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-9	Organics							
10-20	5YR/5/6	100					sil/loa	
21-28	5YR/5/6	100					sil/loa	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks: Very disturbed site

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ______ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 16, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ____

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.138229 Y coord 46.939851

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Shrub Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland? Yes X No ____**
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: Wetland 17

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus tremuloides*	20		FAC
2. *Acer rubrum*	05		FAC
3.			
4.			
5.			
	25 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Alnus incana*	50		FACW
2. *Ilex mucronatus*	05		FAC
3. *Sorbus americana*	05		FAC
4. *Abies balsamea*	05		FAC
5.			
6.			
	70 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Carex trisperma*	20		OBL
2. *Onoclea sensibilis*	05		FACW
3. *Dryopteris intermedia*	05		FAC
4. *Equisetum sylvaticum*	05		FAC
5. *Oclemena acuminata*	05		FACU
6.			
7.			
8.			
9.			
10.			
	40 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	20	x 1 = 20
FACW species	55	x 2 = 110
FAC species	30	x 3 = 90
FACU species	05	x 4 = 20
UPL species		x 5 =
Column Totals:	110 (A)	240 (B)

Prevalence Index = B/A = 2.18

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation
X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-10	Organics							
11-18	5YR/7/1	93	5YR/6/6	7	D	M	sil/san	
19-40	2.5YR/2.5/4						sand	red parent material & redox not seen as content color highly variable In sand

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- X Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (cm): ___

Water Table Present? Yes ___ No X Depth (cm): ___

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (cm): 11

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 16, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ____

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.138081 Y coord 46.939685

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____ No X	
Wetland Hydrology Present?	Yes ____ No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Abies balsamea*	30		FAC
2. *Populus tremuloides*	25		FAC
3. *Picea glauca*	10		FAC
4. *Betula papyrifera*	10		FACU
5. *Betula populifolia*	05		FAC
	80 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Abies balsamea*	10		FAC
2. *Acer rubrum*	05		FAC
3.			
4.			
5.			
6.			
	15 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Cornus canadensis*	05		FAC
2. *Vaccinium angustifolium*	05		FAC
3. *Aralia nudicalis*	05		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	15 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	100	x 3 = 300
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	110 (A)	340 (B)

Prevalence Index = B/A = 3.09

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(cm)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	Organics							
11-22	5YR/8/2	100					silty	
23-40	2.5YR/4/6	100					sil/cla	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No X Depth (cm): ______

Water Table Present? Yes ______ No X Depth (cm): ______

Saturation Present? Yes ______ No X Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 16, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ______

Local relief (concave, convex, none): ______ Slope (%): ______ X coord: -64.138858 Y coord 46.941844

Datum: WGS 84 Soil Map Unit Name/Type: ______ Wetland Type: Regen Herbaceous Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation ______, Soil X, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ______	**Is the Sampled Area within a Wetland? Yes X No ______**
Hydric Soil Present?	Yes X No ______	
Wetland Hydrology Present?	Yes X No ______	If yes, optional Wetland Site ID: Wetland 18

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	05		FAC
2. *Betula papyrifera*	05		FACU
3.			
4.			
5.			
	10 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Populus tremuloides*	15		FAC
2. *Betula populifera*	10		FAC
3. *Acer rubrum*	05		FAC
4.			
5.			
6.			
	30 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *scirpus expansus*	10		OBL
2. *Agrostis scabra*	50		FAC
3. *Solidago canadensis*	10		FAC
4. *Spiraea alba*	05		FAC
5. *Juncus effusus*	10		FACW
6.			
7.			
8.			
9.			
10.			
	85 = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	10	x 1 = 10
FACW species	10	x 2 = 20
FAC species	100	x 3 = 300
FACU species	05	x 4 = 20
UPL species		x 5 =
Column Totals:	125 (A)	350 (B)

Prevalence Index = B/A = 2.80

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ______

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-5	Organics							
6-18	5YR/7/2	93	5YR/5/8	7	D	M	sil/cla	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **Roots**

Depth (cm): 18

Hydric Soil Present? Yes ______ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No X Depth (cm): _______

Water Table Present? Yes ______ No X Depth (cm): _______

Saturation Present? Yes X No ______ Depth (cm): 6 (includes capillary fringe)

Wetland Hydrology Present? Yes X No _______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 16, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ______

Local relief (concave, convex, none): ______ Slope (%): ______ X coord: -64.139115 Y coord 46.941852

Datum: WGS 84 Soil Map Unit Name/Type: ______ Wetland Type: Regen Shrub Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil X, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ______	**Is the Sampled Area within a Wetland?** **Yes** ______ **No** X
Hydric Soil Present?	Yes ______ No X	
Wetland Hydrology Present?	Yes ______ No X	If yes, optional Wetland Site ID: ______

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	25	Y	FAC
2. *Populus tremuloides*	10	Y	FAC
3. *Betula populifolia*	05		FAC
4.			
5.			
	40 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Alnus incana*	05		FACW
2. *Sorbus americana*	10	Y	FAC
3. *Abies balsamea*	05		FAC
4. *Prunus serotina*	05		FAC
5. *Ilex mucronatus*	05		FAC
6.			
	30 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Rubus idaeus*	05		FAC
2. *Aralia nudicaulis*	05		FAC
3. *Solidago canadensis*	05		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	15 = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1. No woody vines			
2.			
	______ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	05	x 2 = 10
FAC species	75	x 3 = 225
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	80 (A)	235 (B)

Prevalence Index = B/A = 2.94

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ______ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-7	Organics							
8-35	2.5YR/3/3	100					silt	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 16, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ____

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.142056 Y coord 46.944230

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Shrub Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____ Hydric Soil Present? Yes X No ____ Wetland Hydrology Present? Yes X No ____	**Is the Sampled Area within a Wetland?** **Yes X No ____** If yes, optional Wetland Site ID: Wetland 19
Remarks: (Explain alternative procedures here or in a separate report.)	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	05		FAC
2. *Populus tremuloides*	05		FAC
3.			
4.			
5.			
	10 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Alnus incana*	60		FACW
2. *Sorbus americana*	05		FAC
3. *Salix bebbiana*	10		FAC
4. *Acer rubrum*	05		FAC
5.			
6.			
	80 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Hypericum perforatum*	05		FAC
2. *Equisetum sylvaticum*	05		FAC
3. *Cornus canadensis*	15		FAC
4. *Dryupteris intermedia*	05		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	30 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	60	x 2 = 120
FAC species	60	x 3 = 180
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	120 (A)	300 (B)

Prevalence Index = B/A = 2.50

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12							Organics	
13-35	5YR8/1	90	5YR/5/6	10	D	M	silt	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- X Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **Water**

Depth (cm): **12**

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (cm): ___

Water Table Present? Yes X No ___ Depth (cm): 12

Saturation Present? Yes X No ___ Depth (cm): 13 (includes capillary fringe)

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Sep 16, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire & Ryan Power Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ____

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.142709 Y coord 46.944379

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Shrub Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?** **Yes ____ No X**
Hydric Soil Present?	Yes ____ No X	
Wetland Hydrology Present?	Yes ____ No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	05		FAC
2.			
3.			
4.			
5.			
	05 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Acer rubrum*	10		FAC
2. *Vibrunum nudum*	15		FAC
3. *Populus tremuloides*	25		FAC
4. *Betula papyrifera*	10		FACU
5. *Sorbus americana*	05		FAC
6. *Alnus incana*	05		FACW
	65 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Cornus canadensis*	05		FAC
2. *Maianthemum canadanse*	05		FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	10 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	05	x 2 = 10
FAC species	70	x 3 = 210
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	85 (A)	260 (B)

Prevalence Index = B/A = 3.06

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ____ No X**

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	Organics							
11-17	5YR/7/2	100					sand	
18-40	2.5YR/4/6	100					sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Oct 18, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ______

Local relief (concave, convex, none): ______ Slope (%): ______ X coord: -64.099528 Y coord 46.961780

Datum: WGS 84 Soil Map Unit Name/Type: ______ Wetland Type: Shrub Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation ______, Soil X, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ______	**Is the Sampled Area within a Wetland? Yes X No ______**
Hydric Soil Present?	Yes X No ______	
Wetland Hydrology Present?	Yes X No ______	If yes, optional Wetland Site ID: Wetland 20

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picea mariana*	05		FACW
2. *Acer rubrum*	10		FAC
3.			
4.			
5.			
	15 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus incana*	30		FACW
2. *Cornus sericea*	15		FACW
3. *Ilex mucronatus*	05		FAC
4.			
5.			
6.			
	50 = Total Cover		

Herb Stratum (Plot size: 1m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carex intumescens*	20		FAC
2. *Dryopteris intermedia*	20		FAC
3. *Spiraea alba*	05		FAC
4. *Doellingeria umbellata*	05		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	50 = Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. No woody vines			
2.			
	______ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	50	x 2 = 100
FAC species	65	x 3 = 195
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	115 (A)	295 (B)

Prevalence Index = B/A = 2.57

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ______

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-5	Organic							
6-45	2.5YR/4/4	95						Redox too hard to see in red parent material from saturation

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
X Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (cm): ______

Hydric Soil Present? Yes X No ______

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No X Depth (cm): ______
Water Table Present? Yes X No ______ Depth (cm): 40
Saturation Present? Yes X No ______ Depth (cm): 6 (includes capillary fringe)

Wetland Hydrology Present? Yes X No ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Oct 18, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ______

Local relief (concave, convex, none): ______ Slope (%): ______ X coord: -64.099187 Y coord 46.961666

Datum: WGS 84 Soil Map Unit Name/Type: ______ Wetland Type: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ______	**Is the Sampled Area within a Wetland?** **Yes** ______ **No** X
Hydric Soil Present?	Yes ______ No X	
Wetland Hydrology Present?	Yes ______ No X	If yes, optional Wetland Site ID: ______

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	03		FAC
2.			
3.			
4.			
5.			
	03 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Populus balsameifera*	20		FACW
2. *Acer rubrum*	03		FAC
3. *Sorbus americana*	03		FAC
4.			
5.			
6.			
	26 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Symphyotrichum novi-belgii*	05		FAC
2. *Doellingeria umbellata*	10		FAC
3. *Eupatorium maculatum*	05		FACW
4. *Solidago canadesnsis*	05		FAC
5.			
6.			
7.			
8.			
9.			
10.			
	25 = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1. No woody vines			
2.			
	______ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	25	x 2 = 50
FAC species	29	x 3 = 87
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	54 (A)	137 (B)

Prevalence Index = B/A = 2.53

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ______

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5							Organic	
6-40	2.5YR/4/4	100					san/loa	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No X Depth (cm): _______
Water Table Present? Yes ______ No X Depth (cm): _______
Saturation Present? Yes ______ No X Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Oct 18, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ____

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.127105 Y coord 46.934253

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Shrub Seepage Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?** **Yes X No ____**
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: Wetland 21

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Larix laricina*	05		FAC
2. *Picea mariana*	05		FACW
3.			
4.			
5.			
	10 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix bebbiana*	30		FAC
2. *Cornus sericea*	15		FACW
3.			
4.			
5.			
6.			
	45 = Total Cover		

Herb Stratum (Plot size: 1m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Doellingeria umbellata*	20		FAC
2. *Onoclea sensibilis*	20		FACW
3. *Osmunda cinnamomea*	20		FAC
4. *Solidago canadensis*	10		FAC
5. *Equisetum sylvaticum*	10		FAC
6. *Typha latifolia*	20		OBL
7.			
8.			
9.			
10.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	20	x 1 = 20
FACW species	40	x 2 = 80
FAC species	95	x 3 = 285
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	155 (A)	385 (B)

Prevalence Index = B/A = 2.48

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-40	7.5YR/2.5/1	100						Organic heavy

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **Water**

Depth (cm): **30**

Hydric Soil Present? Yes X____ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X_____ No _____ Depth (cm): 50

Water Table Present? Yes X_____ No _____ Depth (cm): 30

Saturation Present? Yes X_____ No _____ Depth (cm): 5 (includes capillary fringe)

Wetland Hydrology Present? Yes X_____ No _______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Oct 18, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ____

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.126961 Y coord 46.934485

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____ No X	
Wetland Hydrology Present?	Yes ____ No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picaea glauca*	65	Y	FAC
2. *Betula papyrifera*	15	Y	FACU
3. *Salix bebbiana*	05		FAC
4.			
5.			
	85 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Picea glauca*	05		FAC
2. *Fraxinus americana*	05		FAC
3. *Alnus incana*	05		FACW
4.			
5.			
6.			
	15 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. **N/A**			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	____ = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	05	x 2 = 10
FAC species	80	x 3 = 240
FACU species	15	x 4 = 60
UPL species		x 5 =
Column Totals:	100 (A)	310 (B)

Prevalence Index = B/A = 3.10

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	Organics							
3-25	7.5 YR/3/4	100					sand	
26-40	2.5YR/4/4	100					san/loa	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Oct 18, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ____

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.126276 Y coord 46.948872

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Hard Wood Forest Riverine Swamp

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____ Hydric Soil Present? Yes X No ____ Wetland Hydrology Present? Yes X No ____	**Is the Sampled Area within a Wetland? Yes X No ____** If yes, optional Wetland Site ID: Wetland 22
Remarks: (Explain alternative procedures here or in a separate report.)	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Betula papyrifera*	10		FACU
2. *Bettula alleghaniensis*	05		FAC
3. *Fraxinus americana*	15		FAC
4. *Acer rubrum*	15		FAC
5.			
	45 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Alnus incana*	10		FACW
2. *Salix bebbiana*	20		FAC
3. *Acer rubrum*	10		FAC
4.			
5.			
6.			
	45 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Onoclea sensibilis*	20		FACW
2. *Osmunda cinnamomea*	20		FAC
3. *Doellingeria umbellata*	10		FAC
4. *Dryopteris intermedia*	05		FAC
5. *Equisetum sylvaticum*	05		FAC
6. *Glyceria striata*	05		FACW
7.			
8.			
9.			
10.			
	65 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	35	x 2 = 70
FAC species	105	x 3 = 315
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	140 (A)	385 (B)

Prevalence Index = B/A = 2.75

Hydrophytic Vegetation Indicators:

X Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	Organics							
3-25	5YR/3/3	95					san/loa	cant see redox due to saturation

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- X__ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______________________

Depth (cm): ______________________

Hydric Soil Present? **Yes** X____ **No** ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X__ Surface Water (A1)
- X__ High Water Table (A2)
- X__ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X__ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X____ No _____ Depth (cm): 50

Water Table Present? Yes X____ No _____ Depth (cm): 15

Saturation Present? (includes capillary fringe) Yes X____ No _____ Depth (cm): 3

Wetland Hydrology Present? **Yes** X____ **No** ________

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Oct 18, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ______

Local relief (concave, convex, none): ______ Slope (%): ______ X coord: -64.126553 Y coord 46.948876

Datum: WGS 84 Soil Map Unit Name/Type: ______ Wetland Type: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ______ No X	**Is the Sampled Area within a Wetland?** Yes ______ No X
Hydric Soil Present?	Yes ______ No X	
Wetland Hydrology Present?	Yes ______ No X	If yes, optional Wetland Site ID: ______

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer saccharum*	05		FACU
2. *Acer rubrum*	20		FAC
3. *Picea glauca*	05		FAC
4. *Abies balsamea*	15		FAC
5. *Betula papyrifera*	25		FACU
	30 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Abies balsamea*	20		FAC
2. *Picea glauca*	03		FAC
3.			
4.			
5.			
6.			
	23 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Dryopteris intermedia*	05		FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		
Woody Vine Stratum (Plot size: ______)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	48	x 3 = 144
FACU species	30	x 4 = 120
UPL species		x 5 =
Column Totals:	78 (A)	264 (B)

Prevalence Index = B/A = 3.38

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ______ No X

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	Organics							
3-20	7.5YR/3/4	100					san/sil	
21-35	2.5YR/3/5	100					san/sil	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No X Depth (cm): ______
Water Table Present? Yes ______ No X Depth (cm): ______
Saturation Present? Yes ______ No X Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Oct 19, 2022

Applicant/Owner: Invenergy Sampling Point: 1 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ______

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.132031 Y coord 46.944863

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Shrub Riverine Swamp w/Beaver Pond

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil X, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?** **Yes X No ____**
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: Wetland 23

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Betula papyrifera*	10		FACU
2. *Picea mariana*	05		FACW
3. *Thuja occidentalis*	05		FACW
4.			
5.			
	20 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Alnus incana*	55		FACW
2.			
3.			
4.			
5.			
6.			
	55 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Dryopteris intermedia*	10		FAC
2. *Onoclea sensibilis*	15		FACW
3. *Rubus pubescens*	10		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	35 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	80	x 2 = 160
FAC species	20	x 3 = 60
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	110 (A)	260 (B)

Prevalence Index = B/A = 2.36

Hydrophytic Vegetation Indicators:

- X Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- X Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No ____**

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 1 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	Organic							
3-25	5YR/3/4	95					san/sil	can't see redox due to saturation
36-40	5YR/4/4	100					san/sil	red parent material

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
X__ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______________________

Depth (cm): ______________________

Hydric Soil Present? Yes X____ No ________

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

X__ Surface Water (A1)
X__ High Water Table (A2)
X__ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
X__ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X_____ No _____ Depth (cm): 70-100

Water Table Present? Yes X_____ No _____ Depth (cm): 25

Saturation Present? Yes X_____ No _____ Depth (cm): 3 (includes capillary fringe)

Wetland Hydrology Present? Yes X_____ No ________

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – PRINCE EDWARD ISLAND

Project/Site: Skinners Pond Wind Municipality/County: Skinners Pond PEI Sampling Date: Oct 19, 2022

Applicant/Owner: Invenergy Sampling Point: 2 of 2

Investigator(s): Lyle Vicaire Affiliation: Maqamgiew Angotumeg Landform (hillslope, terrace, etc.): ____

Local relief (concave, convex, none): ____ Slope (%): ____ X coord: -64.132289 Y coord 46.944864

Datum: WGS 84 Soil Map Unit Name/Type: ____ Wetland Type: Shrub Riverine Swamp w/Beaver Pond

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No X Hydric Soil Present? Yes ____ No X Wetland Hydrology Present? Yes ____ No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15m)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Betula papyrifera*	30		FACU
2. *Picea glauca*	30		FAC
3. *Larix laricina*	10		FAC
4. *Acer rubrum*	03		FAC
5.			
	73 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. *Acer rubrum*	03		FAC
2. *Betula papyrifera*	05		FACU
3.			
4.			
5.			
6.			
	8 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. *Dryopteris intermedia*	05		FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	05 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. No woody vines			
2.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	51	x 3 = 153
FACU species	35	x 4 = 140
UPL species		x 5 =
Column Totals:	86 (A)	293 (B)

Prevalence Index = B/A = 3.41

Hydrophytic Vegetation Indicators:

- ___ Rapid Test for Hydrophytic Vegetation
- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

SOIL

Sampling Point: 2 of 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	Organics							
3-40	5YR/4/4	100					san/sil	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surfaces (S7)
___ Polyvalue Below Surface (S8)
___ Thin Dark Surface (S9)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ 5 c Mucky Peat or Peat (S3)
___ Iron-Manganese Masses (F12)
___ Piedmont Floodplain Soils (F19)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: **NA**

Depth (cm): **NA**

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No _____ Depth (cm): _______
Water Table Present? Yes ______ No ______ Depth (cm): _______
Saturation Present? Yes ______ No ______ Depth (cm): ____ (includes capillary fringe)

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Adapted from U.S. Army Corps of Engineers form for North Central and North East Region (Version 2.0), and Field Indicators for Identifying Hydric Soils in New England (Version 4.0) Supplement for use in New Brunswick (2019)

APPENDIX B – WETLAND FUNCTIONAL ASSESSMENT EXCEL SPREAD SHEETS

Cover Page: Basic Description of Assessment WESP-AC version 2	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5	Wetland 6	Wetland 7	Wetland 8	Wetland 9
Site Name:	Skinners Pond Wind Energy Center								
Investigator Name:	Lyle Vicaire & Ryan Power								
Date of Field Assessment:	July 26, 2022	July 27, 2022		August 03, 2022					
Nearest Town:	Skinners Pond, Prince Edward Island								
Latitude (decimal degrees):	46.959671	46.948709	46.938117	46.938358	46.933856	46.932152	46.920995	46.923465	46.923918
Longitude (decimal degrees):	-64.095943	-64.116218	-64.135173	-64.166799	-64.161004	-64.163710	-64.154973	-64.157938	-64.160433
Is a map based on a formal on-site wetland delineation available?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approximate size of the Assessment Area (AA, in hectares):	3.86	0.98	4.18	2.26	0.40	0.43	0.919	0.72	0.17
AA as percent of entire wetland (approx.). Attach sketch map if AA is smaller than the entire contiguous wetland.	70	40	90	80	100	100	50	100	100
What percent (approx.) of the **wetland** were you able to visit?	70	40	70	60	100	100	50	100	100
What percent (approx.) of the **AA** were you able to visit?	100	100	80	70	100	100	100	100	100
Were you able to ask the site owner/manager about any of the questions?	No	No	No	No	No	No	No	No	No
Indicate here if you intentionally surveyed for rare plants, calciphile plants, or rare animals:	No	No	No	No	No	No	No	No	No
Have you attended a WESP-AC training session? If so, indicate approximate month & year.	NA	NA	NA	NA	NA	NA	NA	NA	NA
How many wetlands have you assessed previously using WESP-AC? (approx.)	20	21	22	23	24	25	26	27	28

Cover Page: Basic Description of Assessment WESP-AC version 2	**Wetland 10**	**Wetland 11**	**Wetland 12**	**Wetland 13**	**Wetland 14**	**Wetland 15**	**Wetland 16**	**Wetland 17**	**Wetland 18**
Site Name:	Skinners Pond Wind Energy Center								
Investigator Name:	Lyle Vicaire & Ryan Power								
Date of Field Assessment:	August 05, 2022	September 12, 2022		September 13, 2022	September 14, 2022		September 15, 2022	September 15, 2022	September 16, 2022
Nearest Town:	Skinners Pond, Prince Edward Island								
Latitude (decimal degrees):	46.925040	46.925915	46.936638	46.935113	46.932311	46.936840	46.942570	46.939851	46.941844
Longitude (decimal degrees):	-64.157067	-64.156542	-64.148712	-64.145882	--64.145433	-64.144498	-64.156701	-64.138229	-64.138858
Is a map based on a formal on-site wetland delineation available?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approximate size of the Assessment Area (AA, in hectares):	0.25	7.25	5.74	1.82	3.75	0.52	2.11	0.16	0.06
AA as percent of entire wetland (approx.). Attach sketch map if AA is smaller than the entire contiguous wetland.	100	70	80	80	40	00	90	100	100
What percent (approx.) of the **wetland** were you able to visit?	100	40	60	80	40	100	90	100	100
What percent (approx.) of the **AA** were you able to visit?	100	75	80	100	100	100	100	100	100
Were you able to ask the site owner/manager about any of the questions?	No	No	No	No	No	No	No	No	No
Indicate here if you intentionally surveyed for rare plants, calciphile plants, or rare animals:	No	No	No	No	No	No	No	No	No
Have you attended a WESP-AC training session? If so, indicate approximate month & year.	NA	NA	NA	NA	NA	NA	NA	NA	NA
How many wetlands have you assessed previously using WESP-AC? (approx.)	29	30	31	32	33	34	35	36	37

Cover Page: Basic Description of Assessment WESP-AC version 2	Wetland 19	Wetland 20	Wetland 21	Wetland 22	Wetland 23
Site Name:	Skinners Pond Wind Energy Center				
Investigator Name:	Lyle Vicaire & Ryan Power				
Date of Field Assessment:	September 16, 2022	October 18, 2022			October 19, 2022
Nearest Town:	Skinners Pond, Prince Edward Island				
Latitude (decimal degrees):	46.944230	46.961780	46.934253	46.948872	46.944863
Longitude (decimal degrees):	-64.142056	-64.099528	-64.127105	-64.126276	-64.132031
Is a map based on a formal on-site wetland delineation available?	Yes	Yes	Yes	Yes	Yes
Approximate size of the Assessment Area (AA, in hectares):	1.80	0.51	0.80	0.41	1.00
AA as percent of entire wetland (approx.). Attach sketch map if AA is smaller than the entire contiguous wetland.	70	10	50	25	80
What percent (approx.) of the **wetland** were you able to visit?	70	10	50	25	80
What percent (approx.) of the **AA** were you able to visit?	100	100	100	100	100
Were you able to ask the site owner/manager about any of the questions?	No	No	No	No	No
Indicate here if you intentionally surveyed for rare plants, calciphile plants, or rare animals:	No	No	No	No	No
Have you attended a WESP-AC training session? If so, indicate approximate month & year.	NA	NA	NA	NA	NA
How many wetlands have you assessed previously using WESP-AC? (approx.)	38	39	40	41	42

Form OF (Office). Non-tidal Wetland Data Form. WESP-AC version 2 for New Brunswick wetlands only

#	Indicators	Condition Choices	WL1	WL2	WL3	WL4	WL5	WL6	WL7	WL8	WL9
OF1	Province	Mark the province in which the AA is located by changing the 0 in the column next to it to a "1". Mark only one.									
		New Brunswick	0	0	0	0	0	0	0	0	0
		Nova Scotia	0	0	0	0	0	0	0	0	0
		Prince Edward Island	1	1	1	1	1	1	1	1	1
		Newfoundland-Labrador	0	0	0	0	0	0	0	0	0
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:									
		<0.01 hectare (about 10 m x 10 m).	0	0	0	0	0	0	0	0	0
		0.01 - 0.1 hectare.	0	0	0	0	0	0	0	0	0
		0.1 - 1 hectare.	0	1	1	0	0	0	0	0	0
		1 to 10 hectares.	1	0	0	1	1	1	1	1	1
		10 to 100 hectares.	0	0	0	0	0	0	0	0	0
		>100 hectares.	0	0	0	0	0	0	0	0	0
OF3	Ponded Water & Wetland Within 1 km.	The area of wetlands and surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:									
		<0.01 hectare (about 10 m x 10 m).	0	0	0	0	0	0	0	0	0
		0.01 - 0.1 hectare.	0	0	0	0	0	0	0	0	0
		0.1 - 1 hectare.	1	0	0	0	0	0	0	0	0
		1 to 10 hectares.	0	1	1	0	0	0	0	1	0
		10 to 100 hectares.	0	0	0	1	1	1	1	0	1
		>100 hectares.	0	0	0	0	0	0	0	0	0
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:									
		<0.01 hectare (about 10 m x 10 m).	0	0	0	0	0	0	0	0	0
		0.01 - 0.1 hectare.	0	0	0	0	0	0	0	0	0
		0.1 - 1 hectare.	0	0	0	0	0	0	0	0	0
		1 to 10 hectares.	1	0	0	0	0	0	0	0	0
		10 to 100 hectares.	0	1	0	0	0	0	0	0	0
		100 to 1000 hectares.	0	0	1	1	1	1	1	1	1
		>1000 hectares. [*This is nearly always the answer in relatively undeveloped landscapes.*]	0	0	0	0	0	0	0	0	0

OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest *vegetated land* (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:									
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0	0	0	0	0	0	0	0	0
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	0	0	0	0	0	0	0	0
		50-500 m, and not separated.	0	0	0	0	0	0	0	0	0
		50-500 m, but separated by those features.	0	0	0	0	0	0	0	0	0
		0.5 - 5 km, and not separated.	0	0	0	0	0	0	0	0	0
		0.5 - 5 km, but separated by those features.	0	1	1	1	1	1	1	1	1
		None of the above (the closest patches or corridors which are that large are >5 km away).	1	0	0	0	0	0	0	0	0
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1	1	1	1	1	1	1	1	1
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	1	1	1	1	1	1	1	1	1
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:									
		<5% of the land.	0	0	0	0	0	0	0	0	0
		5 to 20% of the land.	0	0	0	0	0	0	0	0	0
		20 to 60% of the land.	1	1	1	1	1	1	1	1	1
		60 to 90% of the land.	0	0	0	0	0	0	0	0	0
		>90% of the land. SKIP to OF10.	0	0	0	0	0	0	0	0	0

OF9	Type of Land Cover Alteration	Within the 5-km radius circle, and ignoring all permanent water, the land area that is bare or non-perennial cover is mostly:									
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0	0	0	0	0	0	0
		Bare pervious surface, e.g., lawn, recent (<5 yrs ago) clearcut, dirt or gravel road, cropland, landslide, conifer plantation.	1	1	1	1	1	1	1	1	1
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:									
		<100 m.	0	0	0	0	0	0	0	0	0
		100 - 500 m.	0	0	0	0	0	0	0	0	0
		0.5- 1 km.	0	0	0	0	0	0	0	0	0
		1 - 5 km.	1	1	1	1	1	1	1	1	1
		>5 km.	0	0	0	0	0	0	0	0	0
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:									
		<10 m.	1	0	0	0	0	0	0	0	0
		10 - 25 m.	0	0	0	0	0	0	0	0	0
		25 - 50 m.	0	0	0	0	0	0	0	0	0
		50 - 100 m.	0	0	0	0	0	0	0	0	0
		100 - 500 m.	0	0	0	1	0	0	0	0	0
		>500 m.	0	1	1	0	1	1	1	1	1
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0	0	0	0	0	0	0	0	0
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:									
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0	0	0	0	0	0	0
		<50 m, but completely separated by those features.	0	0	0	0	0	0	0	0	0
		50-500 m, and not separated.	0	0	0	1	1	1	0	1	1
		50-500 m, but separated by those features.	0	0	0	0	0	0	0	0	0
		0.5 - 1 km, and not separated.	0	0	0	0	0	0	1	0	0
		0.5 - 1 km, but separated by those features.	0	0	0	0	0	0	0	0	0
		None of the above (the closest patches or corridors that large are >1 km away).	1	1	1	0	0	0	0	0	0
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:									
		<100 m.	0	0	0	0	0	0	0	0	0

		100 m - 1 km.	0	0	0	0	0	0	0	0	0
		1 -2 km.	0	1	0	0	0	0	0	0	0
		2-5 km.	1	0	1	1	1	1	1	1	1
		5-10 km.	0	0	0	0	0	0	0	0	0
		>10 km.	0	0	0	0	0	0	0	0	0
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:									
		<100 m.	0	0	0	0	0	0	0	0	0
		100 m - 1 km.	0	0	0	1	0	0	0	0	0
		1 - 5 km.	1	1	1	0	1	1	1	1	1
		5-10 km.	0	0	0	0	0	0	0	0	0
		10-40 km.	0	0	0	0	0	0	0	0	0
		>40 km.	0	0	0	0	0	0	0	0	0
OF16	Upland Edge Contact	Select one:									
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0	0	0	0	0	0	0	0	0
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0	0	0	0	0	0	0	0	0
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	0	0	0	0	0	0	0	0
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	0	0	0	0	0	0	0	0
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1	1	1	1	1	1	1	1	1
OF17	Flood Damage from Non-tidal Waters	Within 5 km downstream or downslope of the AA (select first true choice):									
		Maps show Flood Zone or Flood Risk areas and there appears to be infrastructure vulnerable to river flooding not caused by tidal storm surges.	0	0	0	0	0	0	0	0	0
		Maps show Flood Zone or Flood Risk areas, but infrastructure is absent or is not vulnerable to floods from a non-tidal river. In some cases levees, upriver dams, or other measures may partly limit damage or risk from smaller events.	0	0	0	0	0	0	0	0	0
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there appears to be infrastructure vulnerable to river flooding unrelated to tidal storm surges.	0	0	0	0	0	0	0	0	0
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there is no infrastructure vulnerable to river flooding unrelated to tidal storm surges.	1	1	1	1	1	1	1	1	1

OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NB_Watersheds KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).	0.80	0.75	0.43	0.35	0.35	0.32	0.40	0.28	0.22
OF19	Water Quality Sensitive Watershed or Area	In Google Earth, open the KMZ file NB_Watershed Protected Area which accompanies this calculator. The AA is within such an area. Enter 1= yes, 0= no.	0	0	0	0	0	0	0	0	0
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:									
		The condition is present within the AA.	0	0	0	0	0	0	0	0	0
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0	0	0	0	0	0	0	0	0
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0	0	0	0	0	0	0	0	0
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1	1	1	1	1	1	1	1	1
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:									
		The condition is present within 1 km downslope and connected to the AA by a channel.	0	0	0	0	0	0	0	0	0
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0	0	0	0	0	0	0	0	0
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0	0	0	0	0	0	0	0	0
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1	1	1	1	1	1	1	1	1
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:									
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate area.	0	0	0	0	1	1	0	0	0
		0.01 to 0.1.	1	1	1	1	0	0	1	1	1
		0.1 to 1.	0	0	0	0	0	0	0	0	0

		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	0	0	0	0	0	0	0	0
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :									
		<10%.	1	1	1	1	1	1	1	1	1
		10 to 25%.	0	0	0	0	0	0	0	0	0
		>25%.	0	0	0	0	0	0	0	0	0
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:									
		Mostly true.	0	0	0	0	0	0	0	0	0
		Somewhat true.	1	1	1	1	0	0	1	1	0
		Mostly untrue.	0	0	0	0	1	1	0	0	1
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:									
		Northward (N, NE). north-facing contributing area.	0	0	0	0	0	0	0	0	0
		Southward (S, SW). south-facing contributing area.	0	0	1	1	1	1	0	0	1
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	1	0	0	0	0	1	1	0
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:									
		<10 m.	0	0	0	0	0	0	0	0	0
		10 - 50 m.	0	0	0	0	1	1	0	0	1
		50 - 100 m.	0	0	0	0	0	0	1	1	0
		100 - 1000 m.	1	1	1	1	0	0	0	0	0
		1- 2 km.	0	0	0	0	0	0	0	0	0
		>2 km, or wetland lacks an inlet and outlet.	0	0	0	0	0	0	0	0	0
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NB-PEI_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up, enter the GRIDCODE in the next column.	2359	2359	2393	2393	2393	2393	2393	2393	2393
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [M*ark just the first choice that is true.]*:									

		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. In NB, consult Figure A-2 in Appendix A of the Manual. Contact local fishery biologists, review the ACCDC report, and visit these websites: http://www.salmonatlas.com/atlanticsalmon/canada-east/index.1.html http://atlanticsalmonfederation.org/rivers/introduction.html	0	0	0	0	0	0	0	0	0
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	0	0	0	0	0	0	0	0
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0	0	0	0	0	0	0	0	0
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	1	1	1	1	1	1	1	1	1
OF29	Species of Conservation Concern	Within the past 10 years, in the AA (or in its adjoining waters or wetland), qualified observers have documented *[mark all applicable*]:									
		Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer	0	0	0	0	0	0	0	0	0
		Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	0	0	0	0	0	0	0	0
		Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	0	0	0	0	0	0	0	0
		Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	0	0	0	0	0	1	0	0	0
		None of the above, or no data.	1	1	1	1	1	0	1	1	1
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0	0	0	0	0	0	0	0	0
OF31	Black Duck Nesting Area	In Google Earth, open the KMZ file that accompanies this calculator, called BlackDuck. Adjust its alignment and opacity. Determine the predicted density (pairs per 25 sq. km) of nesting American Black Duck in the AA's vicinity: <10 (enter 0), 10-20 (enter 1), 20-30 (enter 2), >30 (enter 3). If outside of region shown in map, change to blank.	0	0	0	0	0	0	0	0	0
OF32	Wintering Deer or Moose Concentration Areas	If AA is on private land with no information, change to blank (not 0). If on public/crown land, in Google Earth open the KMZ file that accompanies this report called NB_DeerWinteringAreas.Otherwise: Enter: yes= 1, no= 0.	0	0	0	0	0	0	0	0	0

OF33	Other Conservation Designation	With GeoNB, click on Candidate PNA Map Viewer to identify Provincially Significant Wetland, Environmentally Significant Area, Protected Natural Area -- but also include if the AA is all or part of an area designated by government, FIrst Nations, or the Nature Conservancy of Canada (NCC) for its exceptional ecological features or highly intact natural conditions. Enter: yes= 1, no= 0. If uncertain, consult NCC and agencies for more recent information.	0	0	0	0	0	0	0	0	0
OF34	Conservation Investment	The AA is part of or contiguous to a wetland on which public or private organizational funds were spent to preserve, create, restore, or enhance the wetland (excluding mitigation wetlands). Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank (not 0).	0	0	0	0	0	0	0	0	0
OF35	Mitigation Investment	The AA is all or part of a mitigation site used explicitly to offset impacts elsewhere. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0	0	0	0	0	0	0	0	0
OF36	Sustained Scientific Use	Plants, animals, or water in the AA have been monitored for >2 years, unrelated to any regulatory requirements, and data are available to the public. Or the AA is part of an area that has been designated by an agency or institution as a benchmark, reference, or status-trends monitoring area. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0	0	0	0	0	0	0	0	0
OF37	Calcareous Region	The AA is in an area that is at least partly underlain by soil, sediment, or bedrock that is highly calcareous (enter 3 in next column), moderately calcareous (enter 2), or slightly calcareous (enter 1), none= 0. Limestone is typically a major component (karst geology) and water is not acidic (pH is usually >8).See Figure A-6 in Appendix A of the Manual. If no map coverage, change to blank.	0	0	0	0	0	0	0	0	0
OF38	Ownership	Select the ONE ownership that covers the most of the AA. In Google Earth, open KMZ file called NB Crown lands.Use more recent information if available.									
		New timber harvest, roads, mineral extraction, and intensive summer recreation (e.g., off-road vehicles) are permanently prohibited. Includes many publicly-owned Protected Lands, and private lands under long-term (30+ year) legal agreements to maintain nearly-unaltered conditions.	0	0	0	0	0	0	0	0	0
		Ownership is public (e.g., municipal, Crown Reservations/Notations) but some or all of the above activities are allowed.	0	0	0	0	0	0	0	0	0
		Ownership is private but public access is allowed, and/or a shorter-term conservation easement (whether renewable or not) is in place.	0	0	0	0	0	0	0	0	0
		Ownership is private and owner does not allow access, or access permission unknown, and not a conservation easement.	1	1	1	1	1	1	1	1	1

Form OF (Office). Non-tidal Wetland Data Form. WESP-AC version 2 for New Brunswick wetlands only continued

#	WL10	WL11	WL12	WL13	WL14	WL15	WL16	WL17	WL18	WL19	WL20	WL21	WL22	WL23
OF1														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF2														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF3														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF4														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	1	1	1	1	1	1	1	1	1	1	1	1	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0

OF5														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	0	1	1	1
	0	0	0	0	0	0	0	0	0	0	1	0	0	0
OF6	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OF7	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OF8														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0

OF9														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OF10														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF11														
	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	0	1	1
OF12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF13														
	0	0	1	0	1	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	1	1	0	1	0	1	0	0	0	1	0	0	0	1
	0	0	0	0	0	0	0	1	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	1	0	1	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF14														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	0	0	1	0	0	1	0	1	1	1	1	0	0	1
	1	1	0	1	1	0	1	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF15														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	1	1	1	1	1	1	0	1	1	1	1	1	1	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF16														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OF17														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1

OF18	0.28	0.33	0.43	0.41	0.28	0.44	0.88	0.44	0.56	0.44	0.80	0.73	0.49	0.29
OF19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF20														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OF21														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OF22														
	0	0	0	1	0	1	0	0	1	0	0	0	0	0
	1	1	1	0	1	0	0	0	0	0	1	1	1	1
	0	0	0	0	0	0	1	1	0	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0

OF23														
	1	1	1	1	1	1	1	1	1	1	1	0	1	1
	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF24														
	0	0	1	0	0	0	0	0	0	0	1	1	1	0
	0	1	0	1	1	1	1	1	1	1	0	0	0	1
	1	0	0	0	0	0	0	0	0	0	0	0	0	0
OF25														
	0	0	0	0	0	0	0	0	1	1	1	1	0	0
	0	0	1	1	0	0	0	1	0	0	0	0	0	0
	1	1	0	0	1	0	1	0	0	0	0	0	1	1
OF26														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	1	0	1	1	0	1	0	0	0
	0	0	0	0	0	0	0	0	0	1	0	1	0	0
	0	1	1	1	0	0	1	0	0	0	0	0	1	1
	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF27	2393	2393	2393	2393	2393	2393	2393	2393	2393	2393	2513	2393	2393	2393
OF28														

	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OF29														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	0	1
OF30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF31	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF32	0	0		0	0	0	0	0	0	0	0	0	0	0
OF33	0	0	0	0	0	0	0	0	0	0	0	0	0	0

OF34	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF35	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF37	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OF38														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Form F (Field). Non-tidal Wetland Data Form. WESP-AC version 2 for New Brunswick wetlands only

#	Indicators	Condition Choices	WL1	WL2	WL3	WL4	WL5	WL6	WL7	WL8	WL9
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:									
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.									
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (*Carex rariflora*). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0	0	1	0	0	0	0
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	0	0	0	0	0	0	0	0
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:									
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	1	1	1	0	1	1	1	1
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	0	0	0	0	0	0	0	0
<u>Reminder</u>: For all questions, the AA should include all persistent waters in ponds smaller than 8 hectares (~283 m on a side) that are adjacent to the AA. The AA should also include part of the water area of adjacent ponded water larger than 8 ha and adjacent rivers wider than 20 m. Specifically, the AA should include the open water part adjacent to wetland vegetation and equal in width to the average width of that vegetated zone. Throughout this data form, "adjacent" is used synonymously with abutting, adjoining,											

bordering, contiguous -- and means no upland (manmade or natural) completely separates the described features along their directly shared edge. Features joined only by a channel are not necessarily considered to be adjacent -- a large portion of their edges must match. The features do not have to be hydrologically connected in order to be considered adjacent.											
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.									
		A1.	0	0	0	0	0	0	0	0	0
		A2.	0	0	0	0	0	0	0	0	0
		B1.	1	1	1	1	0	0	1	0	0
		B2.	0	0	0	0	0	0	0	0	0
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.									
		coniferous trees (may include tamarack) taller than 3 m.	3	0	3	4	3	1	3	3	1
		deciduous trees taller than 3 m.	3	0	3	2	2	4	3	2	5
		coniferous or ericaceous shrubs or trees 1-3 m tall not directly below the canopy of trees.	2	0	2	2	2	1	2	2	1
		deciduous shrubs or trees 1-3 m tall not directly below the canopy of trees.	2	4	2	2	1	2	2	2	2
		coniferous or ericaceous shrubs <1 m tall not directly below the canopy of taller vegetation.	2	0	2	2	1	1	2	2	1
		deciduous shrubs or trees <1 m tall (e.g., deciduous seedlings) not directly below the canopy of taller vegetation.	2	1	2	2	1	2	2	2	2
Note: If none of top 4 rows in F3 was marked 2 or greater, SKIP to F9 (N fixers).											
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:									
		those species together comprise > 50% of such cover.	1	1	1	1	1	1	1	1	1
		those species together do not comprise > 50% of such cover.	0	0	0	0	0	0	0	0	0
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.									
		coniferous, 1-9 cm diameter and >1 m tall.	1	0	1	1	1	1	1	1	1
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	1	1	1	1	1	1	1	1

		coniferous, 10-19 cm diameter.	1	0	1	1	1	0	1	1	0
		broad-leaved deciduous 10-19 cm diameter.	1	0	1	1	1	1	1	1	1
		coniferous, 20-40 cm diameter.	1	0	1	1	1	0	0	1	0
		broad-leaved deciduous 20-40 cm diameter.	1	0	1	0	0	0	1	0	0
		coniferous, >40 cm diameter.	0	0	1	1	0	0	0	0	0
		broad-leaved deciduous >40 cm diameter.	0	0	1	0	0	0	0	0	0
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:									
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.									
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	1	0	0	0	0	0	0	1	0
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	0	0	0	0	0	0	0	0
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:								0	
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	0	1	1	1	1	1	0	1
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	1	0	0	0	0	0	0	0
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:									
		None, or fewer than 8/ hectare which exceed this diameter.	0	1	0	0	0	1	0	0	1
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0	0	1	1	0	0	1	1	0
		Several (>8/hectare) but above not true.	1	0	0	0	1	0	0	0	0
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:									
		Few or none that meet these criteria.	0	1	0	0	0	1	0	0	1
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	1	0	1	1	1	0	1	1	0
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:									
		<1% or none.	0	0	0	0	1	0	0	0	0
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	1	0	1	0	1	1	1	0

		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	0	1	0	0	0	0	0	1
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	0	0	0	0	0	0	0	0
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	0	0	0	0	0	0	0	0
F10	Sphagnum Moss Extent	The cover of Sphagnum moss (or any moss that forms a dense cushion many centimeters thick), including the moss obscured by taller sedges and other plants rooted in it, is:									
		<5% of the vegetated part of the AA.	0	1	0	0	0	1	0	0	0
		5-25% of the vegetated part of the AA.	1	0	1	1	0	0	1	1	1
		25-50% of the vegetated part of the AA.	0	0	0	0	1	0	0	0	0
		50-95% of the vegetated part of the AA.	0	0	0	0	0	0	0	0	0
		>95% of the vegetated part of the AA.	0	0	0	0	0	0	0	0	0
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:									
		Little or no (<5%) *bare ground* is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	1	0	0	0	0	0	0	0
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	0	1	0	1	0	0	1	0
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	1	0	0	1	0	1	1	0	1
		Other conditions.	0	0	0	0	0	0	0	0	0
		Not applicable. Surface water (either open or obscured by emergent plants) covers all of the AA all the time.	0	0	0	0	0	0	0	0	0
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:									
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0	0	0	0	0	0	0
		Intermediate.	0	1	0	0	1	1	1	0	1
		Several (extensive micro-topography).	1	0	1	1	0	0	0	1	0
F13	Upland Inclusions	Within the AA, inclusions of upland are:									
		Few or none.	0	1	0	0	0	0	0	0	0

		Intermediate (1 - 10% of vegetated part of the AA).	1	0	1	1	1	1	1	1	1
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	0	0	0	0	0	0	0	0
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [*To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]*									
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	0	1	0	0	0	1	0	0
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0	0	1	1	1	1	1
		Deep Peat, to 40 cm depth or greater.	0	0	0	0	0	0	0	0	0
		Shallow Peat or organic <40 cm deep.	0	0	0	1	1	1	0	1	1
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1	0	0	0	0	1	1
F15	Shorebird Feeding Habitats	During any 2 consecutive weeks of the growing season, the extent of mudflats, bare unshaded saturated areas not covered by thatch, and unshaded waters shallower than 6 cm is: [Include also any area that is adjacent to the AA.]									
		None, or <100 sq. m.	1	1	1	1	1	1	0	1	1
		100-1000 sq. m.	0	0	0	0	0	0	1	0	0
		1000 – 10,000 sq. m.	0	0	0	0	0	0	0	0	0
		>10,000 sq. m.	0	0	0	0	0	0	0	0	0
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:									
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	0	0	0	0	0	1	0	0	1
		5-25% of the vegetated part of the AA.	0	0	0	0	1	0	0	0	0
		25-50% of the vegetated part of the AA.	1	1	1	1	0	0	1	1	0
		50-95% of the vegetated part of the AA.	0	0	0	0	0	0	0	0	0
		>95% of the vegetated part of the AA.	0	0	0	0	0	0	0	0	0
F17	Forb Cover	Within parts of the AA having herbaceous cover (excluding SAV), the areal cover of forbs reaches an annual maximum of:									
		<5% of the herbaceous part of the AA.	0	0	0	0	1	0	0	0	0
		5-25% of the herbaceous part of the AA.	0	1	1	1	0	0	0	0	0
		25-50% of the herbaceous part of the AA.	1	0	0	0	0	0	1	1	0
		50-95% of the herbaceous part of the AA.	0	0	0	0	0	0	0	0	0

		>95% of the herbaceous part of the AA.	0	0	0	0	0	0	0	0	0
F18	Sedge Cover	Sedges (*Carex* spp.) and cottongrass (*Eriophorum* spp.) occupy:									
		<5% of the vegetated area, or none.	0	0	0	1	0	0	0	0	0
		5-50% of the vegetated area.	1	1	1	0	1	0	1	1	0
		50-95% of the vegetated area.	0	0	0	0	0	0	0	0	0
		>95% of the vegetated area.	0	0	0	0	0	0	0	0	0
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:									
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1	0	1	0	0	0	0	1	0
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0	1	0	1	1	0	1	0	0
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.									
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	1	1	1	1	1	1	1	1	1
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	0	0	0	0	0	0	0	0	0
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	0	0	0	0	0	0	0	0
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0	0	0	0	0	0	0
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0	0	0	0	0	0	0
F21	Invasive Cover Along Upland Edge	Along the wetland-upland boundary, the percent of the upland edge (within 3 m upslope from the wetland) that is occupied by invasive plant species is:									
		none of the upland edge (invasives apparently absent), or AA has no upland edge.	1	1	1	1	1	1	1	1	1
		some (but <5%) of the upland edge.	0	0	0	0	0	0	0	0	0
		5-50% of the upland edge.	0	0	0	0	0	0	0	0	0
		most (>50%) of the upland edge.	0	0	0	0	0	0	0	0	0
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0	0	0	0	0	0	0	0	0
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0	0	0	0	0	0	0	0	0

F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:									
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	0	0	0	0	1	0	0	0
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	1	0	0	0	0	1	0	0
		25-50% of the AA never contains surface water.	0	0	1	1	0	0	0	0	0
		50-75% of the AA never contains surface water.	1	0	0	0	0	0	0	0	0
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	0	0	0	1	0	0	1	1
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0	0	0	0	0	0	0
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:									
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0	1	1	1	0	1	1
		1-20% of the AA.	1	1	0	0	0	0	0	0	0
		20-50% of the AA.	0	0	1	0	0	0	0	0	0
		50-95% of the AA.	0	0	0	0	0	0	1	0	0
		>95% of the AA. True for many fringe wetlands.	0	0	0	0	0	0	0	0	0
F26	% of Summertime Water that Is Shaded	At mid-day during the warmest time of year, the area of surface water within the AA that is shaded by vegetation and other features that are within the AA at that time is:									
		<5% of the water is shaded, or no surface water is present then.	0	0	0	0	0	0	0	0	0
		5-25% of the water is shaded.	0	0	0	0	0	0	0	0	0
		25-50% of the water is shaded.	0	0	0	0	0	0	1	0	0
		50-75% of the water is shaded.	0	0	1	0	0	0	0	0	0
		>75% of the water is shaded.	1	1	0	0	0	0	0	0	0
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:									
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0		1	1	0	1	1
		1-20% of the AA, or <1% but >0.01 ha.	1	1	0	0	0	0	0	0	0
		20-50% of the AA.	0	0	1	1	0	0	0	0	0
		50-95% of the AA.	0	0	0	0	0	0	1	0	0

		>95% of the AA.	0	0	0	0	0	0	0	0	0
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:									
		<10 cm change (stable or nearly so).	0	1	0	1	0	0	0	0	0
		10 cm - 50 cm change.	1	0	1	0	0	0	1	0	0
		0.5 - 1 m change.	0	0	0	0	0	0	0	0	0
		1-2 m change.	0	0	0	0	0	0	0	0	0
		>2 m change.	0	0	0	0	0	0	0	0	0
Is the AA plus adjacent ponded water smaller than 0.01 hectare (about 10m x 10m, or 1m x 100 m)? If so, enter "1" in column D and SKIP TO F42 (Connection).			0	0	0	0	0	0	0	0	0
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:									
		<10 cm deep (but >0).	0	1	0	1	1	1	0	1	1
		10 - 50 cm deep.	1	0	1	0	0	0	0	0	0
		0.5 - 1 m deep.	0	0	0	0	0	0	1	0	0
		1 - 2 m deep.	0	0	0	0	0	0	0	0	0
		>2 m deep. True for many fringe wetlands.	0	0	0	0	0	0	0	0	0
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):									
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question above).	1	1	0	1	1	1	0	1	1
		One depth class that comprises 50-90% of the AA's inundated area.	0	0	1	0	0	0	0	0	0
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	0	0	0	0	0	1	0	0
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:									
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to F34.	1	1	0	1	1	1	0	1	1
		5-30% of the water.	0	0	1	0	0	0	0	0	0
		30-70% of the water.	0	0	0	0	0	0	1	0	0
		70-95% of the water.	0	0	0	0	0	0	0	0	0
		>95% of the water.	0	0	0	0	0	0	0	0	0
F32	Ponded Open Water - Minimum Size	During most of the growing season, the largest patch of open water that is ponded and is in or bordering the AA is >0.01 hectare (about 10 m by 10 m) and mostly deeper than 0.5 m. If true enter "1" and continue, If false, enter "0" and SKIP to F41 (Floating Algae & Duckweed).	0	0	1	0	0	0	1	0	0

F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:									
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	0	0	0	0	0	0	0	0
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	0	0	0	0	0	0	0	0
		5-30% of the ponded water.	0	0	1	0	0	0	0	0	0
		30-70% of the ponded water.	0	0	0	0	0	0	1	0	0
		70-99% of the ponded water.	0	0	0	0	0	0	0	0	0
		100% of the ponded water.	0	0	0	0	0	0	0	0	0
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area <u>in the AA</u> that separates adjoining uplands from open water within the AA is:									
		<1 m.	0	0	0	0	0	0	0	0	0
		1 - 9 m.	0	0	0	0	0	0	0	0	0
		10 - 29 m.	0	0	0	0	0	0	1	0	0
		30 - 49 m.	0	0	1	0	0	0	0	0	0
		50 - 100 m.	0	0	0	0	0	0	0	0	0
		> 100 m, or open water is absent at that time.	0	0	0	0	0	0	0	0	0
F35	Flat Shoreline Extent	During most of the part of the growing season when water is present, the percentage of the AA's water edge length that is nearly flat (a slope less than about 5% measured within 5 m landward of the water) is:									
		<1% of the water edge.	0	0	0	0	0	0	0	0	0
		1-25% of the water edge.	0	0	0	0	0	0	0	0	0
		25-50% of the water edge.	0	0	0	0	0	0	0	0	0
		50-75% of the water edge.	0	0	0	0	0	0	0	0	0
		>75% of the water edge.	0	0	1	0	0	0	1	0	0
F36	Robust Emergents	The percentage of the emergent vegetation cover in the AA that is cattail (*Typha* spp.), common reed (*Phragmites*), or tall (>1m) bulrush is:									
		<1% of the emergent vegetation, or emergent vegetation is absent. SKIP to F38.	0	0	0	0	0	0	1	0	0
		1-25% of the emergent vegetation.	0	0	1	0	0	0	0	0	0
		25-75% of the emergent vegetation.	0	0	0	0	0	0	0	0	0
		>75%, of the emergent vegetation.	0	0	0	0	0	0	0	0	0

F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:									
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	0	0	0	0	0	0	0	0
		Intermediate.	0	0	0	0	0	0	0	0	0
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	0	0	0	0	0	0	0	0
F38	Persistent Deepwater Area	If the deepest patch of surface water (flowing or ponded) in or directly adjacent to the AA is mostly deeper than 0.5 m for >2 weeks during the growing season, enter "1" and continue. If not, enter "0" and SKIP to F42.(Connection).	0	0	1	0	0	0	1	0	0
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:									
		Little or none.	0	0	0	0	0	0	1	0	0
		Intermediate.	0	0	1	0	0	0	0	0	0
		Extensive.	0	0	0	0	0	0	0	0	0
F40	Isolated Island	The AA contains (or is part of) an island or beaver lodge within a lake, pond, or river, and is isolated from the shore by water depths >1 m on all sides during an average June. The island may be solid, or it may be a floating vegetation mat that is sufficiently large and dense to support a waterbird nest.	0	0	0	0	0	0	1	0	0
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0	0	0	0	0	0	0	0	0
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]									
		Persistent (surface water flows out for >9 months/year).	0	0	0	0	0	0	1	0	0
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	1	1	0	0	0	0	1	0
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	0	0	0	0	0	0	0	0

		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	0	0	0	0	0	0	0	0
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	1	0	0	1	1	1	0	0	1
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:									
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	0	1	0	0	0	1	0	0
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	0	1	0	0	0	0	0	0	0
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0	0	0	0	0	1	0
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	0	0	0	0	0	0	0	0	0
F45	Input Water Temperature	Based on lack of shade, water source characteristics, or actual temperature measurements, the inflow is likely to be warmer than surface water in the AA during part of most years. Enter 1= yes, 0= no.	0	0	0	0	0	0	0	0	0
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].									
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0	0	0	0	0	0	0
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	0	0	0	0	0	0	0	0	0
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	0	0	0	0	0	0	0	0
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	0	0	0	0	0	0	0	0
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	0	0	0	0	0	0	0	0
F47		The pH in most of the AA's surface water:									

	pH Measurement	Was measured, and is: [*enter the reading in the column to the right.*]									
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0	0	0	0	0	0	0	0	0
		Neither of above. Enter "1".	1	1	1	1	1	1	1	1	1
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):									
		TDS is: [*Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.*]									
		Conductivity is [*Enter the reading in µS/cm in the column to the right.*]									
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0	0	0	0	0	0	0	0	0
		Neither of above	1	1	1	1	1	1	1	1	1
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):									
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	0	0	0	0	0	0	1	0	0
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	0	1	0	0	0	0	0	0
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	1	1	0	1	1	1	0	1	1
F50	Groundwater Strength of Evidence	Select first applicable choice:									
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	0	0	0	0	0	0	0	0
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	0	0	0	0	0	0	0	0
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	1	1	1	1	1	1	1	1
F51		The gradient along most of the flow path within the AA is:							0		

	Internal Gradient	<2% or the AA has no surface water outlet (not even seasonally).	1	1	1	1	1	1	1	0	1
		2-5%.	0	0	0	0	0	0	0	1	0
		6-10%.	0	0	0	0	0	0	0	0	0
		>10%.	0	0	0	0	0	0	0	0	0
Note for the next three questions: If the AA lacks an upland edge, evaluate based on the AA's entire perimeter, and moving outward into whatever areas are adjacent. In many situations, these questions are best answered by measuring from aerial images.											
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:									
		<5%.	0	0	0	0	0	0	0	0	0
		5 to 30%.	0	0	0	0	0	0	0	0	0
		30 to 60%.	0	0	0	0	0	0	0	0	0
		60 to 90%.	1	0	0	1	0	0	0	0	0
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	1	1	0	1	1	1	1	1
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):									
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	1	0	0	0	0	0	0	0	0
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	0	1	0	1	0	0	0	0	0
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:									
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	1	1	0	1	0	0	0	0	0
		2-5%.	0	0	0	0	0	0	0	0	0
		5-30%.	0	0	0	0	0	0	0	0	0
		>30%.	0	0	0	0	0	0	0	0	0
F55	Cliffs or Steep Banks	In the AA or within 100 m, there are elevated terrestrial features such as cliffs, talus slopes, stream banks, or excavated pits (but not riprap) that extend at least 2 m nearly vertically, are unvegetated, and potentially contain crevices or other substrate suitable for nesting or den areas. Enter 1 (yes) or 0 (no).	0	0	0	0	0	0	0	0	0
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):									

		No.	1	0	0	0	0	0	0	0	0
		Yes, and created or expanded 20 - 100 years ago.	0	1	1	1	1	1	1	1	1
		Yes, and created or expanded 3-20 years ago.	0	0	0	0	0	0	0	0	0
		Yes, and created or expanded within last 3 years.	0	0	0	0	0	0	0	0	0
		Yes, but time of origin or expansion unknown.	0	0	0	0	0	0	0	0	0
		Unknown if new or expanded within 20 years or not.	0	0	0	0	0	0	0	0	0
F57	Burn History	More than 1% of the AA's previously vegetated area:									
		Burned within past 5 years.	0	0	0	0	0	0	0	0	0
		Burned 6-10 years ago.	0	0	0	0	0	0	0	0	0
		Burned 11-30 years ago.	0	0	0	0	0	0	0	0	0
		Burned >30 years ago, or no evidence of a burn and no data.	1	1	1	1	1	1	1	1	1
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:									
		<25%.	1	1	1	1	1	1	1	1	1
		25-50%.	0	0	0	0	0	0	0	0	0
		>50%.	0	0	0	0	0	0	0	0	0
F59	Non-consumptive Uses - Actual or Potential	Assuming access permission was granted, select ALL statements that are true of the AA as it currently exists:									
		For an average person, walking is physically possible <u>in</u> (not just near) >5% of the AA during most of the growing season, e.g., free of deep water and dense shrub thickets.	0	0	0	0	0	0	0	0	0
		Maintained roads, parking areas, or foot-trails are within 10 m of the AA, or the AA can be accessed part of the year by boats arriving via contiguous waters.	0	0	0	0	0	0	0	0	0
		Within or near the AA, there is an interpretive center, trails with interpretive signs or brochures, and/or regular guided interpretive tours.	0	0	0	0	0	0	0	0	0
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: *[Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]*									
		<5% and no inhabited building is within 100 m of the AA.	0	0	0	0	0	0	0	0	0
		<5% and inhabited building is within 100 m of the AA.	0	0	0	0	0	0	0	0	0
		5-50% and no inhabited building is within 100 m of the AA.	0	0	0	0	0	0	0	0	0
		5-50% and inhabited building is within 100 m of the AA.	0	0	0	0	0	0	0	0	0
		50-95%, with or without inhabited building nearby.	0	0	0	0	0	0	0	0	0

		>95% of the AA with or without inhabited building nearby.	1	1	1	1	1	1	1	1	1
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: *[See note above.]*									
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	1	1	1	1	1	1	1	1
		5-50%.	0	0	0	0	0	0	0	0	0
		50-95%.	0	0	0	0	0	0	0	0	0
		>95% of the AA.	0	0	0	0	0	0	0	0	0
F62	BMP - Soils	Boardwalks, paved trails, fences or other infrastructure and/or well-enforced regulations appear to effectively prevent visitors from walking on soil within nearly all of the AA when the soil is unfrozen. Enter "1" if true.	0	0	0	0	0	0	0	0	0
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0	0	0	0	0	0	0	0	0
F64	Consumptive Uses (Provisioning Services)	Recent evidence was found within the AA of the following potentially-sustainable consumptive uses. Select ALL that apply.									
		Low-impact commercial timber harvest (e.g., selective thinning).	0	0	0	0	0	0	0	0	0
		Commercial or traditional-use harvesting of native plants, their fruits, or mushrooms.	0	0	0	0	0	0	0	0	0
		Waterfowl hunting.	0	0	0	0	0	0	0	0	0
		Fishing.	0	0	0	0	0	0	0	0	0
		Trapping of furbearers.	0	0	0	0	0	0	0	0	0
		None of the above.	1	1	1	1	1	1	1	1	1
F65	Domestic Wells	The closest wells or water bodies that currently provide drinking water are:									
		Within 0-100 m. of the AA.	0	0	0	0	0	0	0	0	0
		100-500 m. away.	0	0	0	0	0	0	0	0	0
		>500 m. away, or no information.	1	1	1	1	1	1	1	1	1
F66	Calcareous Fen	The AA is, or is part of, a calcareous fen. See the Plants_Calcar worksheet in the accompanying SuppInfo file for list of plant indicators (calciphiles). Enter 1 If more than two Strong or more than five Moderate calciphile species are present; otherwise enter 0, but if not able to identify those and no information, change to blank.	0	0	0	0	0	0	0	0	0

Form F (Field). Non-tidal Wetland Data Form. WESP-AC version 2 for New Brunswick wetlands only continued

#	WL10	WL11	WL12	WL13	WL14	WL15	WL16	WL17	WL18	WL19	WL20	WL21	WL22	WL23
F1														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	1	1	0	0	0	0	1	0	0	0	
	1	1	0	0	0	1	1	1	0	0	1	0	0	
	0	0	1	0	0	0	0	0	1	0	0	1	1	
F2														
	0	0	1	1	0	0	0	0	0	0	0	0	0	
	0	0	0	0	1	0	0	0	0	1	0	0	0	
	0	1	0	1	1	0	1	0	0	0	1	0	0	
	0	0	0	0	0	0	0	0	0	0	0	1	1	
F3														
	1	4	2	2	3	4	2	2	2	2	2	2	2	
	5	2	3	2	2	3	2	3	2	2	2	2	3	
	1	2	2	2	2	2	2	2	2	2	1	2	2	
	3	2	2	2	2	2	2	2	2	3	3	2	2	
	1	2	2	1	2	2	2	1	2	2	1	2	2	
	2	2	2	1	2	2	2	1	2	2	2	2	2	

F4														
	1	0	0	1	1	1	1	1	1	1	1	1	1	
	0	1	1	0	0	0	0	0	0	0	0	0	0	
F5														
	1	1	1	1	1	1	1	1	1	1	1	1	1	
	1	1	1	1	1	1	1	1	1	1	1	1	1	
	0	1	1	1	1	1	1	1	0	1	1	1	1	
	1	1	1	1	1	1	1	1	0	1	1	0	1	
	0	1	1	1	1	1	0	1	0	1	1	1	0	
	0	1	1	0	1	1	0	1	0	1	1	0	1	
	0	1	0	0	1	1	0	0	0	0	0	1	0	
	0	0	0	0	1	1	0	1	0	0	0	0	1	
F6														
	0	0	1	0	1	0	1	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1	1	0	1		1	0	1	0	1	1	1	1	
	0	0	0	0	0	0	0	0	1	0	0	0	0	
F7														
	1	0	0	1	0	0	1	0	1	1	1	0	0	
	0	1	1	0	1	1	0	1	0	0	0	1	1	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F8														
	1	0	0	0	0	0	0	0	1	0	1	0	0	
	0	1	1	1	1	1	1	1	0	1	0	1	1	
F9														
	1	0	0	0	0	1	1	0	1	0	0	0	0	
	0	1	1	0	1	0	0	0	0	0	0	1	1	
	0	0	0	0	0	0	0	0	0	0	1	0	0	
	0	0	0	1	0	0	0	1	0	1	0	0	0	

	0	0	0	0	0	0	0	0	0	0	0	0	0	
F10														
	1	0	0	0	1	1	1	0	1	0	1	0	0	
	0	1	1	0	0	0	0	1	0	0	0	1	1	
	0	0	0	1	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	1	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F11														
	0	0	0	0	0	0	0	0	1	1	1	0	1	
	0	0	0	1	1	0	0	1	0	0	0	1	0	
	1	1	1	0	0	1	1	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F12														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1	0	0	1	0	1	0	1	1	0	1	0	0	
	0	1	1	0	1	0	1	0	0	1	0	1	1	
F13														
	0	0	0	0	0	0	0	0	0	0	0	0	1	
	1	1	0	1	1	0	1	1	1	1	1	1	0	
	0	0	1	0	0	1	0	0	0	0	0	0	0	
F14														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1	1	1	1	1	1	1	1	1	1	1	0	0	
	0	0	0	0	0	0	1	0	0	0	0	1	0	
	1	1	1	1	1	1	0	1	0	1	0	0	0	
	1	1	0	0	0	0	1	1	0	0	1	0	1	

F15														
	1	0	0	1	0	1	1	1	1	1	1	1	1	
	0	1	1	0	1	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F16														
	1	0	0	0	0	1	0	1	0	0	0	0	0	
	0	0	0	1	0	0	0	0	0	1	0	0	0	
	0	0	1	0	0	0	1	0	0	0	1	0	1	
	0	1	0	0	1	0	0	0	1	0	0	1	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F17														
	0	0	0	1	0	0	0	0	0	0	0	0	0	
	0	0	1	0	0	0	1	0	1	1	1	0	1	
	0	1	0	0	0	0	0	0	0	0	0	1	0	
	0	0	0	0	1	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F18														
	0	0	1	0	0	0	1	0	1	1	0	1	1	
	0	1	0	1	1	0	0	0	0	0	1	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F19														
	0	1	1	1	1	0	1	0	1	1	1	0	1	
	0	0	0	0	0	0	0	0	0	0	0	1	0	
F20														
	1	1	1	1	1	1	1	1	1	1	1	1	1	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F21														

	1	1	1	1	1	1	1	1	1	1	1	1	1	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F22	0	0	0	0	0	0	0	0	0	0	0	0	0	
F23	0	0	0	0	0	0	0	0	0	0	0	0	0	
F24														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	1	1	0	1	0	0	0	0	0	0	1	0	
	0	0	0	1	0	1	1	0	0	1	0	0	1	
	1	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	1	1	0	0	0	0	
F25														
	1	0	0	0	0	1	0	0	0	0	1	0	0	
	0	0	0	1	0	0	1	0	0	1	0	0	1	
	0	1	1	0	0	0	0	0	0	0	0	1	0	
	0	0	0	0	1	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F26														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	1	0	0	1	0	0	0	0	0	0	0	0	
	0	0	1	0	0	0	1	0	0	0	0	1	1	
	0	0	0	1	0	0	0	0	0	1	0	0	0	
F27														
	1	0	0	0	0	1	0	0	0	0	0	0	0	
	0	1	0	1	0	0	1	0	0	1	1	0	1	
	0	0	1	0	0	0	0	0	0	0	0	1	0	

	0	0	0	0	1	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F28														
	0	0	0	1	0	0	1	0	0	1	1	0	0	
	0	0	1	0	0	0	0	0	0	0	0	1	1	
	0	1	0	0	1	0	0	0	0	0	0	0	0	
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	0	0	0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	
F29														
	1	0	0	1	0	1	0	0	0	1	1	0	0	
	0	0	0	0	0	0	1	0	0	0	0	1	1	
	0	1	1	0	1	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F30														
	1	0	0	1	0	1	0	0	0	1	1	0	0	
	0	0	0	0	0	0	1	0	0	0	0	1	0	
	0	1	1	0	1	0	0	0	0	0	0	0	1	
F31														
	0	0	0	0	0	0	0	0	0	0	0	0	1	
	0	1	1	0	1	0	1	0	0	0	0	1	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F32	0	0	1	0	1	0	0	0	0	0	0	0	0	
F33														
	0	0	0	1	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	1	0	0	0	0	0	0	0	0	0	0	

	0	1	0	0	1	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F34														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	1	0	0	1	0	0	0	0	0	0	0	1	
	0	0	1	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F35														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	1	0	0	0	0	0	0	0	0	0	0	
	0	1	0	0	1	0	0	0	0	0	0	0	1	
F36														
	0	0	0	0	0	0	0	0	0	0	0	0	1	
	0	1	0	0	1	0	0	0	0	0	0	0	0	
	0	0	1	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F37														
	0	1	0	0	1	0	0	0	0	0	0	0	0	
	0	0	1	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F38	0	1	1	0	1	0	0	0	0	0	0	0	0	
F39														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	1	1	0	1	0	0	0	0	0	0	0	0	

	0	0	0	0	0	0	0	0	0	0	0	0	0	
F40	0	1	1	0	1	0	0	0	0	0	0	0	0	
F41	0	0	0	0	0	0	0	0	0	0	0	0	0	
F42														
	0	0	0	0	1	0	0	0	0	0	0	1	1	
	1	1	1	1	0	0	0	0	0	1	0	0	0	
	0	0	0	0	0	0	0	0	0	0	1	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	1	1	1	1	0	0	0	0	
F43														
	0	1	1	0	1	0	0	0	0	0	0	0	0	
	0	0	0	1	0	0	0	0	0	1	0	0	1	
	1	0	0	0	0	0	0	0	0	0	1	1	0	
F44	0	0	1	0	0	0	0	0	0	0	0	0	0	
F45	0	0	0	0	0	0	0	0	0	0	0	0	0	
F46														
	0	0	0	1	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	1	0	0	0	0	0	0	0	0	0	0	

	0	1	0	0	0	0	0	0	0	0	1	0	0	
F47														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1	1	1	1	1	1	1	1	1	1	1	1	1	
F48														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1	1	1	1	1	1	1	1	1	1	1	1	1	
F49														
	0	1	1	0	1	0	1	0	0	0	0	0	0	
	0	0	0	1	0	0	0	0	0	0	0	1	1	
	1	0	0	0	0	1	0	1	1	1	1	0	0	
F50														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1	1	1	1	1	1	1	1	1	1	1	1	1	
F51														
	1	1	1	1	0	1	1	1	1	1	1	1	1	
	0	0	0	0	1	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F52														

	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	1	0	
	0	0	0	0	0	0	0	0	1	0	0	0	1	
	1	1	1	1	1	1	1	1	0	1	1	0	0	
F53														
	0	0	0	0	0	0	0	0	0	0	0	1	0	
	0	0	0	0	0	0	0	0	1	0	0	0	1	
F54														
	0	0	0	0	0	0	0	0	1	0	0	0	1	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	1	0	
F55	0	0	0	0	0	0	0	0	0	0	0	0	0	
F56														
	0	0	0	0	0	0	0	1	0	0	1	1	1	
	1	1	0	1	1	1	1	0	1	1	0	0	0	
	0	0	1	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F57														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1	1	1	1	1	1	1	1	1	1	1	1	1	
F58														
	1	1	1	1	1	1	1	1	1	1	1	1	1	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F59														

	0	0	0	0	0	0	0	0	0	0	0	0	1	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F60														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	1	0	
	1	1	1	1	1	1	1	1	1	1	1	0	1	
F61														
	1	1	1	1	1	1	1	1	1	1	1	1	1	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
F62	0	0	0	0	0	0	0	0	0	0	0	0	0	
F63	0	0	0	0	0	0	0	0	0	0	0	0	0	
F64														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1	1	0	1	1	1	1	1	1	0	1	1	1	
F65														
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1	1	1	1	1	1	1	1	1	0	0	1	1	

F66	0	0	0	0	0	0	0	0	0	0	0	0	0	

Stressor (S) Data Form for Non-Tidal Wetlands. WESP-AC for New Brunswick. Version 2.					WL1	WL2	WL3	WL4	WL5	WL6	WL7	WL8	WL9
S1	**Aberrant Timing of Water Inputs**												
	In the last column, place a check mark next to any item that is likely to have caused the timing of water inputs (but not necessarily their volume) to shift by hours, days, or weeks, becoming either more muted (smaller or less frequent peaks spread over longer times, more temporal homogeneity of flow or water levels) or more flashy (larger or more frequent spikes but over shorter times). [FA, FR, INV, PH, STR]												
	Stormwater from impervious surfaces that drains directly to the wetland.				1		1	1					
	Water subsidies from wastewater effluent, septic system leakage, snow storage areas, or irrigation.												
	Regular removal of surface or groundwater for irrigation or other consumptive use.												
	Flow regulation in tributaries or water level regulation in adjoining water body, or other control structure at water entry points that regulates inflow to the wetland.												
	A dam, dike, levee, weir, berm, or fill -- within or downgradient from the wetland -- that interferes with surface or subsurface flow in/out of the AA (e.g., road fill, wellpads, pipelines).										1	1	
	Excavation within the wetland, e.g., dugout, artificial pond, dead-end ditch.												
	Artificial drains or ditches in or near the wetland.						1		1	1	1	1	
	Accelerated downcutting or channelization of an adjacent or internal channel (incised below the historical water table level).												
	Logging within the wetland.						1		1	1	1	1	1
	Subsidence or compaction of the wetland's substrate as a result of machinery, livestock, fire, drainage, or off road vehicles.												
	Straightening, ditching, dredging, and/or lining of tributary channels.												1
	If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items had no measurable effect on the timing of water conditions in any part of the AA, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.												
		Severe (3 points)		Mild (1 point)									
	Spatial extent of timing shift within the wetland:	>95% of wetland.	0	<5% of wetland.	1	0	2	1	2	1	2	2	2
	When most of the timing shift began:	<3 yrs ago.	0	10-100 yrs ago.	1	0	1	1	1	1	1	1	1
	Score the following 2 rows only if the altered inputs began within past 10 years, and only for the part of the wetland that experiences those.												
	Input timing now vs. previously:	Shift of weeks.	0	Shift of hours or minutes.	0	0	0	0	0	0	0	0	0
	Flashiness or muting:	Became very flashy or controlled.	0	Became mildly flashy or controlled.	0	0	0	0	0	0	0	0	0
	Sum=				2	0	3	2	3	2	3	3	3
				Stressor subscore=	0.00	0.00	0.25	0.17	0.25	0.17	0.25	0.25	0.25

S2	**Accelerated Inputs of Contaminants and/or Salts**												
	In the last column, place a check mark next to any item -- occurring in either the wetland or its CA -- that is likely to have accelerated the inputs of contaminants or salts to the AA. [AM, FA, PH, POL, STR]												
	Stormwater or wastewater effluent (including failing septic systems), landfills, industrial facilities.												
	Metals & chemical wastes from mining, shooting ranges, snow storage areas, oil/ gas extraction, other sources (download many locations from National Pollutant Release Inventory and view KMZ overlay in Google Earth. https://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=B85A1846-1							1					
	Road salt.				1			1					
	Spraying of pesticides, as applied to lawns, croplands, roadsides, or other areas in the CA.					1	1		1	1	1	1	1
	If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not cumulatively expose the AA to significantly higher levels of contaminants and/or salts, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.												
		Severe (3 points)		Mild (1 point)									
	Usual toxicity of most toxic contaminants:	Industrial effluent, mining waste, unmanaged landfill.	2	Low density residential.	1	2	2	2	2	2	2	2	2
	Frequency & duration of input:	Frequent and year-round.	2	Infrequent & during high runoff events mainly.	1	2	1	1	2	2	2	2	2
	AA proximity to main sources (actual or potential):	0 - 15 m.	2	In more distant part of contributing area.	3	2	1	2	1	1	1	1	1
	Sum=				5	6	4	5	5	5	5	5	5
				Stressor subscore=	0.56	0.67	0.44	0.56	0.56	0.56	0.56	0.56	0.56
S3	**Accelerated Inputs of Nutrients**												
	In the last column, place a check mark next to any item -- occurring in either the wetland or its CA -- that is likely to have accelerated the inputs of nutrients to the wetland. [NRv, PRv, STR]												
	Stormwater or wastewater effluent (including failing septic systems), landfills.												
	Fertilizers applied to lawns, ag lands, or other areas in the CA.				1		1	1	1	1	1	1	1
	Livestock, dogs.				1		1	1		1	1	1	1
	Artificial drainage of upslope lands.				1	1	1			1	1	1	
	If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not cumulatively expose the AA to significantly more nutrients, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.												
		Severe (3 points)		Mild (1 point)									
	Type of loading:	High density of unmaintained septic, some types of industrial sources.	2	Livestock, pets, low density residential.	2	2	2	1	2	2	2	2	2

	Frequency & duration of input:	Frequent and year-round.	2	Infrequent & during high runoff events mainly.	3	2	2	1	2	2	2	2	2
	AA proximity to main sources (actual or potential):	0 - 15 m.	2	In more distant part of contributing area.	2	2	1	2	1	1	1	1	1
	Sum=				7	6	5	4	5	5	5	5	5
				Stressor subscore=	0.67	0.67	0.56	0.44	0.56	0.56	0.56	0.56	0.56
S4	**Excessive Sediment Loading *from Contributing Area***												
	In the last column, place a check mark next to any item present in the CA that is likely to have elevated the load of waterborne or windborne sediment reaching the wetland from its CA. [FA, FR, INV, PH, SRv, STR]												
	Erosion from plowed fields, fill, timber harvest, dirt roads, vegetation clearing, fires.				1	1	1	1	1	1	1	1	1
	Erosion from construction, in-channel machinery in the CA.												
	Erosion from off-road vehicles in the CA.				1	1	1						
	Erosion from livestock or foot traffic in the CA.				1	1		1	1	1	1	1	1
	Stormwater or wastewater effluent.				1	1							
	Sediment from road sanding, gravel mining, other mining, oil/ gas extraction.						1						1
	Accelerated channel downcutting or headcutting of tributaries due to altered land use.												
	Other human-related disturbances within the CA.				1	1							
	If any items were checked above, then for each row of the table below, assign points (3, 2, or 1 as shown in header) in the last column. However, if you believe the checked items did not cumulatively add significantly more sediment or suspended solids to the AA, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.												
		Severe (3 points)		Mild (1 point)									
	Erosion in CA:	Extensive evidence, high intensity.*	1	Potentially (based on low-intensity* land use) with little or no direct evidence.	1	1	1	1	1	1	2	2	1
	Recentness of significant soil disturbance in the CA:	Current & ongoing.	1	>1 yr ago.	1	1	1	1	1	1	1	1	1
	Duration of sediment inputs to the wetland:	Frequent and year-round.	1	Infrequent & during high runoff events mainly.	1	1	1	1	1	1	2	2	1
	AA proximity to actual or potential sources:	0 - 15 m.	2	In more distant part of contributing area.	2	2	1	3	1	1	1	1	1
	* high-intensity= extensive off-road vehicle use, plowing, grading, excavation, erosion with or without veg removal; low-intensity= veg removal only with little or no apparent erosion or disturbance of soil or sediment.			Sum=	5	5	4	4	4	4	6	6	4
				Stressor subscore=	0.42	0.42	0.33	0.33	0.33	0.33	0.50	0.50	0.33
S5	**Soil or Sediment Alteration *Within the Assessment Area***												

In the last column, place a check mark next to any item present in the wetland that is likely to have compacted, eroded, or otherwise altered the wetland's soil. Consider only items occurring within past 100 years or since wetland was created or restored (whichever is less). [CS, INV, NR, PH, SR, STR]												
Compaction from machinery, off-road vehicles, livestock, or mountain bikes, especially during wetter periods.						1						
Leveling or other grading not to the natural contour.												
Tillage, plowing (but excluding disking for enhancement of native plants).												
Fill or riprap, excluding small amounts of upland soils containing organic amendments (compost, etc.) or small amounts of topsoil imported from another wetland.							1					
Excavation.												
Ditch cleaning or dredging in or adjacent to the wetland.												
Boat traffic in or adjacent to the wetland and sufficient to cause shore erosion or stir bottom sediments.												
Artificial water level or flow manipulations sufficient to cause erosion or stir bottom sediments.												
If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not measurably alter the soil structure and/or topography, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.												
	Severe (3 points)		Mild (1 point)									
Spatial extent of altered soil:	>95% of wetland or >95% of its upland edge (if any).	0	<5% of wetland and <5% of its upland edge (if any).	0	0	1	1	0	0	0	0	0
Recentness of significant soil alteration in wetland:	Current & ongoing.	0	>1 yr ago.	0	0	1	1	0	0	0	0	0
Duration:	Long-lasting, minimal veg recovery.	0	Short-term, revegetated, not intense.	0	0	1	1	0	0	0	0	0
Timing of soil alteration:	Frequent and year-round.	0	Mainly during one-time or scattered events.	0	0	1	1	0	0	0	0	0
Sum=				0	0	4	4	0	0	0	0	0
			Stressor subscore=	0.00	0.00	0.33	0.33	0.00	0.00	0.00	0.00	0.00

	WL10	WL11	WL12	WL13	WL14	WL15	WL16	WL17	WL18	WL19	WL20	WL21	WL22	WL23
S1														
			1					1	1	1	1	1		
		1	1	1	1		1					1		
	1	1	1	1	1			1		1		1		
	1	1	1		1	1	1		1				1	
	2	2	2	2	2	1	2	1	2	1	1	2	2	0
	1	1	1	1	1	1	1	1	1	1	1	1	3	0
	0	0	0	0	0	0	0	0	0	0	0	0	3	0
	0	0	0	0	0	0	0	0	0	0	0	0	3	0
	3	3	3	3	3	2	3	2	3	2	2	3	11	0
	0.25	0.25	0.25	0.25	0.25	0.17	0.25	0.17	0.25	0.17	0.17	0.25	0.92	0.00
S2														

							1				1	1		1
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	2	2	2	2	2	2	2	2	2	0	2	2	2	2
	1	1	1	1	1	1	1	1	1	1	1	3	2	1
	5	5	5	5	5	5	5	5	5	3	5	7	6	5
	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.33	0.56	0.78	0.67	0.56
S3														
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	1	1	1	1	1	1	1	1	1	1	1	3	2	1
	5	5	5	5	5	5	5	5	5	5	5	7	6	5
	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.78	0.67	0.56
S4														

	1	1	1	1	1	1	1	1	1	1	1	1	1	1
							1				1		1	
								1	1	1		1		
	1	1	1	1	1	1	1	1	1			1	1	
											1			
	1	1			1		1					1	1	
	1	1	3	1	1	1	1	1	1	1	2	2	3	1
	1	1	1	1	1	1	1	1	1	1	1	1	2	1
	1	1	2	2	2	2	2	2	2	1	1	2	2	2
	0	1	3	1	1	1	1	1	1	1	1	3	2	2
	3	4	9	5	5	5	5	5	5	4	5	8	9	6
	0.25	0.33	0.75	0.42	0.42	0.42	0.42	0.42	0.42	0.33	0.42	0.67	0.75	0.50
S5														
			1		1						1		1	
													1	
													1	
							1				1			
			1									1		
	0	0	2	0	1	0	1	0	0	0	1	1	2	0
	0	0	1	0	1	0	1	0	0	0	1	1	2	0

	0	0	2	0	1	0	1	0	0	0	2	2	3	0
	0	0	1	0	1	0	1	0	0	0	1	1	1	0
	0	0	6	0	4	0	4	0	0	0	5	5	8	0
	0.00	0.00	0.50	0.00	0.33	0.00	0.33	0.00	0.00	0.00	0.42	0.42	0.67	0.00

Assessment Area (AA) Results: Wetland 1

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	6.65	Higher	3.19	Moderate	6.84	3.25
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	8.30	Higher	0.00	Lower	5.53	0.00
Sediment Retention & Stabilisation (SR)	10.00	Higher	1.75	Lower	10.00	1.06
Phosphorus Retention (PR)	10.00	Higher	8.23	Higher	10.00	7.78
Nitrate Removal & Retention (NR)	10.00	Higher	7.50	Higher	10.00	7.78
Carbon Sequestration (CS)	5.03	Moderate			6.73	
Organic Nutrient Export (OE)	3.53	Moderate			4.20	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.70	Higher	4.56	Moderate	5.88	3.70
Amphibian & Turtle Habitat (AM)	3.94	Moderate	9.29	Higher	5.38	7.73
Waterbird Feeding Habitat (WBF)	7.22	Higher	10.00	Higher	5.75	10.00
Waterbird Nesting Habitat (WBN)	4.27	Moderate	10.00	Higher	3.65	10.00
Songbird, Raptor, & Mammal Habitat (SBM)	8.97	Higher	10.00	Higher	7.43	10.00
Pollinator Habitat (POL)	9.08	Higher	3.33	Moderate	7.31	3.33
Native Plant Habitat (PH)	5.39	Moderate	6.95	Higher	5.26	6.03
Public Use & Recognition (PU)			0.89	Lower		0.96
Wetland Sensitivity (Sens)			7.58	Higher		4.47
Wetland Ecological Condition (EC)			5.18	Moderate		7.22
Wetland Stressors (STR) (higher score means more stress)			4.56	Moderate		3.94
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	6.65	Higher	3.19	Moderate	6.84	3.25
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.38	Higher	7.03	Moderate	9.59	6.66
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	6.34	Higher	3.04	Moderate	4.89	2.47
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	5.16	Moderate	7.93	Higher	4.35	7.77
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.45	Higher	8.38	Higher	7.05	8.23
WETLAND CONDITION (EC)			5.18	Moderate		7.22
WETLAND RISK (average of Sensitivity & Stressors)			6.07	Higher		4.20

Assessment Area (AA) Results: Wetland 2

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	1.55	Lower	3.07	Moderate	2.92	3.13
Stream Flow Support (SFS)	2.50	Lower	8.35	Higher	1.33	4.86
Water Cooling (WC)	6.60	Higher	1.70	Moderate	4.40	1.02
Sediment Retention & Stabilisation (SR)	1.37	Lower	1.45	Lower	4.09	0.88
Phosphorus Retention (PR)	3.37	Moderate	7.00	Higher	5.29	6.67
Nitrate Removal & Retention (NR)	2.06	Lower	6.25	Moderate	5.10	6.67
Carbon Sequestration (CS)	2.88	Lower			5.81	
Organic Nutrient Export (OE)	4.84	Moderate			4.90	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	8.00	Higher	4.63	Moderate	6.69	3.74
Amphibian & Turtle Habitat (AM)	4.97	Moderate	9.07	Higher	5.93	7.59
Waterbird Feeding Habitat (WBF)	7.23	Higher	10.00	Higher	5.75	10.00
Waterbird Nesting Habitat (WBN)	4.39	Moderate	10.00	Higher	3.75	10.00
Songbird, Raptor, & Mammal Habitat (SBM)	8.47	Higher	10.00	Higher	7.02	10.00
Pollinator Habitat (POL)	6.97	Moderate	3.33	Moderate	5.62	3.33
Native Plant Habitat (PH)	3.92	Lower	6.14	Moderate	4.67	5.32
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			2.46	Lower		2.94
Wetland Ecological Condition (EC)			8.55	Higher		9.17
Wetland Stressors (STR) (higher score means more stress)			1.45	Lower		2.79
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	1.55	Lower	3.07	Moderate	2.92	3.13
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	2.90	Lower	5.95	Moderate	5.44	5.70
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	6.74	Higher	6.62	Higher	5.51	4.04
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	5.27	Moderate	7.91	Higher	4.51	7.76
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.46	Moderate	8.24	Higher	6.40	8.11
WETLAND CONDITION (EC)			8.55	Higher		9.17
WETLAND RISK (average of Sensitivity & Stressors)			1.95	Lower		2.87

Assessment Area (AA) Results: Wetland 3

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	3.20	Moderate	2.26	Lower	4.19	2.33
Stream Flow Support (SFS)	2.45	Lower	5.41	Moderate	1.31	3.16
Water Cooling (WC)	6.67	Higher	1.87	Moderate	4.44	1.12
Sediment Retention & Stabilisation (SR)	3.53	Moderate	1.74	Lower	5.57	1.06
Phosphorus Retention (PR)	3.47	Moderate	5.78	Higher	5.37	5.56
Nitrate Removal & Retention (NR)	4.18	Moderate	5.00	Moderate	6.41	5.56
Carbon Sequestration (CS)	6.46	Higher			7.35	
Organic Nutrient Export (OE)	5.00	Moderate			4.99	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	6.14	Higher	5.16	Moderate	6.03	4.03
Amphibian & Turtle Habitat (AM)	6.15	Moderate	8.86	Higher	6.55	7.46
Waterbird Feeding Habitat (WBF)	7.34	Higher	10.00	Higher	5.84	10.00
Waterbird Nesting Habitat (WBN)	6.11	Higher	10.00	Higher	5.22	10.00
Songbird, Raptor, & Mammal Habitat (SBM)	7.90	Higher	10.00	Higher	6.55	10.00
Pollinator Habitat (POL)	8.23	Higher	3.33	Moderate	6.63	3.33
Native Plant Habitat (PH)	6.81	Higher	6.34	Higher	5.83	5.51
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			8.49	Higher		4.75
Wetland Ecological Condition (EC)			6.14	Moderate		7.78
Wetland Stressors (STR) (higher score means more stress)			3.01	Moderate		3.36
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	3.20	Moderate	2.26	Lower	4.19	2.33
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	5.43	Higher	4.97	Moderate	6.76	4.81
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	5.87	Moderate	4.78	Moderate	5.11	3.40
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	5.63	Moderate	7.89	Higher	5.04	7.75
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.94	Higher	8.28	Higher	6.48	8.14
WETLAND CONDITION (EC)			6.14	Moderate		7.78
WETLAND RISK (average of Sensitivity & Stressors)			5.75	Higher		4.06

Assessment Area (AA) Results: Wetland 4

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	6.48	Higher	2.06	Lower	6.72	2.13
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	5.25	Moderate	0.00	Lower	3.50	0.00
Sediment Retention & Stabilisation (SR)	10.00	Higher	1.37	Lower	10.00	0.83
Phosphorus Retention (PR)	10.00	Higher	4.55	Moderate	10.00	4.44
Nitrate Removal & Retention (NR)	10.00	Higher	3.75	Moderate	10.00	4.44
Carbon Sequestration (CS)	5.66	Moderate			7.01	
Organic Nutrient Export (OE)	3.50	Moderate			4.19	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.93	Higher	4.34	Moderate	5.96	3.58
Amphibian & Turtle Habitat (AM)	4.65	Moderate	4.93	Moderate	5.76	5.08
Waterbird Feeding Habitat (WBF)	7.00	Higher	3.33	Moderate	5.57	3.33
Waterbird Nesting Habitat (WBN)	4.48	Moderate	3.33	Moderate	3.83	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	7.65	Higher	3.33	Moderate	6.34	3.33
Pollinator Habitat (POL)	9.90	Higher	3.33	Moderate	7.97	3.33
Native Plant Habitat (PH)	6.94	Higher	6.78	Higher	5.89	5.88
Public Use & Recognition (PU)			0.48	Lower		0.67
Wetland Sensitivity (Sens)			3.55	Moderate		3.27
Wetland Ecological Condition (EC)			8.07	Higher		8.89
Wetland Stressors (STR) (higher score means more stress)			3.33	Moderate		3.48
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	6.48	Higher	2.06	Lower	6.72	2.13
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.46	Higher	3.88	Lower	9.63	3.84
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	4.80	Moderate	2.89	Moderate	4.69	2.39
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	5.11	Moderate	3.62	Moderate	4.40	3.72
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	9.03	Higher	5.63	Higher	7.35	5.03
WETLAND CONDITION (EC)			8.07	Higher		8.89
WETLAND RISK (average of Sensitivity & Stressors)			3.44	Moderate		3.38

Assessment Area (AA) Results: Wetland 5

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	5.28	Higher	0.80	Lower	5.79	0.88
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	6.75	Higher	0.00	Lower	4.50	0.00
Sediment Retention & Stabilisation (SR)	10.00	Higher	1.46	Lower	10.00	0.89
Phosphorus Retention (PR)	10.00	Higher	5.78	Higher	10.00	5.56
Nitrate Removal & Retention (NR)	10.00	Higher	5.00	Moderate	10.00	5.56
Carbon Sequestration (CS)	5.36	Moderate			6.87	
Organic Nutrient Export (OE)	2.70	Lower			3.77	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	3.11	Moderate	3.50	Moderate	4.97	3.13
Amphibian & Turtle Habitat (AM)	0.51	Lower	4.53	Moderate	3.57	4.84
Waterbird Feeding Habitat (WBF)	6.20	Moderate	3.33	Moderate	4.93	3.33
Waterbird Nesting Habitat (WBN)	4.72	Moderate	3.33	Moderate	4.03	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	7.53	Higher	3.33	Moderate	6.25	3.33
Pollinator Habitat (POL)	8.44	Higher	3.33	Moderate	6.80	3.33
Native Plant Habitat (PH)	5.30	Moderate	6.29	Moderate	5.22	5.46
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			7.47	Higher		4.44
Wetland Ecological Condition (EC)			7.59	Higher		8.61
Wetland Stressors (STR) (higher score means more stress)			1.86	Lower		2.94
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	5.28	Higher	0.80	Lower	5.79	0.88
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.42	Higher	4.93	Moderate	9.61	4.78
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	4.94	Moderate	2.33	Moderate	4.14	2.09
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.24	Moderate	3.38	Moderate	3.72	3.57
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.77	Higher	5.31	Moderate	6.44	4.75
WETLAND CONDITION (EC)			7.59	Higher		8.61
WETLAND RISK (average of Sensitivity & Stressors)			4.67	Higher		3.69

Assessment Area (AA) Results: Wetland 6

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	5.28	Higher	0.72	Lower	5.79	0.80
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	3.75	Moderate	0.00	Lower	2.50	0.00
Sediment Retention & Stabilisation (SR)	10.00	Higher	1.46	Lower	10.00	0.89
Phosphorus Retention (PR)	10.00	Higher	5.78	Higher	10.00	5.56
Nitrate Removal & Retention (NR)	10.00	Higher	5.00	Moderate	10.00	5.56
Carbon Sequestration (CS)	3.19	Moderate			5.94	
Organic Nutrient Export (OE)	2.70	Lower			3.77	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.46	Moderate	3.87	Moderate	5.79	3.33
Amphibian & Turtle Habitat (AM)	3.51	Moderate	4.21	Moderate	5.16	4.65
Waterbird Feeding Habitat (WBF)	5.86	Moderate	3.33	Moderate	4.67	3.33
Waterbird Nesting Habitat (WBN)	4.95	Moderate	3.33	Moderate	4.23	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	7.17	Moderate	10.00	Higher	5.94	10.00
Pollinator Habitat (POL)	8.73	Higher	3.33	Moderate	7.03	3.33
Native Plant Habitat (PH)	4.81	Moderate	6.27	Moderate	5.03	5.44
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			3.92	Moderate		3.38
Wetland Ecological Condition (EC)			4.94	Moderate		7.08
Wetland Stressors (STR) (higher score means more stress)			1.58	Lower		2.84
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	5.28	Higher	0.72	Lower	5.79	0.80
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.15	Higher	4.93	Moderate	9.49	4.78
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	4.22	Moderate	2.58	Moderate	4.40	2.22
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.37	Moderate	3.19	Moderate	3.98	3.46
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.82	Higher	8.27	Higher	6.52	8.13
WETLAND CONDITION (EC)			4.94	Moderate		7.08
WETLAND RISK (average of Sensitivity & Stressors)			2.75	Moderate		3.11

Assessment Area (AA) Results: Wetland 7

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	2.55	Moderate	2.18	Lower	3.70	2.25
Stream Flow Support (SFS)	6.46	Moderate	5.38	Moderate	3.44	3.13
Water Cooling (WC)	4.83	Moderate	3.57	Moderate	3.22	2.15
Sediment Retention & Stabilisation (SR)	3.97	Moderate	1.89	Lower	5.87	1.15
Phosphorus Retention (PR)	3.34	Moderate	5.78	Higher	5.27	5.56
Nitrate Removal & Retention (NR)	4.49	Higher	5.00	Moderate	6.60	5.56
Carbon Sequestration (CS)	6.23	Higher			7.25	
Organic Nutrient Export (OE)	4.64	Moderate			4.80	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	8.32	Higher	6.06	Higher	6.80	4.51
Amphibian & Turtle Habitat (AM)	7.00	Higher	6.62	Higher	7.00	6.10
Waterbird Feeding Habitat (WBF)	10.00	Higher	5.00	Moderate	8.21	5.00
Waterbird Nesting Habitat (WBN)	7.90	Higher	5.00	Moderate	6.75	5.00
Songbird, Raptor, & Mammal Habitat (SBM)	6.16	Moderate	5.00	Moderate	5.10	5.00
Pollinator Habitat (POL)	8.45	Higher	3.33	Moderate	6.80	3.33
Native Plant Habitat (PH)	6.50	Higher	5.85	Moderate	5.71	5.08
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			7.79	Higher		4.53
Wetland Ecological Condition (EC)			6.63	Higher		8.06
Wetland Stressors (STR) (higher score means more stress)			2.97	Moderate		3.35
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	2.55	Moderate	2.18	Lower	3.70	2.25
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	5.37	Moderate	5.00	Moderate	6.75	4.82
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	7.19	Higher	5.53	Higher	5.68	3.89
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	7.49	Higher	4.97	Moderate	6.30	4.66
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.74	Higher	5.29	Moderate	6.34	4.78
WETLAND CONDITION (EC)			6.63	Higher		8.06
WETLAND RISK (average of Sensitivity & Stressors)			5.38	Higher		3.94

Assessment Area (AA) Results: Wetland 8

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	0.83	Lower	1.88	Lower	2.37	1.95
Stream Flow Support (SFS)	2.92	Lower	4.01	Moderate	1.56	2.34
Water Cooling (WC)	6.75	Higher	1.33	Lower	4.50	0.80
Sediment Retention & Stabilisation (SR)	0.00	Lower	1.83	Lower	2.44	1.11
Phosphorus Retention (PR)	3.38	Moderate	5.78	Higher	5.30	5.56
Nitrate Removal & Retention (NR)	0.44	Lower	5.00	Moderate	4.10	5.56
Carbon Sequestration (CS)	2.50	Lower			5.64	
Organic Nutrient Export (OE)	6.80	Higher			5.94	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.03	Moderate	3.98	Moderate	5.64	3.39
Amphibian & Turtle Habitat (AM)	2.81	Lower	4.86	Moderate	4.78	5.04
Waterbird Feeding Habitat (WBF)	6.41	Moderate	3.33	Moderate	5.10	3.33
Waterbird Nesting Habitat (WBN)	4.39	Moderate	3.33	Moderate	3.75	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	8.07	Higher	3.33	Moderate	6.69	3.33
Pollinator Habitat (POL)	8.79	Higher	3.33	Moderate	7.08	3.33
Native Plant Habitat (PH)	6.53	Higher	6.57	Higher	5.72	5.70
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			6.19	Higher		4.06
Wetland Ecological Condition (EC)			6.14	Moderate		7.78
Wetland Stressors (STR) (higher score means more stress)			7.22	Higher		4.91
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	0.83	Lower	1.88	Lower	2.37	1.95
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	2.48	Lower	4.99	Moderate	5.01	4.81
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	6.09	Higher	3.56	Moderate	5.18	2.78
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.57	Moderate	3.58	Moderate	3.91	3.69
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.29	Higher	5.49	Higher	6.79	4.91
WETLAND CONDITION (EC)			6.14	Moderate		7.78
WETLAND RISK (average of Sensitivity & Stressors)			6.71	Higher		4.49

Assessment Area (AA) Results: Wetland 9

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	5.40	Higher	0.47	Lower	5.88	0.55
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	6.75	Higher	0.00	Lower	4.50	0.00
Sediment Retention & Stabilisation (SR)	10.00	Higher	1.10	Lower	10.00	0.67
Phosphorus Retention (PR)	10.00	Higher	5.78	Higher	10.00	5.56
Nitrate Removal & Retention (NR)	10.00	Higher	5.00	Moderate	10.00	5.56
Carbon Sequestration (CS)	3.71	Moderate			6.16	
Organic Nutrient Export (OE)	2.87	Lower			3.86	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.12	Moderate	3.58	Moderate	5.68	3.17
Amphibian & Turtle Habitat (AM)	2.46	Lower	4.10	Moderate	4.60	4.58
Waterbird Feeding Habitat (WBF)	5.36	Moderate	3.33	Moderate	4.27	3.33
Waterbird Nesting Habitat (WBN)	4.72	Moderate	3.33	Moderate	4.03	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	7.40	Higher	3.33	Moderate	6.14	3.33
Pollinator Habitat (POL)	8.73	Higher	3.33	Moderate	7.03	3.33
Native Plant Habitat (PH)	6.19	Higher	6.34	Higher	5.58	5.50
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			3.88	Moderate		3.36
Wetland Ecological Condition (EC)			4.94	Moderate		7.08
Wetland Stressors (STR) (higher score means more stress)			1.86	Lower		2.94
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	5.40	Higher	0.47	Lower	5.88	0.55
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.21	Higher	4.87	Moderate	9.52	4.74
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	5.22	Moderate	2.38	Moderate	4.59	2.12
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	3.94	Moderate	3.13	Lower	3.59	3.41
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.09	Higher	5.34	Higher	6.64	4.78
WETLAND CONDITION (EC)			4.94	Moderate		7.08
WETLAND RISK (average of Sensitivity & Stressors)			2.87	Moderate		3.15

Assessment Area (AA) Results: Wetland 10

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	0.91	Lower	0.62	Lower	2.44	0.70
Stream Flow Support (SFS)	2.92	Lower	3.65	Moderate	1.56	2.12
Water Cooling (WC)	2.40	Moderate	1.33	Lower	1.60	0.80
Sediment Retention & Stabilisation (SR)	0.00	Lower	1.01	Lower	1.65	0.61
Phosphorus Retention (PR)	2.81	Moderate	5.78	Higher	4.90	5.56
Nitrate Removal & Retention (NR)	0.29	Lower	5.00	Moderate	4.01	5.56
Carbon Sequestration (CS)	1.05	Lower			5.02	
Organic Nutrient Export (OE)	3.82	Moderate			4.36	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	1.35	Lower	3.14	Moderate	4.35	2.94
Amphibian & Turtle Habitat (AM)	1.74	Lower	3.83	Moderate	4.22	4.42
Waterbird Feeding Habitat (WBF)	4.92	Moderate	3.33	Moderate	3.92	3.33
Waterbird Nesting Habitat (WBN)	4.07	Moderate	3.33	Moderate	3.48	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	7.23	Moderate	3.33	Moderate	6.00	3.33
Pollinator Habitat (POL)	8.32	Higher	3.33	Moderate	6.70	3.33
Native Plant Habitat (PH)	4.81	Moderate	6.16	Moderate	5.03	5.34
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			1.67	Lower		2.70
Wetland Ecological Condition (EC)			4.94	Moderate		7.08
Wetland Stressors (STR) (higher score means more stress)			7.05	Higher		4.85
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	0.91	Lower	0.62	Lower	2.44	0.70
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	1.93	Lower	4.85	Moderate	4.45	4.73
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	3.22	Lower	3.17	Moderate	3.67	2.44
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	3.54	Moderate	2.97	Lower	3.27	3.32
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.55	Moderate	5.22	Moderate	6.30	4.67
WETLAND CONDITION (EC)			4.94	Moderate		7.08
WETLAND RISK (average of Sensitivity & Stressors)			4.36	Higher		3.78

Assessment Area (AA) Results: Wetland 11

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	3.51	Moderate	2.01	Lower	4.43	2.08
Stream Flow Support (SFS)	3.44	Moderate	4.85	Moderate	1.83	2.83
Water Cooling (WC)	5.96	Higher	1.37	Lower	3.97	0.82
Sediment Retention & Stabilisation (SR)	4.05	Moderate	1.92	Lower	5.93	1.17
Phosphorus Retention (PR)	4.27	Higher	5.78	Higher	5.93	5.56
Nitrate Removal & Retention (NR)	3.94	Moderate	5.00	Moderate	6.26	5.56
Carbon Sequestration (CS)	6.39	Higher			7.32	
Organic Nutrient Export (OE)	6.07	Higher			5.55	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	9.09	Higher	6.56	Higher	7.07	4.78
Amphibian & Turtle Habitat (AM)	6.69	Higher	6.62	Higher	6.84	6.10
Waterbird Feeding Habitat (WBF)	10.00	Higher	3.33	Moderate	8.24	3.33
Waterbird Nesting Habitat (WBN)	8.04	Higher	3.33	Moderate	6.87	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	8.13	Higher	3.33	Moderate	6.74	3.33
Pollinator Habitat (POL)	8.60	Higher	3.33	Moderate	6.93	3.33
Native Plant Habitat (PH)	8.01	Higher	6.53	Higher	6.32	5.67
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			4.39	Moderate		3.52
Wetland Ecological Condition (EC)			5.18	Moderate		7.22
Wetland Stressors (STR) (higher score means more stress)			2.85	Moderate		3.31
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	3.51	Moderate	2.01	Lower	4.43	2.08
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	5.53	Higher	5.00	Moderate	6.84	4.82
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	7.61	Higher	5.41	Higher	5.84	3.80
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	7.47	Higher	4.64	Moderate	6.32	4.33
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.43	Higher	5.47	Higher	6.80	4.89
WETLAND CONDITION (EC)			5.18	Moderate		7.22
WETLAND RISK (average of Sensitivity & Stressors)			3.62	Moderate		3.41

Assessment Area (AA) Results: Wetland 12

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	3.55	Moderate	3.52	Moderate	4.46	3.58
Stream Flow Support (SFS)	2.14	Lower	5.62	Moderate	1.14	3.28
Water Cooling (WC)	7.08	Higher	2.16	Moderate	4.72	1.30
Sediment Retention & Stabilisation (SR)	3.64	Moderate	8.07	Higher	5.65	4.90
Phosphorus Retention (PR)	4.49	Higher	7.00	Higher	6.09	6.67
Nitrate Removal & Retention (NR)	4.94	Higher	10.00	Higher	6.88	10.00
Carbon Sequestration (CS)	7.10	Higher			7.63	
Organic Nutrient Export (OE)	5.43	Higher			5.22	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	8.19	Higher	7.07	Higher	6.75	5.06
Amphibian & Turtle Habitat (AM)	9.46	Higher	6.35	Higher	8.30	5.95
Waterbird Feeding Habitat (WBF)	9.50	Higher	3.33	Moderate	7.56	3.33
Waterbird Nesting Habitat (WBN)	8.82	Higher	3.33	Moderate	7.53	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	8.38	Higher	3.33	Moderate	6.95	3.33
Pollinator Habitat (POL)	8.58	Higher	3.33	Moderate	6.91	3.33
Native Plant Habitat (PH)	9.96	Higher	6.60	Higher	7.10	5.73
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			7.73	Higher		4.52
Wetland Ecological Condition (EC)			5.18	Moderate		7.22
Wetland Stressors (STR) (higher score means more stress)			4.80	Moderate		4.02
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	3.55	Moderate	3.52	Moderate	4.46	3.58
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	6.07	Higher	9.18	Higher	7.09	8.59
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	6.95	Higher	6.01	Higher	5.61	4.13
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	7.53	Higher	4.48	Moderate	6.49	4.23
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	9.47	Higher	5.51	Higher	7.05	4.93
WETLAND CONDITION (EC)			5.18	Moderate		7.22
WETLAND RISK (average of Sensitivity & Stressors)			6.27	Higher		4.27

Assessment Area (AA) Results: Wetland 13

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	1.61	Lower	2.21	Lower	2.97	2.28
Stream Flow Support (SFS)	3.96	Moderate	4.87	Moderate	2.11	2.84
Water Cooling (WC)	6.50	Higher	1.85	Moderate	4.33	1.11
Sediment Retention & Stabilisation (SR)	1.01	Lower	1.75	Lower	3.85	1.06
Phosphorus Retention (PR)	3.44	Moderate	5.78	Higher	5.35	5.56
Nitrate Removal & Retention (NR)	1.66	Lower	7.19	Moderate	4.86	7.50
Carbon Sequestration (CS)	5.48	Moderate			6.92	
Organic Nutrient Export (OE)	6.05	Higher			5.54	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	2.40	Lower	5.13	Moderate	4.72	4.01
Amphibian & Turtle Habitat (AM)	5.14	Moderate	5.45	Moderate	6.02	5.40
Waterbird Feeding Habitat (WBF)	6.29	Moderate	3.33	Moderate	5.00	3.33
Waterbird Nesting Habitat (WBN)	6.09	Higher	3.33	Moderate	5.20	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	9.47	Higher	3.33	Moderate	7.85	3.33
Pollinator Habitat (POL)	7.34	Moderate	3.33	Moderate	5.91	3.33
Native Plant Habitat (PH)	7.92	Higher	6.57	Higher	6.28	5.70
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			5.67	Higher		3.90
Wetland Ecological Condition (EC)			4.70	Moderate		6.94
Wetland Stressors (STR) (higher score means more stress)			1.49	Lower		2.81
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	1.61	Lower	2.21	Lower	2.97	2.28
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	4.19	Moderate	6.05	Moderate	6.08	6.10
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	5.61	Moderate	4.54	Moderate	4.86	3.33
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.89	Moderate	3.93	Moderate	4.63	3.90
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.86	Higher	5.49	Higher	7.27	4.91
WETLAND CONDITION (EC)			4.70	Moderate		6.94
WETLAND RISK (average of Sensitivity & Stressors)			3.58	Moderate		3.36

Assessment Area (AA) Results: Wetland 14

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	2.90	Moderate	1.88	Lower	3.96	1.95
Stream Flow Support (SFS)	10.00	Higher	4.40	Moderate	5.33	2.56
Water Cooling (WC)	5.96	Higher	3.32	Moderate	3.97	2.00
Sediment Retention & Stabilisation (SR)	4.57	Moderate	2.00	Lower	6.29	1.21
Phosphorus Retention (PR)	3.93	Moderate	5.78	Higher	5.69	5.56
Nitrate Removal & Retention (NR)	4.03	Moderate	5.00	Moderate	6.32	5.56
Carbon Sequestration (CS)	5.24	Moderate			6.82	
Organic Nutrient Export (OE)	8.34	Higher			6.76	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	8.85	Higher	6.59	Higher	6.99	4.80
Amphibian & Turtle Habitat (AM)	7.23	Higher	6.13	Moderate	7.12	5.81
Waterbird Feeding Habitat (WBF)	10.00	Higher	3.33	Moderate	8.24	3.33
Waterbird Nesting Habitat (WBN)	8.87	Higher	3.33	Moderate	7.58	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	7.05	Moderate	3.33	Moderate	5.85	3.33
Pollinator Habitat (POL)	7.73	Moderate	3.33	Moderate	6.22	3.33
Native Plant Habitat (PH)	8.08	Higher	5.92	Moderate	6.34	5.13
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			8.19	Higher		4.66
Wetland Ecological Condition (EC)			6.14	Moderate		7.78
Wetland Stressors (STR) (higher score means more stress)			3.14	Moderate		3.41
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	2.90	Moderate	1.88	Lower	3.96	1.95
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	4.84	Moderate	5.02	Moderate	6.55	4.83
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	9.14	Higher	5.68	Higher	6.37	3.96
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	7.61	Higher	4.34	Moderate	6.42	4.15
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.85	Higher	5.06	Moderate	6.24	4.53
WETLAND CONDITION (EC)			6.14	Moderate		7.78
WETLAND RISK (average of Sensitivity & Stressors)			5.67	Higher		4.03

Assessment Area (AA) Results: Wetland 15

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	5.17	Higher	2.29	Lower	5.70	2.35
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	1.80	Lower	0.00	Lower	1.20	0.00
Sediment Retention & Stabilisation (SR)	10.00	Higher	2.10	Lower	10.00	1.28
Phosphorus Retention (PR)	10.00	Higher	5.78	Higher	10.00	5.56
Nitrate Removal & Retention (NR)	10.00	Higher	5.00	Moderate	10.00	5.56
Carbon Sequestration (CS)	2.47	Lower			5.63	
Organic Nutrient Export (OE)	1.47	Lower			3.11	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	0.15	Lower	3.35	Moderate	3.93	3.05
Amphibian & Turtle Habitat (AM)	2.03	Lower	4.05	Moderate	4.37	4.55
Waterbird Feeding Habitat (WBF)	5.09	Moderate	3.33	Moderate	4.05	3.33
Waterbird Nesting Habitat (WBN)	4.24	Moderate	3.33	Moderate	3.62	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	7.55	Higher	3.33	Moderate	6.26	3.33
Pollinator Habitat (POL)	9.82	Higher	3.33	Moderate	7.91	3.33
Native Plant Habitat (PH)	5.65	Moderate	6.72	Higher	5.36	5.83
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			2.65	Lower		3.00
Wetland Ecological Condition (EC)			4.94	Moderate		7.08
Wetland Stressors (STR) (higher score means more stress)			1.63	Lower		2.86
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	5.17	Higher	2.29	Lower	5.70	2.35
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.06	Higher	5.03	Moderate	9.45	4.84
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	1.33	Lower	2.23	Moderate	2.99	2.03
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	3.68	Moderate	3.10	Lower	3.39	3.40
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.75	Higher	5.59	Higher	7.21	5.00
WETLAND CONDITION (EC)			4.94	Moderate		7.08
WETLAND RISK (average of Sensitivity & Stressors)			2.14	Lower		2.93

Assessment Area (AA) Results: Wetland 16

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	6.35	Higher	3.39	Moderate	6.61	3.45
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	5.67	Higher	0.00	Lower	3.78	0.00
Sediment Retention & Stabilisation (SR)	10.00	Higher	1.14	Lower	10.00	0.69
Phosphorus Retention (PR)	10.00	Higher	5.78	Higher	10.00	5.56
Nitrate Removal & Retention (NR)	10.00	Higher	5.00	Moderate	10.00	5.56
Carbon Sequestration (CS)	4.60	Moderate			6.55	
Organic Nutrient Export (OE)	2.09	Lower			3.45	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	2.62	Moderate	4.85	Moderate	4.79	3.86
Amphibian & Turtle Habitat (AM)	5.82	Moderate	5.55	Moderate	6.38	5.46
Waterbird Feeding Habitat (WBF)	6.93	Higher	3.33	Moderate	5.51	3.33
Waterbird Nesting Habitat (WBN)	4.37	Moderate	3.33	Moderate	3.74	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	9.08	Higher	3.33	Moderate	7.52	3.33
Pollinator Habitat (POL)	8.28	Higher	3.33	Moderate	6.66	3.33
Native Plant Habitat (PH)	6.54	Higher	6.73	Higher	5.72	5.84
Public Use & Recognition (PU)			0.39	Lower		0.61
Wetland Sensitivity (Sens)			6.64	Higher		4.19
Wetland Ecological Condition (EC)			5.18	Moderate		7.22
Wetland Stressors (STR) (higher score means more stress)			2.67	Moderate		3.24
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	6.35	Higher	3.39	Moderate	6.61	3.45
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.33	Higher	4.87	Moderate	9.57	4.75
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	4.13	Moderate	3.23	Moderate	3.90	2.57
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	5.18	Moderate	4.00	Moderate	4.75	3.94
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.52	Higher	5.60	Higher	7.08	5.00
WETLAND CONDITION (EC)			5.18	Moderate		7.22
WETLAND RISK (average of Sensitivity & Stressors)			4.66	Higher		3.72

Assessment Area (AA) Results: Wetland 17

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	9.76	Higher	2.29	Lower	9.24	2.35
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	0.00	Lower	0.00	Lower	0.00	0.00
Sediment Retention & Stabilisation (SR)	7.24	Higher	1.37	Lower	8.11	0.83
Phosphorus Retention (PR)	4.42	Higher	5.78	Higher	6.04	5.56
Nitrate Removal & Retention (NR)	10.00	Higher	7.19	Moderate	10.00	7.50
Carbon Sequestration (CS)	7.33	Higher			7.72	
Organic Nutrient Export (OE)	4.06	Moderate			4.49	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	4.74	Moderate	0.95	Moderate	5.54	1.76
Amphibian & Turtle Habitat (AM)	2.81	Lower	1.54	Lower	4.79	3.03
Waterbird Feeding Habitat (WBF)	0.00	Lower	0.00	Lower	0.00	0.00
Waterbird Nesting Habitat (WBN)	0.00	Lower	0.00	Lower	0.00	0.00
Songbird, Raptor, & Mammal Habitat (SBM)	6.94	Moderate	3.33	Moderate	5.75	3.33
Pollinator Habitat (POL)	7.93	Higher	3.33	Moderate	6.38	3.33
Native Plant Habitat (PH)	6.19	Higher	5.94	Moderate	5.58	5.16
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			10.00	Higher		5.39
Wetland Ecological Condition (EC)			6.39	Moderate		7.92
Wetland Stressors (STR) (higher score means more stress)			1.63	Lower		2.86
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	9.76	Higher	2.29	Lower	9.24	2.35
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	8.62	Higher	5.98	Moderate	8.98	6.06
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	3.47	Lower	0.63	Lower	4.02	1.17
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	1.69	Lower	0.93	Lower	2.87	1.82
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.47	Moderate	5.07	Moderate	6.15	4.55
WETLAND CONDITION (EC)			6.39	Moderate		7.92
WETLAND RISK (average of Sensitivity & Stressors)			5.82	Higher		4.13

Assessment Area (AA) Results: Wetland 18

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	7.95	Higher	2.59	Moderate	7.84	2.65
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	0.00	Lower	0.00	Lower	0.00	0.00
Sediment Retention & Stabilisation (SR)	4.32	Moderate	1.98	Lower	6.11	1.20
Phosphorus Retention (PR)	3.78	Moderate	5.78	Higher	5.58	5.56
Nitrate Removal & Retention (NR)	10.00	Higher	5.00	Moderate	10.00	5.56
Carbon Sequestration (CS)	5.96	Higher			7.13	
Organic Nutrient Export (OE)	2.11	Lower			3.46	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.93	Higher	1.07	Moderate	5.96	1.82
Amphibian & Turtle Habitat (AM)	4.43	Moderate	2.21	Lower	5.64	3.43
Waterbird Feeding Habitat (WBF)	0.00	Lower	0.00	Lower	0.00	0.00
Waterbird Nesting Habitat (WBN)	0.00	Lower	0.00	Lower	0.00	0.00
Songbird, Raptor, & Mammal Habitat (SBM)	6.39	Moderate	5.00	Moderate	5.30	5.00
Pollinator Habitat (POL)	4.98	Moderate	3.33	Moderate	4.01	3.33
Native Plant Habitat (PH)	4.48	Moderate	4.86	Moderate	4.89	4.22
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			3.88	Moderate		3.37
Wetland Ecological Condition (EC)			5.66	Moderate		7.50
Wetland Stressors (STR) (higher score means more stress)			3.45	Moderate		3.53
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	7.95	Higher	2.59	Moderate	7.84	2.65
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	8.01	Higher	5.01	Moderate	8.60	4.83
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	3.97	Moderate	0.72	Lower	4.16	1.22
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	2.66	Moderate	1.33	Lower	3.38	2.06
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	5.84	Moderate	4.70	Moderate	5.02	4.59
WETLAND CONDITION (EC)			5.66	Moderate		7.50
WETLAND RISK (average of Sensitivity & Stressors)			3.67	Moderate		3.45

Assessment Area (AA) Results: Wetland 19

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	1.70	Lower	2.29	Lower	3.04	2.35
Stream Flow Support (SFS)	5.00	Moderate	5.12	Moderate	2.67	2.99
Water Cooling (WC)	4.00	Moderate	1.05	Lower	2.67	0.63
Sediment Retention & Stabilisation (SR)	0.13	Lower	1.07	Lower	3.24	0.65
Phosphorus Retention (PR)	3.22	Moderate	5.78	Higher	5.19	5.56
Nitrate Removal & Retention (NR)	1.22	Lower	7.19	Moderate	4.59	7.50
Carbon Sequestration (CS)	6.57	Higher			7.39	
Organic Nutrient Export (OE)	5.09	Moderate			5.03	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	2.40	Lower	4.50	Moderate	4.72	3.67
Amphibian & Turtle Habitat (AM)	4.63	Moderate	4.93	Moderate	5.75	5.08
Waterbird Feeding Habitat (WBF)	5.28	Moderate	3.33	Moderate	4.20	3.33
Waterbird Nesting Habitat (WBN)	5.09	Moderate	3.33	Moderate	4.35	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	9.31	Higher	3.33	Moderate	7.72	3.33
Pollinator Habitat (POL)	7.44	Moderate	3.33	Moderate	5.99	3.33
Native Plant Habitat (PH)	6.79	Higher	6.55	Higher	5.82	5.68
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			4.83	Moderate		3.65
Wetland Ecological Condition (EC)			7.11	Higher		8.33
Wetland Stressors (STR) (higher score means more stress)			1.14	Lower		2.68
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	1.70	Lower	2.29	Lower	3.04	2.35
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	4.68	Moderate	5.93	Moderate	6.25	6.03
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	4.61	Moderate	4.34	Moderate	4.40	3.05
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.14	Moderate	3.63	Moderate	4.30	3.72
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.58	Higher	5.48	Higher	7.11	4.90
WETLAND CONDITION (EC)			7.11	Higher		8.33
WETLAND RISK (average of Sensitivity & Stressors)			2.99	Moderate		3.17

Assessment Area (AA) Results: Wetland 20

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	2.67	Moderate	4.45	Moderate	3.78	4.50
Stream Flow Support (SFS)	2.01	Lower	8.23	Higher	1.07	4.80
Water Cooling (WC)	0.00	Lower	0.00	Lower	0.00	0.00
Sediment Retention & Stabilisation (SR)	0.00	Lower	1.91	Lower	2.84	1.16
Phosphorus Retention (PR)	3.09	Moderate	5.78	Higher	5.09	5.56
Nitrate Removal & Retention (NR)	0.60	Lower	5.00	Moderate	4.20	5.56
Carbon Sequestration (CS)	0.89	Lower			4.94	
Organic Nutrient Export (OE)	4.55	Moderate			4.75	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	2.55	Lower	3.42	Moderate	4.77	3.09
Amphibian & Turtle Habitat (AM)	2.48	Lower	5.02	Moderate	4.61	5.14
Waterbird Feeding Habitat (WBF)	5.42	Moderate	5.00	Moderate	4.32	5.00
Waterbird Nesting Habitat (WBN)	4.09	Moderate	5.00	Moderate	3.49	5.00
Songbird, Raptor, & Mammal Habitat (SBM)	7.35	Higher	5.00	Moderate	6.09	5.00
Pollinator Habitat (POL)	6.91	Moderate	3.33	Moderate	5.56	3.33
Native Plant Habitat (PH)	3.97	Moderate	5.76	Moderate	4.69	5.00
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			4.25	Moderate		3.47
Wetland Ecological Condition (EC)			5.66	Moderate		7.50
Wetland Stressors (STR) (higher score means more stress)			6.74	Higher		4.74
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	2.67	Moderate	4.45	Moderate	3.78	4.50
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	2.11	Lower	5.00	Moderate	4.68	4.82
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	3.41	Lower	6.05	Higher	3.71	3.71
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	3.91	Moderate	4.01	Moderate	3.55	4.08
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	6.71	Moderate	5.23	Moderate	5.77	4.72
WETLAND CONDITION (EC)			5.66	Moderate		7.50
WETLAND RISK (average of Sensitivity & Stressors)			5.49	Higher		4.11

Assessment Area (AA) Results: Wetland 21

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	1.74	Lower	6.17	Higher	3.07	6.20
Stream Flow Support (SFS)	6.25	Moderate	7.76	Higher	3.33	4.52
Water Cooling (WC)	5.17	Moderate	4.60	Moderate	3.44	2.77
Sediment Retention & Stabilisation (SR)	0.73	Lower	3.71	Lower	3.66	2.25
Phosphorus Retention (PR)	2.46	Lower	8.23	Higher	4.65	7.78
Nitrate Removal & Retention (NR)	2.06	Lower	8.13	Higher	5.10	8.33
Carbon Sequestration (CS)	2.97	Lower			5.84	
Organic Nutrient Export (OE)	6.20	Higher			5.62	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	3.90	Moderate	4.63	Moderate	5.24	3.74
Amphibian & Turtle Habitat (AM)	7.50	Higher	5.25	Moderate	7.26	5.28
Waterbird Feeding Habitat (WBF)	6.20	Moderate	5.00	Moderate	4.93	5.00
Waterbird Nesting Habitat (WBN)	5.09	Moderate	5.00	Moderate	4.35	5.00
Songbird, Raptor, & Mammal Habitat (SBM)	7.11	Moderate	5.00	Moderate	5.89	5.00
Pollinator Habitat (POL)	8.88	Higher	3.33	Moderate	7.15	3.33
Native Plant Habitat (PH)	5.94	Moderate	6.29	Moderate	5.48	5.46
Public Use & Recognition (PU)			1.02	Lower		1.06
Wetland Sensitivity (Sens)			5.54	Higher		3.86
Wetland Ecological Condition (EC)			9.04	Higher		9.44
Wetland Stressors (STR) (higher score means more stress)			10.00	Higher		6.27
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	1.74	Lower	6.17	Higher	3.07	6.20
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	2.51	Lower	7.46	Moderate	5.33	7.23
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	5.81	Moderate	6.71	Higher	5.02	4.10
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	5.63	Moderate	4.15	Moderate	5.29	4.17
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.10	Higher	5.58	Higher	6.66	5.03
WETLAND CONDITION (EC)			9.04	Higher		9.44
WETLAND RISK (average of Sensitivity & Stressors)			7.77	Higher		5.06

Assessment Area (AA) Results: Wetland 22

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	1.21	Lower	3.67	Moderate	2.66	3.73
Stream Flow Support (SFS)	3.96	Moderate	6.11	Moderate	2.11	3.56
Water Cooling (WC)	7.55	Higher	3.76	Moderate	5.03	2.26
Sediment Retention & Stabilisation (SR)	2.72	Moderate	2.41	Lower	5.02	1.46
Phosphorus Retention (PR)	2.95	Moderate	7.00	Higher	4.99	6.67
Nitrate Removal & Retention (NR)	2.48	Moderate	6.25	Moderate	5.36	6.67
Carbon Sequestration (CS)	3.26	Moderate			5.97	
Organic Nutrient Export (OE)	6.62	Higher			5.84	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	7.95	Higher	6.45	Higher	6.67	4.72
Amphibian & Turtle Habitat (AM)	7.00	Higher	6.32	Higher	7.00	5.93
Waterbird Feeding Habitat (WBF)	8.11	Higher	3.33	Moderate	6.45	3.33
Waterbird Nesting Habitat (WBN)	8.07	Higher	3.33	Moderate	6.90	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	9.64	Higher	3.33	Moderate	7.99	3.33
Pollinator Habitat (POL)	8.04	Higher	3.33	Moderate	6.48	3.33
Native Plant Habitat (PH)	5.56	Moderate	6.84	Higher	5.33	5.93
Public Use & Recognition (PU)			1.86	Lower		1.66
Wetland Sensitivity (Sens)			5.00	Moderate		3.70
Wetland Ecological Condition (EC)			7.11	Higher		8.33
Wetland Stressors (STR) (higher score means more stress)			6.66	Higher		4.71
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	1.21	Lower	3.67	Moderate	2.66	3.73
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	3.05	Lower	6.11	Moderate	5.65	5.80
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	7.23	Higher	5.95	Higher	5.79	4.12
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	6.37	Higher	4.46	Moderate	5.54	4.22
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.70	Higher	5.67	Higher	7.30	5.07
WETLAND CONDITION (EC)			7.11	Higher		8.33
WETLAND RISK (average of Sensitivity & Stressors)			5.83	Higher		4.20

Assessment Area (AA) Results: Wetland 23

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	1.14	Lower	1.91	Lower	2.61	1.98
Stream Flow Support (SFS)	5.10	Moderate	4.43	Moderate	2.72	2.58
Water Cooling (WC)	6.95	Higher	3.34	Moderate	4.63	2.01
Sediment Retention & Stabilisation (SR)	2.27	Moderate	1.89	Lower	4.71	1.15
Phosphorus Retention (PR)	3.40	Moderate	5.78	Higher	5.31	5.56
Nitrate Removal & Retention (NR)	2.61	Moderate	7.19	Moderate	5.44	7.50
Carbon Sequestration (CS)	3.28	Moderate			5.98	
Organic Nutrient Export (OE)	6.49	Higher			5.78	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	8.25	Higher	5.20	Moderate	6.78	4.05
Amphibian & Turtle Habitat (AM)	5.20	Moderate	6.02	Moderate	6.05	5.74
Waterbird Feeding Habitat (WBF)	7.33	Higher	3.33	Moderate	5.83	3.33
Waterbird Nesting Habitat (WBN)	5.09	Moderate	3.33	Moderate	4.35	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	9.73	Higher	3.33	Moderate	8.07	3.33
Pollinator Habitat (POL)	8.13	Higher	3.33	Moderate	6.55	3.33
Native Plant Habitat (PH)	6.17	Higher	6.89	Higher	5.58	5.98
Public Use & Recognition (PU)			0.30	Lower		0.55
Wetland Sensitivity (Sens)			1.77	Lower		2.73
Wetland Ecological Condition (EC)			10.00	Higher		10.00
Wetland Stressors (STR) (higher score means more stress)			1.12	Lower		2.67
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	1.14	Lower	1.91	Lower	2.61	1.98
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	3.15	Moderate	6.07	Moderate	5.67	6.12
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	7.48	Higher	4.76	Moderate	5.88	3.47
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	5.43	Moderate	4.28	Moderate	4.65	4.11
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.87	Higher	5.71	Higher	7.40	5.10
WETLAND CONDITION (EC)			10.00	Higher		10.00
WETLAND RISK (average of Sensitivity & Stressors)			1.45	Lower		2.70

Appendix D

Bird Survey

Table D.1: Avian Species Potentially Occuring in the Project Area Based on Field Surveys and Desktop Review

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Detected during field surveys?
				ACCDC	COSEWIC	SARA	
ALFL	Alder Flycatcher	*Empidonax alnorum*	Y	S5B			Y
AMBI	American Bittern	*Botaurus lentiginosus*	Y	S4B			
ABDU	American Black Duck	*Anas rubripes*	Y	S5B,S4N			Y
AMCR	American Crow	*Corvus brachyrhynchos*		S5			Y
AMGO	American Goldfinch	*Spinus tristis*	Y	S5			Y
AMKE	American Kestrel	*Falco sparverius*		S4S5B			Y
AMRE	American Redstart	*Setophaga ruticilla*	Y	S4S5B			Y
AMRO	American Robin	*Turdus migratorius*	Y	S5B			Y
AMWI	American Wigeon	*Mareca americana*	Y	S5B			
AMWO	American Woodcock	*Scolopax minor*	Y	S5B			Y
BAEA	Bald Eagle	*Haliaeetus leucocephalus*		S5	NAR	NS	Y
BANS	Bank Swallow	*Riparia riparia*	Y	S2S3B	T	T	Y
BARS	Barn Swallow	*Hirundo rustica*	Y	S2B	T	T	Y
BADO	Barred Owl	*Strix varia*		S5			
BBWA	Bay-breasted Warbler	*Setophaga castanea*	Y	S2B			Y
BEKI	Belted Kingfisher	*Megaceryle alcyon*		S5B			Y
BAWW	Black-and-White Warbler	*Mniotilta varia*	Y	S5B			Y
BBPL	Black-bellied Plover	*Pluvialis squatarola*	Y	S3M			Y
BLBW	Blackburnian Warbler	*Setophaga fusca*	Y	S5B			Y

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Detected during field surveys?
				ACCDC	COSEWIC	SARA	
BCCH	Black-capped Chickadee	*Poecile atricapillus*	Y	S5			Y
BLPW	Blackpoll Warbler	*Setophaga striata*	Y	SUB			
BTNW	Black-throated Green Warbler	*Setophaga virens*	Y	S5B			Y
BLJA	Blue Jay	*Cyanocitta cristata*		S5			Y
BHVI	Blue-headed Vireo	*Vireo solitarius*	Y	S5B			Y
BWTE	Blue-winged Teal	*Spatula discors*	Y	S3B			
BWWA	Blue-winged Warbler	*Vermivora cyanoptera*	Y	SNA			Y
BOBO	Bobolink	*Dolichonyx oryzivorus*	Y	S2B	T	T	Y
BOCH	Boreal Chickadee	*Poecile hudsonicus*	Y	S3			
BRCR	Brown Creeper	*Certhia americana*	Y	S5			Y
BHCO	Brown-headed Cowbird	*Molothrus ater*		S1S2B			
CANG	Canada Goose	*Branta canadensis*	Y	S5M			Y
CAWA	Canada Warbler	*Cardellina canadensis*	Y	S2B	SC	T	Y
CMWA	Cape May Warbler	*Setophaga tigrina*	Y	S3B			Y
CATE	Caspian Tern	*Hydroprogne caspia*	Y	SNA	NAR	NAR	Y
CEDW	Cedar Waxwing	*Bombycilla cedrorum*	Y	S5B			Y
CSWA	Chestnut-sided Warbler	*Setophaga pensylvanica*	Y	S5B			Y
CHSP	Chipping Sparrow	*Spizella passerina*	Y	S4B			Y
COGR	Common Grackle	*Quiscalus quiscula*		S5B			Y
COLO	Common Loon	*Gavia immer*	Y	S1B,S4M	NAR	NS	Y
COME	Common Merganser	*Mergus merganser*	Y	SUB,S5N			Y

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Detected during field surveys?
				ACCDC	COSEWIC	SARA	
CORA	Common Raven	*Corvus corax*		S5			Y
CORE	Common Redpoll	*Acanthis flammea*	Y	S5N			Y
COSN	Common Snipe	*Gallinago gallinago*	Y	NA			Y
COTE	Common Tern	*Sterna hirundo*	Y	S1B	NAR	NS	Y
COYE	Common Yellowthroat	*Geothlypis trichas*	Y	S5B			Y
DEJU	Dark-eyed Junco	*Junco hyemalis*	Y	S5			Y
DCCO	Double-crested Cormorant	*Phalacrocorax auritus*		S5B	NAR	NS	Y
DOWO	Downy Woodpecker	*Dryobates pubescens*	Y	S5			Y
DUNL	Dunlin	*Calidris alpina*	Y	S4M			Y
EAKI	Eastern Kingbird	*Tyrannus tyrannus*	Y	S2B			Y
EAPH	Eastern Phoebe	*Sayornis phoebe*	Y	SNA			Y
EAWP	Eastern Wood-Pewee	*Contopus virens*	Y	S3B			Y
EUST	European Starling	*Sturnus vulgaris*		SNA			Y
FOSP	Fox Sparrow	*Passerella iliaca*	Y	SUB			Y
GADW	Gadwall	*Mareca strepera*	Y	S4B,S2N			
GLGU	Glaucous Gull	*Larus hyperboreus*	Y	SNA			
GCKI	Golden-crowned Kinglet	*Regulus satrapa*	Y	S5			Y
GRCA	Gray Catbird	*Dumetella carolinensis*	Y	S3B			Y
GBBG	Great Black-backed Gull	*Larus marinus*	Y	S2S3B,S5N			Y
GBHE	Great Blue Heron	*Ardea herodias*	Y	S4B			Y
GRCO	Great Cormorant	*Phalacrocorax carbo*		S1B			Y
GWTE	Green-winged Teal	*Anas crecca*	Y	S5B			Y

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Detected during field surveys?
				ACCDC	COSEWIC	SARA	
HAWO	Hairy Woodpecker	*Dryobates villosus*	Y	S5			Y
HETH	Hermit Thrush	*Catharus guttatus*	Y	S5B			Y
HERG	Herring Gull	*Larus argentatus*	Y	S2B,S5N			Y
HOME	Hooded Merganser	*Lophodytes cucullatus*	Y	S1B,S4M			Y
ICGU	Iceland Gull	*Larus glaucoides*	Y	S4N			Y
KILL	Killdeer	*Charadrius vociferus*	Y	S2S3B			Y
LEFL	Least Flycatcher	*Empidonax minimus*	Y	S4B			Y
LEYE	Lesser Yellowlegs	*Tringa flavipes*	Y	S3M	T	NS	Y
LEOW	Long-eared Owl	*Asio otus*		S1?			
MAWA	Magnolia Warbler	*Setophaga magnolia*	Y	S5B			Y
MALL	Mallard	*Anas platyrhynchos*	Y	S5B			
MERL	Merlin	*Falco columbarius*		S4S5B	NAR	NS	Y
MODO	Mourning Dove	*Zenaida macroura*	Y	S5			Y
MOWA	Mourning Warbler	*Geothlypis philadelphia*	Y	S4B			
NOFL	Northern Flicker	*Colaptes auratus*	Y	S5B			Y
NOGA	Northern Gannet	*Morus bassanus*	Y	S5N			Y
NOGO	Northern Goshawk	*Accipiter gentilis*		S4			
NOHA	Northern Harrier	*Circus hudsonius*		S4B	NAR	NS	Y
NOPA	Northern Parula	*Setophaga americana*	Y	S5B			Y
NOPI	Northern Pintail	*Anas acuta*	Y	S1S2B			
NSWO	Northern Saw-whet Owl	*Aegolius acadicus*		S4B			Y

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Detected during field surveys?
				ACCDC	COSEWIC	SARA	
NSHO	Northern Shoveler	*Spatula clypeata*	Y	S2B			Y
NSHR	Northern Shrike	*Lanius borealis*	Y	SNA			Y
NOWA	Northern Waterthrush	*Parkesia noveboracensis*	Y	S3B			Y
OSPR	Osprey	*Pandion haliaetus*		S5B			Y
OVEN	Ovenbird	*Seiurus aurocapilla*	Y	S5B			Y
PAWA	Palm Warbler	*Setophaga palmarum*	Y	S5B			Y
PBGR	Pied-billed Grebe	*Podilymbus podiceps*	Y	S4B			Y
PIPL	Piping Plover melodus ssp	*Charadrius melodus melodus*	Y	S1B	E	E	
PUFI	Purple Finch	*Haemorhous purpureus*	Y	S4S5B			Y
RBME	Red-breasted Merganser	*Mergus serrator*	Y	S1S2B,S5N			
RBNU	Red-breasted Nuthatch	*Sitta canadensis*	Y	S5			Y
REVI	Red-eyed Vireo	*Vireo olivaceus*	Y	S5B			Y
RTHA	Red-tailed Hawk	*Buteo jamaicensis*		S4B	NAR	NS	Y
RTLO	Red-throated Loon	*Gavia stellata*	Y	S4M			Y
RWBL	Red-winged Blackbird	*Agelaius phoeniceus*		S4B			Y
RBGU	Ring-billed Gull	*Larus delawarensis*	Y	S1B,S5M			Y
RNDU	Ring-necked Duck	*Aythya collaris*	Y	S5B			
ROPI	Rock Pigeon	*Columba livia*	Y	SNA			Y
RBGR	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Y	S2S3B			Y
RLHA	Rough-legged Hawk	*Buteo lagopus*		S2S3N	NAR	NS	Y
RCKI	Ruby-crowned Kinglet	*Regulus calendula*	Y	S3B			Y

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Detected during field surveys?
				ACCDC	COSEWIC	SARA	
RTHU	Ruby-throated Hummingbird	*Archilochus colubris*	Y	S5B			Y
RUGR	Ruffed Grouse	*Bonasa umbellus*		S5			Y
RUBL	Rusty Blackbird	*Euphagus carolinus*		S1B	SC	SC	
SAVS	Savannah Sparrow	*Passerculus sandwichensis*	Y	S5B			Y
SEPL	Semipalmated Plover	*Charadrius semipalmatus*	Y	SHB,S3M			Y
SESA	Semipalmated Sandpiper	*Calidris pusilla*	Y	S3M			Y
SSHA	Sharp-shinned Hawk	*Accipiter striatus*		S4B	NAR	NAR	Y
SBDO	Short-billed Dowitcher	*Limnodromus griseus*	Y	S3M			Y
SNBU	Snow Bunting	*Plectrophenax nivalis*	Y	S5N			Y
SOSP	Song Sparrow	*Melospiza melodia*	Y	S5B			Y
SORA	Sora	*Porzana carolina*	Y	S5B			
SPSA	Spotted Sandpiper	*Actitis macularius*	Y	S2S3B			Y
SWTH	Swainson's Thrush	*Catharus ustulatus*	Y	S4B			Y
SWSP	Swamp Sparrow	*Melospiza georgiana*	Y	S5B			Y
TEWA	Tennessee Warbler	*Leiothlypis peregrina*	Y	S2B			Y
TRES	Tree Swallow	*Tachycineta bicolor*	Y	S3S4B			Y
TUVU	Turkey Vulture	*Cathartes aura*		SUB			Y
VEER	Veery	*Catharus fuscescens*	Y	S3B			Y
VESP	Vesper Sparrow	*Pooecetes gramineus*	Y	S1S2B			
VIRA	Virginia Rail	*Rallus limicola*	Y	S2B			

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Detected during field surveys?
				ACCDC	COSEWIC	SARA	
WCSP	White-crowned Sparrow	*Zonotrichia leucophrys*	Y	SNA			Y
WTSP	White-throated Sparrow	*Zonotrichia albicollis*	Y	S5B			Y
WWCR	White-winged Crossbill	*Loxia leucoptera*	Y	S3			Y
WIWR	Winter Wren	*Troglodytes hiemalis*	Y	S5B			Y
WODU	Wood Duck	*Aix sponsa*	Y	S4B			Y
YEWA	Yellow Warbler	*Setophaga petechia*	Y	S5B			Y
YBFL	Yellow-bellied Flycatcher	*Empidonax flaviventris*	Y	S3B			
YBSA	Yellow-bellied Sapsucker	*Sphyrapicus varius*	Y	S5B			Y
YRWA	Yellow-rumped Warbler	*Setophaga coronata*	Y	S5B			Y

Table D.2: Maritimes Breeding Bird Atlas Species List for Square 20MS19

Common Name	Scientific Name	MBCA	Priority Status	Breeding Evidence Code[1]	Breeding Status in Square 20MS19
American Black Duck	*Anas rubripes*	Y		H	Possible
Green-winged Teal	*Anas crecca*	Y		H	Possible
Ruffed Grouse	*Bonasa umbellus*			S	Possible
Northern Goshawk	*Accipiter gentilis*			H	Possible
American Woodcock	*Scolopax minor*	Y		S	Possible
Herring Gull	*Larus argentatus*	Y		nd	nd
Rock Pigeon	*Columba livia*	Y		T	Probable
Mourning Dove	*Zenaida macroura*	Y		S	Possible
Barred Owl	*Strix varia*			S	Possible
Long-eared Owl	*Asio otus*			S	Possible
Northern Saw-whet Owl	*Aegolius acadicus*			S	Possible
Ruby-throated Hummingbird	*Archilochus colubris*	Y		P	Probable
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Y		S	Possible
Downy Woodpecker	*Dryobates pubescens*	Y		NY	Confirmed
Hairy Woodpecker	*Dryobates villosus*	Y		H	Possible
Northern Flicker	*Colaptes auratus*	Y		T	Probable
American Kestrel	*Falco sparverius*			H	Possible
Merlin	*Falco columbarius*			H	Possible
Alder Flycatcher	*Empidonax alnorum*	Y		S	Possible
Blue-headed Vireo	*Vireo solitarius*	Y		S	Possible
Red-eyed Vireo	*Vireo olivaceus*	Y		S	Possible
Blue Jay	*Cyanocitta cristata*			H	Possible
American Crow	*Corvus brachyrhynchos*			FY	Confirmed
Common Raven	*Corvus corax*			H	Possible
Tree Swallow	*Tachycineta bicolor*	Y		H	Possible
Black-capped Chickadee	*Poecile atricapillus*	Y		FY	Confirmed
Boreal Chickadee	*Poecile hudsonicus*	Y		S	Possible
Red-breasted Nuthatch	*Sitta canadensis*	Y		S	Possible
Veery	*Catharus fuscescens*	Y		S	Possible
Swainson's Thrush	*Catharus ustulatus*	Y		S	Possible
Hermit Thrush	*Catharus guttatus*	Y		S	Possible
American Robin	*Turdus migratorius*	Y		CF	Confirmed

Common Name	Scientific Name	MBCA	Priority Status	Breeding Evidence Code[1]	Breeding Status in Square 20MS19
European Starling	*Sturnus vulgaris*			FY	Confirmed
Ovenbird	*Seiurus aurocapilla*	Y		S	Possible
Black-and-white Warbler	*Mniotilta varia*	Y		S	Possible
Tennessee Warbler	*Leiothlypis peregrina*	Y		S	Possible
Common Yellowthroat	*Geothlypis trichas*	Y		A	Probable
American Redstart	*Setophaga ruticilla*	Y		S	Possible
Northern Parula	*Setophaga americana*	Y		S	Possible
Magnolia Warbler	*Setophaga magnolia*	Y		S	Possible
Blackburnian Warbler	*Setophaga fusca*	Y		S	Possible
Yellow Warbler	*Setophaga petechia*	Y		S	Possible
Chestnut-sided Warbler	*Setophaga pensylvanica*	Y		S	Possible
Yellow-rumped Warbler	*Setophaga coronata*	Y		S	Possible
Black-throated Green Warbler	*Setophaga virens*	Y		S	Possible
Chipping Sparrow	*Spizella passerina*	Y		S	Possible
Savannah Sparrow	*Passerculus sandwichensis*	Y		S	Possible
Song Sparrow	*Melospiza melodia*	Y		CF	Confirmed
Swamp Sparrow	*Melospiza georgiana*	Y		S	Possible
White-throated Sparrow	*Zonotrichia albicollis*	Y		S	Possible
Dark-eyed Junco	*Junco hyemalis*	Y		S	Possible
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Y		H	Possible
Bobolink	*Dolichonyx oryzivorus*	Y		S	Possible
Red-winged Blackbird	*Agelaius phoeniceus*			T	Probable
Common Grackle	*Quiscalus quiscula*			CF	Confirmed
Purple Finch	*Haemorhous purpureus*	Y		H	Possible
American Goldfinch	*Spinus tristis*	Y		P	Probable

Table D.3: Maritimes Breeding Bird Atlas Species List for Square 20MT20

Common Name	Scientific Name	MBCA	Priority Status	Breeding Evidence Code[1]	Breeding Status in Square 20MT20
Canada Goose	*Branta canadensis*	Y		P	Probable
Gadwall	*Mareca strepera*	Y		FY	Confirmed
American Wigeon	*Mareca americana*	Y		FY	Confirmed
American Black Duck	*Anas rubripes*	Y		FY	Confirmed
Mallard	*Anas platyrhynchos*	Y		FY	Confirmed
Blue-winged Teal	*Spatula discors*	Y		P	Probable
Northern Shoveler	*Spatula clypeata*	Y		P	Probable
Northern Pintail	*Anas acuta*	Y		P	Probable
Ring-necked Duck	*Aythya collaris*	Y		FY	Confirmed
Red-breasted Merganser	*Mergus serrator*	Y		nd	nd
Ruffed Grouse	*Bonasa umbellus*			S	Possible
Common Loon	*Gavia immer*	Y		nd	nd
Pied-billed Grebe	*Podilymbus podiceps*	Y		FY	Confirmed
Double-crested Cormorant	*Phalacrocorax auritus*			nd	nd
American Bittern	*Botaurus lentiginosus*	Y		T	Probable
Bald Eagle	*Haliaeetus leucocephalus*			H	Possible
Northern Harrier	*Circus hudsonius*			D	Probable
Northern Goshawk	*Accipiter gentilis*			H	Possible
Virginia Rail	*Rallus limicola*	Y		S	Possible
Sora	*Porzana carolina*	Y		T	Probable
Herring Gull	*Larus argentatus*	Y		nd	nd
Great Black-backed Gull	*Larus marinus*	Y		nd	nd
Rock Pigeon	*Columba livia*	Y		V	Probable
Mourning Dove	*Zenaida macroura*	Y		V	Probable
Northern Saw-whet Owl	*Aegolius acadicus*			S	Possible
Ruby-throated Hummingbird	*Archilochus colubris*	Y		T	Probable
Belted Kingfisher	*Megaceryle alcyon*			P	Probable
Hairy Woodpecker	*Dryobates villosus*	Y		S	Possible
Northern Flicker	*Colaptes auratus*	Y		FY	Confirmed

Common Name	Scientific Name	MBCA	Priority Status	Breeding Evidence Code[1]	Breeding Status in Square 20MT20
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Y		S	Possible
Alder Flycatcher	*Empidonax alnorum*	Y		T	Probable
Least Flycatcher	*Empidonax minimus*	Y		S	Possible
Blue-headed Vireo	*Vireo solitarius*	Y		A	Probable
Red-eyed Vireo	*Vireo olivaceus*	Y		A	Probable
Blue Jay	*Cyanocitta cristata*			T	Probable
American Crow	*Corvus brachyrhynchos*			FY	Confirmed
Common Raven	*Corvus corax*			T	Probable
Tree Swallow	*Tachycineta bicolor*	Y		D	Probable
Bank Swallow	*Riparia riparia*	Y		AE	Confirmed
Barn Swallow	*Hirundo rustica*	Y		NY	Confirmed
Black-capped Chickadee	*Poecile atricapillus*	Y		FY	Confirmed
Boreal Chickadee	*Poecile hudsonicus*	Y		S	Possible
Red-breasted Nuthatch	*Sitta canadensis*	Y		NB	Confirmed
Winter Wren	*Troglodytes hiemalis*	Y		FY	Confirmed
Golden-crowned Kinglet	*Regulus satrapa*	Y		FY	Confirmed
Ruby-crowned Kinglet	*Regulus calendula*	Y		S	Possible
Veery	*Catharus fuscescens*	Y		S	Possible
Swainson's Thrush	*Catharus ustulatus*	Y		A	Probable
Hermit Thrush	*Catharus guttatus*	Y		S	Possible
American Robin	*Turdus migratorius*	Y		CF	Confirmed
Gray Catbird	*Dumetella carolinensis*	Y		T	Probable
European Starling	*Sturnus vulgaris*			NY	Confirmed
Cedar Waxwing	*Bombycilla cedrorum*	Y		S	Possible
Ovenbird	*Seiurus aurocapilla*	Y		T	Probable
Black-and-white Warbler	*Mniotilta varia*	Y		S	Possible
Tennessee Warbler	*Leiothlypis peregrina*	Y		S	Possible
Mourning Warbler	*Geothlypis philadelphia*	Y		S	Possible
Common Yellowthroat	*Geothlypis trichas*	Y		FY	Confirmed
American Redstart	*Setophaga ruticilla*	Y		D	Probable

Common Name	Scientific Name	MBCA	Priority Status	Breeding Evidence Code[1]	Breeding Status in Square 20MT20
Northern Parula	*Setophaga americana*	Y		T	Probable
Magnolia Warbler	*Setophaga magnolia*	Y		T	Probable
Yellow Warbler	*Setophaga petechia*	Y		CF	Confirmed
Chestnut-sided Warbler	*Setophaga pensylvanica*	Y		S	Possible
Blackpoll Warbler	*Setophaga striata*	Y		T	Probable
Palm Warbler	*Setophaga palmarum*	Y		S	Possible
Yellow-rumped Warbler	*Setophaga coronata*	Y		CF	Confirmed
Black-throated Green Warbler	*Setophaga virens*	Y		T	Probable
Chipping Sparrow	*Spizella passerina*	Y		A	Probable
Savannah Sparrow	*Passerculus sandwichensis*	Y		NB	Confirmed
Song Sparrow	*Melospiza melodia*	Y		CF	Confirmed
Swamp Sparrow	*Melospiza georgiana*	Y		D	Probable
White-throated Sparrow	*Zonotrichia albicollis*	Y		T	Probable
Dark-eyed Junco	*Junco hyemalis*	Y		S	Possible
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Y		T	Probable
Bobolink	*Dolichonyx oryzivorus*	Y		CF	Confirmed
Red-winged Blackbird	*Agelaius phoeniceus*			T	Probable
Rusty Blackbird	*Euphagus carolinus*			D	Probable
Common Grackle	*Quiscalus quiscula*			CF	Confirmed
Brown-headed Cowbird	*Molothrus ater*			H	Possible
Purple Finch	*Haemorhous purpureus*	Y		H	Possible
American Goldfinch	*Spinus tristis*	Y		P	Probable

Table D.4: Avian Species Observed During Spring Migration Surveys

Code	Common Name	*Scientific Name*	MBCA	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
SOSP	Song Sparrow	*Melospiza melodia*	Y				157	41.3
AMRO	American Robin	*Turdus migratorius*	Y				124	32.6
CORE	Common Redpoll	*Acanthis flammea*	Y				102	26.8
AMCR	American Crow	*Corvus brachyrhynchos*					95	25
BCCH	Black-capped Chickadee	*Poecile atricapillus*	Y				67	17.6
BLJA	Blue Jay	*Cyanocitta cristata*					60	15.8
WTSP	White-throated Sparrow	*Zonotrichia albicollis*	Y				49	12.9
CORA	Common Raven	*Corvus corax*					43	11.3
SWSP	Swamp Sparrow	*Melospiza georgiana*	Y				34	8.9
COYE	Common Yellowthroat	*Geothlypis trichas*	Y				32	8.4
EUST	European Starling	*Sturnus vulgaris*					31	8.2
YRWA	Yellow-rumped Warbler	*Setophaga coronata*	Y				25	6.6
YBSA	Yellow-bellied Sapsucker	*Sphyrapicus varius*	Y				24	6.3
COGR	Common Grackle	*Quiscalus quiscula*					21	5.5
AMGO	American Goldfinch	*Spinus tristis*	Y				19	5
CSWA	Chestnut-sided Warbler	*Setophaga pensylvanica*	Y				18	4.7
OVEN	Ovenbird	*Seiurus aurocapilla*	Y				18	4.7

Code	Common Name	*Scientific Name*	MBCA	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
RUGR	Ruffed Grouse	*Bonasa umbellus*	Y				18	4.7
BTNW	Black-throated Green Warbler	*Setophaga virens*	Y				16	4.2
BAWW	Black-and-White Warbler	*Mniotilta varia*	Y				15	3.9
RCKI	Ruby-crowned Kinglet	*Regulus calendula*	Y	S3B			15	3.9
NOPA	Northern Parula	*Setophaga americana*	Y				14	3.7
GCKI	Golden-crowned Kinglet	*Regulus satrapa*	Y				13	3.4
HAWO	Hairy Woodpecker	*Dryobates villosus*	Y				12	3.2
NOFL	Northern Flicker	*Colaptes auratus*	Y				12	3.2
PUFI	Purple Finch	*Haemorhous purpureus*	Y				12	3.2
ALFL	Alder Flycatcher	*Empidonax alnorum*	Y				11	2.9
HETH	Hermit Thrush	*Catharus guttatus*	Y				11	2.9
YEWA	Yellow Warbler	*Setophaga petechia*	Y				11	2.9
MAWA	Magnolia Warbler	*Setophaga magnolia*	Y				10	2.6
AMRE	American Redstart	*Setophaga ruticilla*	Y				8	2.1
RBNU	Red-breasted Nuthatch	*Sitta canadensis*	Y				8	2.1
BOBO	Bobolink	*Dolichonyx oryzivorus*	Y	S2B	T	T	7	1.8
CANG	Canada Goose	*Branta canadensis*	Y				7	1.8
RWBL	Red-winged Blackbird	*Agelaius phoeniceus*					7	1.8

Code	Common Name	*Scientific Name*	MBCA	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
SAVS	Savannah Sparrow	*Passerculus sandwichensis*	Y				7	1.8
UNBI	Unidentified Bird	*Aves (gen, sp)*					7	1.8
VEER	Veery	*Catharus fuscescens*	Y	S3B			7	1.8
ABDU	American Black Duck	*Anas rubripes*	Y				5	1.3
GBHE	Great Blue Heron	*Ardea herodias*					5	1.3
BAEA	Bald Eagle	*Haliaeetus leucocephalus*			NAR	NS	4	1.1
BHVI	Blue-headed Vireo	*Vireo solitarius*	Y				4	1.1
DEJU	Dark-eyed Junco	*Junco hyemalis*	Y				4	1.1
DOWO	Downy Woodpecker	*Dryobates pubescens*	Y				4	1.1
ROPI	Rock Pigeon	*Columba livia*	Y	SNA			4	1.1
TRES	Tree Swallow	*Tachycineta bicolor*	Y	S3S4B			4	1.1
BRCR	Brown Creeper	*Certhia americana*	Y				3	0.8
NOHA	Northern Harrier	*Circus hudsonius*			NAR	NS	3	0.8
BARS	Barn Swallow	*Hirundo rustica*	Y	S2B	T	T	2	0.5
CAWA	Canada Warbler	*Cardellina canadensis*	Y	S2B	SC	T	2	0.5
CMWA	Cape May Warbler	*Setophaga tigrina*	Y	S3B			2	0.5
HERG	Herring Gull	*Larus argentatus*	Y	S2B,S5N			2	0.5
MERL	Merlin	*Falco columbarius*			NAR	NS	2	0.5
MODO	Mourning Dove	*Zenaida macroura*	Y				2	0.5
REVI	Red-eyed Vireo	*Vireo olivaceus*	Y				2	0.5

Code	Common Name	*Scientific Name*	MBCA	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
RBGR	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Y	S2S3B			2	0.5
RTHU	Ruby-throated Hummingbird	*Archilochus colubris*	Y				2	0.5
SNBU	Snow Bunting	*Plectrophenax nivalis*	Y				2	0.5
AMWO	American Woodcock	*Scolopax minor*	Y				1	0.3
BBWA	Bay-breasted Warbler	*Setophaga castanea*	Y	S2B			1	0.3
BEKI	Belted Kingfisher	*Megaceryle alcyon*					1	0.3
BWWA	Blue-winged Warbler	*Vermivora cyanoptera*	Y	SNA			1	0.3
CHSP	Chipping Sparrow	*Spizella passerina*	Y				1	0.3
COLO	Common Loon	*Gavia immer*	Y	S1B,S4M	NAR	NS	1	0.3
DCCO	Double-crested Cormorant	*Phalacrocorax auritus*			NAR	NS	1	0.3
EAPH	Eastern Phoebe	*Sayornis phoebe*	Y	SNA			1	0.3
FOSP	Fox Sparrow	*Passerella iliaca*	Y	SUB			1	0.3
GRCA	Gray Catbird	*Dumetella carolinensis*	Y	S3B			1	0.3
KILL	Killdeer	*Charadrius vociferus*	Y	S2S3B			1	0.3
LEFL	Least Flycatcher	*Empidonax minimus*	Y				1	0.3
NSHR	Northern Shrike	*Lanius borealis*		SNA			1	0.3
NOWA	Northern Waterthrush	*Parkesia noveboracensis*	Y	S3B			1	0.3
RTHA	Red-tailed Hawk	*Buteo jamaicensis*			NAR	NS	1	0.3
RTLO	Red-throated Loon	*Gavia stellata*	Y				1	0.3

Code	Common Name	*Scientific Name*	MBCA	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
RBGU	Ring-billed Gull	*Larus delawarensis*	Y	S1B,S5 M			1	0.3
SWTH	Swainson's Thrush	*Catharus ustulatus*	Y				1	0.3
TEWA	Tennessee Warbler	*Leiothlypis peregrina*	Y	S2B			1	0.3
WWCR	White-winged Crossbill	*Loxia leucoptera*	Y	S3			1	0.3
WIWR	Winter Wren	*Troglodytes hiemalis*	Y				1	0.3
* Note: Total counts divided by average number of visits per survey location (3.8)								

Table D.5: Avian Species Observed During Breeding Bird Point Count Surveys

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
AMRO	American Robin	*Turdus migratorius*	Y				73	33.8
SOSP	Song Sparrow	*Melospiza melodia*	Y				68	31.5
ALFL	Alder Flycatcher	*Empidonax alnorum*	Y				65	30.1
COYE	Common Yellowthroat	*Geothlypis trichas*	Y				62	28.7
SWSP	Swamp Sparrow	*Melospiza georgiana*	Y				44	20.4
REVI	Red-eyed Vireo	*Vireo olivaceus*	Y				35	16.2
AMRE	American Redstart	*Setophaga ruticilla*	Y				34	15.7
YEWA	Yellow Warbler	*Setophaga petechia*	Y				30	13.9
COGR	Common Grackle	*Quiscalus quiscula*					29	13.4
AMCR	American Crow	*Corvus brachyrhynchos*					28	13
SAVS	Savannah Sparrow	*Passerculus sandwichensis*	Y				27	12.5
WTSP	White-throated Sparrow	*Zonotrichia albicollis*	Y				26	12
BLJA	Blue Jay	*Cyanocitta cristata*					19	8.8
CSWA	Chestnut-sided Warbler	*Setophaga pensylvanica*	Y				18	8.3
CORA	Common Raven	*Corvus corax*					18	8.3
YRWA	Yellow-rumped Warbler	*Setophaga coronata*	Y				17	7.9
BTNW	Black-throated	*Setophaga virens*	Y				16	7.4

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
	Green Warbler							
BOBO	Bobolink	*Dolichonyx oryzivorus*	Y	S2B	T	T	16	7.4
VEER	Veery	*Catharus fuscescens*	Y	S3B			16	7.4
BAWW	Black-and-White Warbler	*Mniotilta varia*	Y				15	6.9
GCKI	Golden-crowned Kinglet	*Regulus satrapa*	Y				15	6.9
AMGO	American Goldfinch	*Spinus tristis*	Y				14	6.5
OVEN	Ovenbird	*Seiurus aurocapilla*	Y				13	6
NOPA	Northern Parula	*Setophaga americana*	Y				10	4.6
BCCH	Black-capped Chickadee	*Poecile atricapillus*	Y				9	4.2
CEDW	Cedar Waxwing	*Bombycilla cedrorum*	Y				9	4.2
MAWA	Magnolia Warbler	*Setophaga magnolia*	Y				9	4.2
BANS	Bank Swallow	*Riparia riparia*	Y	S2S3B	T	T	7	3.2
NOHA	Northern Harrier	*Circus hudsonius*			NAR	NS	7	3.2
YBSA	Yellow-bellied Sapsucker	*Sphyrapicus varius*	Y				7	3.2
EUST	European Starling	*Sturnus vulgaris*		SNA			6	2.8
RBNU	Red-breasted Nuthatch	*Sitta canadensis*	Y				6	2.8
UNBI	Unidentified Bird	*Aves (gen, sp)*	n/a				5	2.3
HETH	Hermit Thrush	*Catharus guttatus*	Y				4	1.9

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
RBGR	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Y	S2S3B			4	1.9
TRES	Tree Swallow	*Tachycineta bicolor*	Y	S3S4B			4	1.9
RWBL	Red-winged Blackbird	*Agelaius phoeniceus*					3	1.4
DCCO	Double-crested Cormorant	*Nannopterum auritum*			NAR	NS	2	0.9
GWTE	Green-winged Teal	*Anas crecca*	Y				2	0.9
RTHA	Red-tailed Hawk	*Buteo jamaicensis*			NAR	NS	2	0.9
SWTH	Swainson's Thrush	*Catharus ustulatus*	Y				2	0.9
BARS	Barn Swallow	*Hirundo rustica*	Y	S2B	T	T	1	0.5
BBWA	Bay-breasted Warbler	*Setophaga castanea*	Y	S2B			1	0.5
BLBW	Blackburnian Warbler	*Setophaga fusca*	Y				1	0.5
BHVI	Blue-headed Vireo	*Vireo solitarius*	Y				1	0.5
CMWA	Cape May Warbler	*Setophaga tigrina*	Y	S3B			1	0.5
DOWO	Downy Woodpecker	*Dryobates pubescens*	Y				1	0.5
EAWP	Eastern Wood-Pewee	*Contopus virens*	Y	S3B			1	0.5
GBHE	Great Blue Heron	*Ardea herodias*	Y				1	0.5
MODO	Mourning Dove	*Zenaida macroura*	Y				1	0.5
NOFL	Northern Flicker	*Colaptes auratus*	Y				1	0.5
NOGA	Northern Gannet	*Morus bassanus*	Y				1	0.5
NOWA	Northern Waterthrush	*Parkesia noveboracensis*	Y	S3B			1	0.5

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
RTHU	Ruby-throated Hummingbird	*Archilochus colubris*	Y				1	0.5
SSHA	Sharp-shinned Hawk	*Accipiter striatus*			NAR	NS	1	0.5
TEWA	Tennessee Warbler	*Leiothlypis peregrina*	Y	S2B			1	0.5
WODU	Wood Duck	*Aix sponsa*	Y				1	0.5
* Note: Total counts divided by average number of visits per survey location (2.16)								

Table D.6: Avian Species Observed During Fall Migration Surveys

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
EUST	European Starling	*Sturnus vulgaris*	Y	SNA			840	113.8
BLJA	Blue Jay	*Cyanocitta cristata*					563	76.3
AMCR	American Crow	*Corvus brachyrhynchos*					377	51.1
AMRO	American Robin	*Turdus migratorius*	Y				326	44.2
HERG	Herring Gull	*Larus argentatus*	Y	S2B,S5N			262	35.5
GBBG	Great Black-backed Gull	*Larus marinus*	Y	S2S3B,S5N			189	25.6
CEDW	Cedar Waxwing	*Bombycilla cedrorum*	Y				171	23.2
AMGO	American Goldfinch	*Spinus tristis*	Y				159	21.5
CORA	Common Raven	*Corvus corax*					135	18.3
BCCH	Black-capped Chickadee	*Poecile atricapillus*	Y				132	17.9
SOSP	Song Sparrow	*Melospiza melodia*	Y				127	17.2
DCCO	Double-crested Cormorant	*Phalacrocorax auritus*			NAR	NS	104	14.1
YRWA	Yellow-rumped Warbler	*Setophaga coronata*	Y				71	9.6
UNBI	Unidentified Bird	*Aves (gen, sp)*	n/a				56	7.6
RBGU	Ring-billed Gull	*Larus delawarensis*	Y	S1B,S5M			55	7.5
SAVS	Savannah Sparrow	*Passerculus sandwichensis*	Y				55	7.5
WWCR	White-winged Crossbill	*Loxia leucoptera*	Y	S3			51	6.9
ABDU	American Black Duck	*Anas rubripes*	Y				30	4.1

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
CANG	Canada Goose	*Branta canadensis*	Y				27	3.7
BANS	Bank Swallow	*Riparia riparia*	Y	S2S3B	T	T	26	3.5
DCCO/ GRCO	Double-crested Cormorant/ Great Cormorant	*P. auritus/ Phalacrocorax carbo*		NA			24	3.3
WTSP	White-throated Sparrow	*Zonotrichia albicollis*	Y				21	2.8
NOFL	Northern Flicker	*Colaptes auratus*	Y				20	2.7
REVI	Red-eyed Vireo	*Vireo olivaceus*	Y				20	2.7
ROPI	Rock Pigeon	*Columba livia*	Y	SNA			20	2.7
COME	Common Merganser	*Mergus merganser*	Y	SUB,S5N			18	2.4
GCKI	Golden-crowned Kinglet	*Regulus satrapa*	Y				17	2.3
GRCO	Great Cormorant	*Phalacrocorax carbo*		S1B			17	2.3
RBNU	Red-breasted Nuthatch	*Sitta canadensis*	Y				17	2.3
SWSP	Swamp Sparrow	*Melospiza georgiana*	Y				17	2.3
HOME	Hooded Merganser	*Lophodytes cucullatus*	Y	S1B,S4M			14	1.9
BAEA	Bald Eagle	*Haliaeetus leucocephalus*			NAR	NS	13	1.8
NOHA	Northern Harrier	*Circus hudsonius*			NAR	NS	13	1.8
DEJU	Dark-eyed Junco	*Junco hyemalis*	Y				12	1.6
COYE	Common Yellowthroat	*Geothlypis trichas*	Y				11	1.5
SBDO	Short-billed Dowitcher	*Limnodromus griseus*	Y	S3M			11	1.5

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
GBHE	Great Blue Heron	*Ardea herodias*	Y				10	1.4
MODO	Mourning Dove	*Zenaida macroura*	Y				10	1.4
NOGA	Northern Gannet	*Morus bassanus*	Y				10	1.4
SEPL	Semipalmated Plover	*Charadrius semipalmatus*	Y	SHB,S3M			10	1.4
HAWO	Hairy Woodpecker	*Dryobates villosus*	Y				9	1.2
NSHO	Northern Shoveler	*Spatula clypeata*	Y	S2B			8	1.1
ALFL	Alder Flycatcher	*Empidonax alnorum*	Y				7	0.9
YEWA	Yellow Warbler	*Setophaga petechia*	Y				7	0.9
BEKI	Belted Kingfisher	*Megaceryle alcyon*					6	0.8
COSN	Common Snipe	*Gallinago gallinago*	Y				6	0.8
COTE	Common Tern	*Sterna hirundo*	Y	S1B	NAR	NS	6	0.8
DOWO	Downy Woodpecker	*Dryobates pubescens*	Y				6	0.8
GRCA	Gray Catbird	*Dumetella carolinensis*	Y	S3B			6	0.8
RCKI	Ruby-crowned Kinglet	*Corthylio calendula*	Y	S3B			6	0.8
RTHU	Ruby-throated Hummingbird	*Archilochus colubris*	Y				6	0.8
MAWA	Magnolia Warbler	*Setophaga magnolia*	Y				5	0.7
OSPR	Osprey	*Pandion haliaetus*					5	0.7
RTHA	Red-tailed Hawk	*Buteo jamaicensis*			NAR	NS	5	0.7
DUNL	Dunlin	*Calidris alpina*	Y				4	0.5
MERL	Merlin	*Falco columbarius*			NAR	NS	4	0.5

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
RWBL	Red-winged Blackbird	*Agelaius phoeniceus*					4	0.5
SSHA	Sharp-shinned Hawk	*Accipiter striatus*			NAR	NS	4	0.5
TUVU	Turkey Vulture	*Cathartes aura*		SUB			4	0.5
CSWA	Chestnut-sided Warbler	*Setophaga pensylvanica*	Y				3	0.4
COGR	Common Grackle	*Quiscalus quiscula*					3	0.4
EAKI	Eastern Kingbird	*Tyrannus tyrannus*	Y	S2B			3	0.4
GWTE	Green-winged Teal	*Anas crecca*	Y				3	0.4
HETH	Hermit Thrush	*Catharus guttatus*	Y				3	0.4
LEYE	Lesser Yellowlegs	*Tringa flavipes*	Y	S3M	T	NS	3	0.4
SPSA	Spotted Sandpiper	*Actitis macularius*	Y	S2S3B			3	0.4
WCSP	White-crowned Sparrow	*Zonotrichia leucophrys*	Y	SNA			3	0.4
AMKE	American Kestrel	*Falco sparverius*					2	0.3
AMRE	American Redstart	*Setophaga ruticilla*	Y				2	0.3
CATE	Caspian Tern	*Hydroprogne caspia*	Y	SNA	NAR	NS	2	0.3
EAPH	Eastern Phoebe	*Sayornis phoebe*	Y	SNA			2	0.3
LEFL	Least Flycatcher	*Empidonax minimus*	Y				2	0.3
RUGR	Ruffed Grouse	*Bonasa umbellus*	Y				2	0.3
SESA	Semipalmated Sandpiper	*Calidris pusilla*	Y	S3M			2	0.3
BBPL	Black-bellied Plover	*Pluvialis squatarola*	Y	S3M			1	0.1

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Total Count	Average Count per Survey
				ACCDC	COSEWIC	SARA		
BLBW	Blackburnian Warbler	*Setophaga fusca*	Y				1	0.1
BHVI	Blue-headed Vireo	*Vireo solitarius*	Y				1	0.1
BWWA	Blue-winged Warbler	*Vermivora cyanoptera*	Y	SNA			1	0.1
BRCR	Brown Creeper	*Certhia americana*	Y				1	0.1
PAWA	Palm Warbler	*Setophaga palmarum*	Y				1	0.1
PBGR	Pied-billed Grebe	*Podilymbus podiceps*	Y				1	0.1
RLHA	Rough-legged Hawk	*Buteo lagopus*		S2S3N	NAR	NS	1	0.1
SWTH	Swainson's Thrush	*Catharus ustulatus*	Y				1	0.1
* Note: Total counts divided by average number of visits per survey location (7.38)								

Table D.7: Avian Species Observed During Winter Resident Surveys

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Total Count	Average Count per Survey*
				ACCDC	COSEWIC	SARA		
SNBU	Snow Bunting	*Plectrophenax nivalis*	Y				363	90.8
WWCR	White-winged Crossbill	*Loxia leucoptera*	Y	S3			352	88
BCCH	Black-capped Chickadee	*Poecile atricapillus*	Y				226	56.5
EUST	European Starling	*Sturnus vulgaris*		SNA			214	53.5
CORA	Common Raven	*Corvus corax*					177	44.2
AMCR	American Crow	*Corvus brachyrhynchos*					158	39.5
AMGO	American Goldfinch	*Spinus tristis*	Y				119	29.8
BLJA	Blue Jay	*Cyanocitta cristata*					63	15.8
HERG	Herring Gull	*Larus argentatus*	Y	S2B,S5N			54	13.5
DEJU	Dark-eyed Junco	*Junco hyemalis*	Y				35	8.8
CORE	Common Redpoll	*Acanthis flammea*	Y				25	6.2
UNBI	Unidentified Bird	*Aves (gen, sp)*	n/a				17	4.2
GCKI	Golden-crowned Kinglet	*Regulus satrapa*	Y				12	3
BAEA	Bald Eagle	*Haliaeetus leucocephalus*			NAR	NS	11	2.8
RBNU	Red-breasted Nuthatch	*Sitta canadensis*	Y				9	2.2
AMRO	American Robin	*Turdus migratorius*	Y				7	1.8
ICGU	Iceland Gull	*Larus glaucoides*	Y				7	1.8
RTHA	Red-tailed Hawk	*Buteo jamaicensis*			NAR	NS	7	1.8
GLGU	Glaucous Gull	*Larus hyperboreus*	Y	SNA			2	0.5
GBBG	Great Black-backed Gull	*Larus marinus*	Y	S2S3B,S5N			2	0.5
HAWO	Hairy Woodpecker	*Dryobates villosus*	Y				2	0.5

Code	Common Name	*Scientific Name*	MBCA?	Priority Status			Total Count	Average Count per Survey*
				ACCDC	COSEWIC	SARA		
RBGU	Ring-billed Gull	*Larus delawarensis*	Y	S1B,S5M			2	0.5
DOWO	Downy Woodpecker	*Dryobates pubescens*	Y				1	0.2
GRCA	Gray Catbird	*Dumetella carolinensis*	Y	S3B			1	0.2
GBHE	Great Blue Heron	*Ardea herodias*	Y				1	0.2
NOFL	Northern Flicker	*Colaptes auratus*	Y				1	0.2
NOHA	Northern Harrier	*Circus hudsonius*			NAR	NS	1	0.2
NSHR	Northern Shrike	*Lanius borealis*	Y	SNA			1	0.2
SOSP	Song Sparrow	*Melospiza melodia*	Y				1	0.2
* Note: Total counts divided by number of surveys (4)								

Table D.8: Weekly Avian Species Diversity During Fall Acoustic Monitoring

Date Range (Week)	Species/Species Groups Detected (Alphabetic Order)	Total Number of Species/Species Groups Detected	Average Number of Species/Species Groups Detected per Night
Jul 15-Jul 18	Alder Flycatcher, American Crow, American Robin, Common Loon, Common Raven, Golden-crowned Kinglet, Savannah Sparrow, Song Sparrow, Swamp Sparrow	10	4
Jul 19-Jul 25	Alder Flycatcher, American Crow, American Robin, Blue Jay, Common Raven, Red-winged Blackbird, Savannah Sparrow, Song Sparrow	8	3.2
Jul 26-Aug 01	Alder Flycatcher, American Crow, American Robin, Common Raven, Common Yellowthroat, Song Sparrow, White-throated Sparrow	8	3.8
Aug 02-Aug 08	Alder Flycatcher, American Goldfinch, American Robin, Blue Jay, Common Raven, Common Yellowthroat, Least Flycatcher, Red-breasted Nuthatch, Savannah Sparrow, Song Sparrow, White-throated Sparrow, Yellow Warbler	13	3.4
Aug 09-Aug 15	Alder Flycatcher, American Crow, American Redstart, American Robin, Blue Jay, Common Raven, Hermit Thrush, Herring Gull, Red-breasted Nuthatch, Song Sparrow, White-throated Sparrow	12	3.9
Aug 16-Aug 22	Alder Flycatcher, American Crow, American Redstart, American Robin, Blue Jay, Canada Goose, Common Raven, Common Yellowthroat, Dark-eyed Junco, Hairy Woodpecker, Red-breasted Nuthatch, Song Sparrow, Swainson's Thrush	14	3.1
Aug 23-Aug 29	Alder Flycatcher, American Crow, American Goldfinch, American Redstart, American Robin, Black-and-white Warbler, Blue Jay, Common Raven, Hermit Thrush, Song Sparrow, White-throated Sparrow	12	3.6

Date Range (Week)	Species/Species Groups Detected (Alphabetic Order)	Total Number of Species/Species Groups Detected	Average Number of Species/Species Groups Detected per Night
Aug 30-Sep 05	American Redstart, American Robin, Black-capped Chickadee, Blue Jay, Chestnut-sided Warbler, Hermit Thrush, Song Sparrow, White-throated Sparrow	9	2.8
Sep 06-Sep 12	Alder Flycatcher, American Goldfinch, American Robin, Chestnut-sided Warbler, Golden-crowned Kinglet, Song Sparrow, White-throated Sparrow, Yellow Warbler	9	2.8
Sep 13-Sep 19	American Redstart, American Robin, White-throated Sparrow	4	1.9
Sep 20-Sep 26	American Crow, American Redstart, American Robin, Black-capped Chickadee, Blue Jay, Brown Creeper, Chipping Sparrow, Common Raven, Song Sparrow, White-throated Sparrow	11	2.5
Sep 27-Oct 03	American Crow, American Robin, Black-capped Chickadee, Blue Jay, Herring Gull, Magnolia Warbler, Red-breasted Nuthatch, Song Sparrow, White-throated Sparrow	10	3.4
Oct 04-Oct 10	American Crow, American Robin, Black-capped Chickadee, Blue Jay, Common Raven, Dark-eyed Junco, Golden-crowned Kinglet, Song Sparrow, White-throated Sparrow	10	4.2
Oct 11-Oct 17	American Crow, American Redstart, American Robin, Blue Jay, Gray Catbird, Herring Gull, Song Sparrow, White-throated Sparrow	9	3.1
Oct 18-Oct 22	Blue Jay, Common Raven, Northern Saw-whet Owl, White-throated Sparrow	4	1.2

Table D.9: Weekly Avian Species Diversity During Spring Acoustic Monitoring

Date Range (Week)	Species/Species Groups Detected (Alphabetic Order)	Total Number of Species/Species Groups Detected	Average Number of Species/Species Groups Detected per Night
Apr 18-Apr 24	Black-capped Chickadee, Song Sparrow	2	2
Apr 25-May 01	American Crow, American Robin, Black-capped Chickadee, Blue Jay, Brown Creeper, double banded upseep sp., Northern Flicker, Rose-breasted Grosbeak, Ruby-crowned Kinglet, Song Sparrow, sparrow sp. , Yellow-bellied Sapsucker	12	3.3
May 02-May 08	American Crow, American Robin, Cedar Waxwing, duck sp., Mallard, Northern Saw-whet Owl, Red-winged Blackbird, Savannah Sparrow, Song Sparrow, sparrow sp. , warbler sp.	11	4.3
May 09-May15	American Robin, American Woodcock, Black-capped Chickadee, Blue Jay, Cedar Waxwing, Dark-eyed Junco, Northern Saw-whet Owl, Red-winged Blackbird, Savannah Sparrow, Song Sparrow, sparrow sp. , warbler sp. , White-Throated Sparrow	13	5.6
May 16-May 22	American Crow, American Robin, American Woodcock, Black-capped Chickadee, Blue Jay, Chipping Sparrow, Dark-eyed Junco, Northern Saw-whet Owl, Red-breasted	12	6.7

Date Range (Week)	Species/Species Groups Detected (Alphabetic Order)	Total Number of Species/Species Groups Detected	Average Number of Species/Species Groups Detected per Night
	Nuthatch, Song Sparrow, warbler sp. , White-Throated Sparrow		
May 23-May 29	American Crow, American Robin, Black-capped Chickadee, Chipping Sparrow, Common Yellowthroat, Savannah Sparrow, Song Sparrow, White-Throated Sparrow, Yellow-rumped Warbler	9	4.9
May 30-Jun 05	Alder Flycatcher, American Crow, American Robin, Black-capped Chickadee, Blue Jay, mammal sp., Mourning Dove, Savannah Sparrow, Song Sparrow, thrush sp., warbler sp.	11	3.7
Jun 06-Jun 12	Alder Flycatcher, American Crow, American Robin, American Woodcock, Black-capped Chickadee, Black-throated Green Warbler, Chipping Sparrow, Common Yellowthroat, Dark-eyed Junco, Golden-crowned Kinglet, Killdeer, Ovenbird, Savannah Sparrow, Song Sparrow, warbler sp., White-Throated Sparrow, Yellow-rumped Warbler	17	8.6
Jun 13-Jun19	Alder Flycatcher, American Crow, American Redstart, American Robin, Black-capped Chickadee, Boreal Chickadee, Black-throated Green Warbler, Common Yellowthroat, Dark-eyed Junco, Golden-crowned	16	9.9

Date Range (Week)	Species/Species Groups Detected (Alphabetic Order)	Total Number of Species/Species Groups Detected	Average Number of Species/Species Groups Detected per Night
	Kinglet, Savannah Sparrow, Song Sparrow, sparrow sp., Veery, warbler sp., White-Throated Sparrow		
Jun 20-Jun 26	Alder Flycatcher, American Crow, American Redstart, American Robin, Black-capped Chickadee, Black-throated Green Warbler, Chipping Sparrow, Common Raven, Common Yellowthroat, Dark-eyed Junco, Golden-crowned Kinglet, mammal sp. , Mourning Dove, Red-eyed Vireo, Song Sparrow, Veery, White-Throated Sparrow, Yellow Warbler, Yellow-rumped Warbler	19	13.1
Jun 27-Jul 03	American Redstart, American Robin, Common Yellowthroat, Golden-crowned Kinglet, Mourning Dove, Song Sparrow, White-Throated Sparrow	7	5

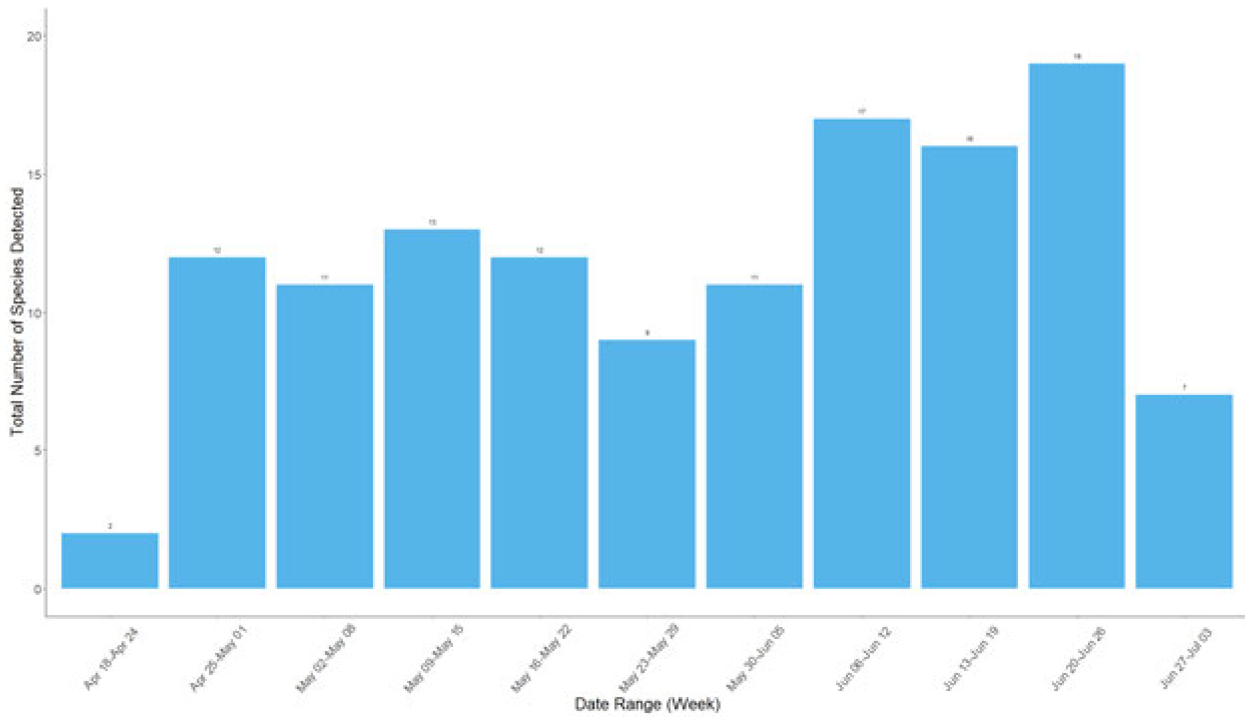


Figure D.1: Height Data

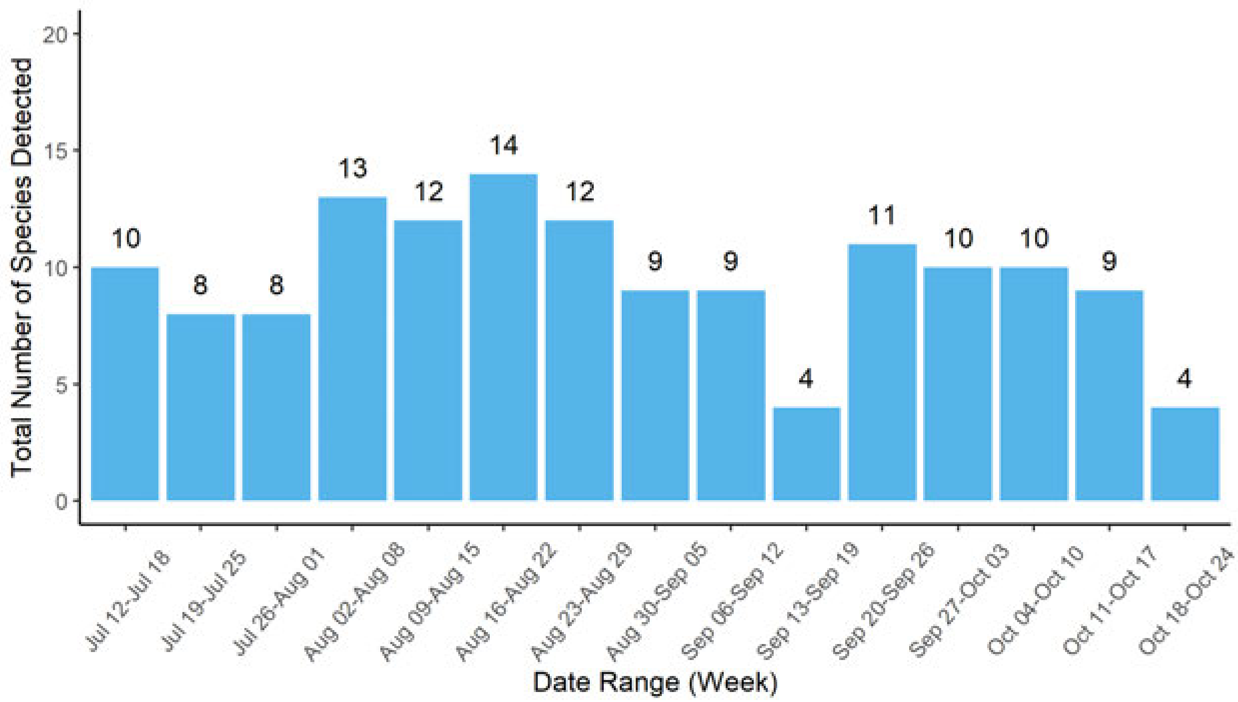


Figure D.2: Fall Acoustic Monitoring

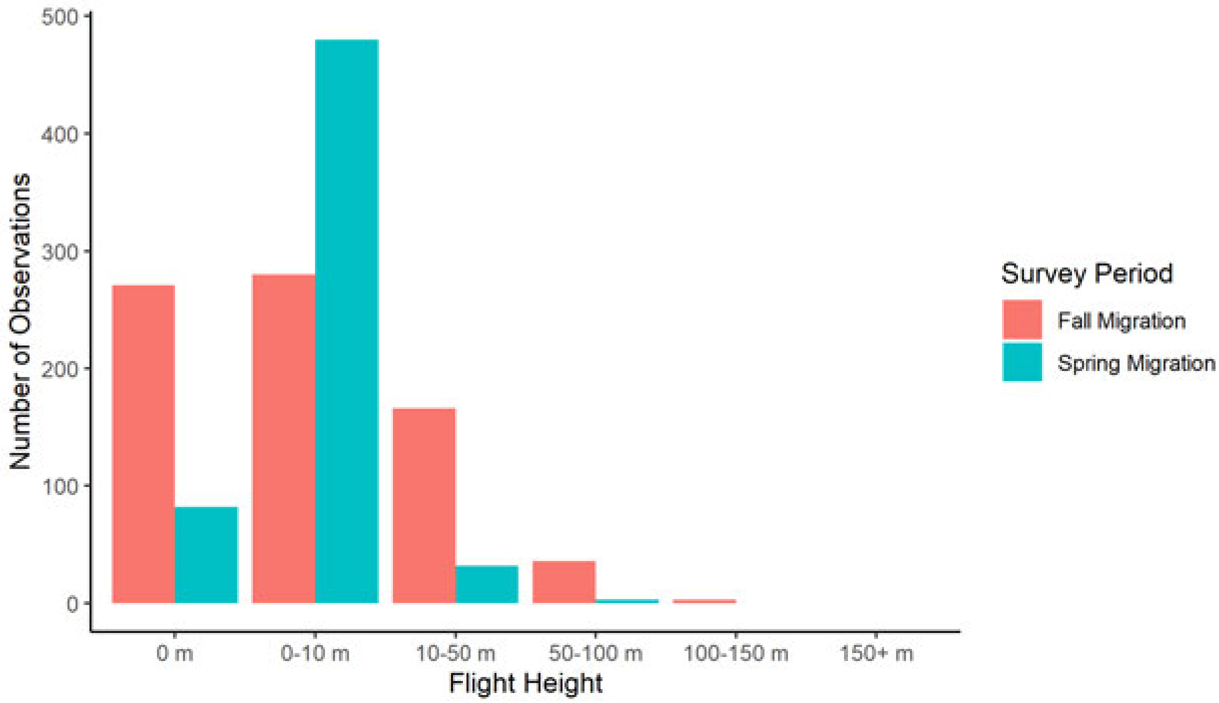


Figure D.3: Spring Acoustic Monitoring

Appendix E

Bat Survey

Table E.1 Bat Call Sequences Detected at the Project Site

Detector ID	Species/Species Grouping	Month and Year (# monitoring nights per detector)						Total
		May 2022 (14)	June 2022 (10-26[1])	July 2021 (174)	August 2021 (186)	September 2021 (180)	October 2021 (132)	
SM-B01	Myotis sp.	0	0	4	17	2	0	23
	Hoary Bat	0	0	1	15	1	0	17
	Eastern Red Bat	0	0	0	1	2	0	3
	Silver-haired Bat	0	0	0	0	0	0	0
	Myotis sp./Eastern Red Bat	0	0	1	2	0	0	3
	Silver-haired Bat/Big Brown Bat	0	0	1	3	1	0	5
	Hoary Bat/Silver-haired Bat/Big Brown Bat	0	0	0	1	0	0	1
	Total	0	0	7	39	6	0	**52**
SM-B02	Myotis sp.	nd	nd	7	36	2	0	45
	Hoary Bat	nd	nd	1	19	0	0	20
	Eastern Red Bat	nd	nd	0	3	0	0	3
	Silver-haired Bat	nd	nd	0	0	0	0	0
	Myotis sp./Eastern Red Bat	nd	nd	0	0	0	0	0
	Silver-haired Bat/Big Brown Bat	nd	nd	0	3	0	0	3
	Hoary Bat/Silver-haired Bat/Big Brown Bat	nd	nd	0	0	0	0	0
	Total	**0**	**0**	8	61	2	0	**71**
SM-B03	Myotis sp.	0	2	4	52	0	0	56
	Hoary Bat	0	1	3	21	2	1	27
	Eastern Red Bat	0	0	2	11	1	0	14
	Silver-haired Bat	0	0	0	2	0	0	2
	Myotis sp./Eastern Red Bat	0	0	0	5	0	0	5

Detector ID	Species/Species Grouping	Month and Year (# monitoring nights per detector)						Total
		May 2022 (14)	June 2022 (10-26[1])	July 2021 (174)	August 2021 (186)	September 2021 (180)	October 2021 (132)	
	Silver-haired Bat/Big Brown Bat	0	0	0	5	1	0	6
	Hoary Bat/Silver-haired Bat/Big Brown Bat	0	0	0	1	1	0	2
	Total	**0**	**3**	9	97	5	1	112
SM-B04	Myotis sp.	14	3	80	163	80	5	328
	Hoary Bat	0	0	19	17	12	19	67
	Eastern Red Bat	0	0	2	7	6	0	15
	Silver-haired Bat	0	0	0	0	0	0	0
	Myotis sp./Eastern Red Bat	0	0	2	8	2	0	12
	Silver-haired Bat/Big Brown Bat	0	0	1	2	0	0	3
	Hoary Bat/Silver-haired Bat/Big Brown Bat	0	0	0	0	0	0	0
	Total	**14**	**3**	**104**	**197**	**100**	**24**	**425**
SM-B05	Myotis sp.	0	2	5	61	2	1	69
	Hoary Bat	0	4	1	12	1	1	15
	Eastern Red Bat	0	0	13	4	1	0	18
	Silver-haired Bat	0	0	3	0	0	0	3
	Myotis sp./Eastern Red Bat	0	0	1	6	0	0	7
	Silver-haired Bat/Big Brown Bat	0	0	1	1	2	0	4
	Hoary Bat/Silver-haired Bat/Big Brown Bat	0	0	2	1	0	0	3
	Total	**0**	**6**	**26**	**85**	**6**	**2**	**119**
SM-B06	Myotis sp.	0	3	7	97	8	0	112
	Hoary Bat	0	1	2	6	36	60	104
	Eastern Red Bat	0	0	1	7	11	0	19

Detector ID	**Species/Species Grouping**	**Month and Year (# monitoring nights per detector)**						**Total**
		May 2022 (14)	**June 2022 (10-26[1])**	**July 2021 (174)**	**August 2021 (186)**	**September 2021 (180)**	**October 2021 (132)**	
	Silver-haired Bat	0	0	0	0	0	0	0
	Myotis sp./Eastern Red Bat	0	0	1	2	3	0	6
	Silver-haired Bat/Big Brown Bat	0	0	0	0	1	0	1
	Hoary Bat/Silver-haired Bat/Big Brown Bat	0	1	0	0	0	0	0
	Total	**0**	**5**	**11**	**112**	**59**	**60**	**242**
Grand Total		**14**	**17**	**165**	**591**	**178**	**87**	**1021**

Note: nd = no data
[1] Due to data loss, the number of monitoring nights in June varied by detector: SM-B01 = 26; SM-B02 = 0 (no data); SM-B03 = 26; SM-B04 = 10; SM-B05 = 26; SM-B06 = 26.

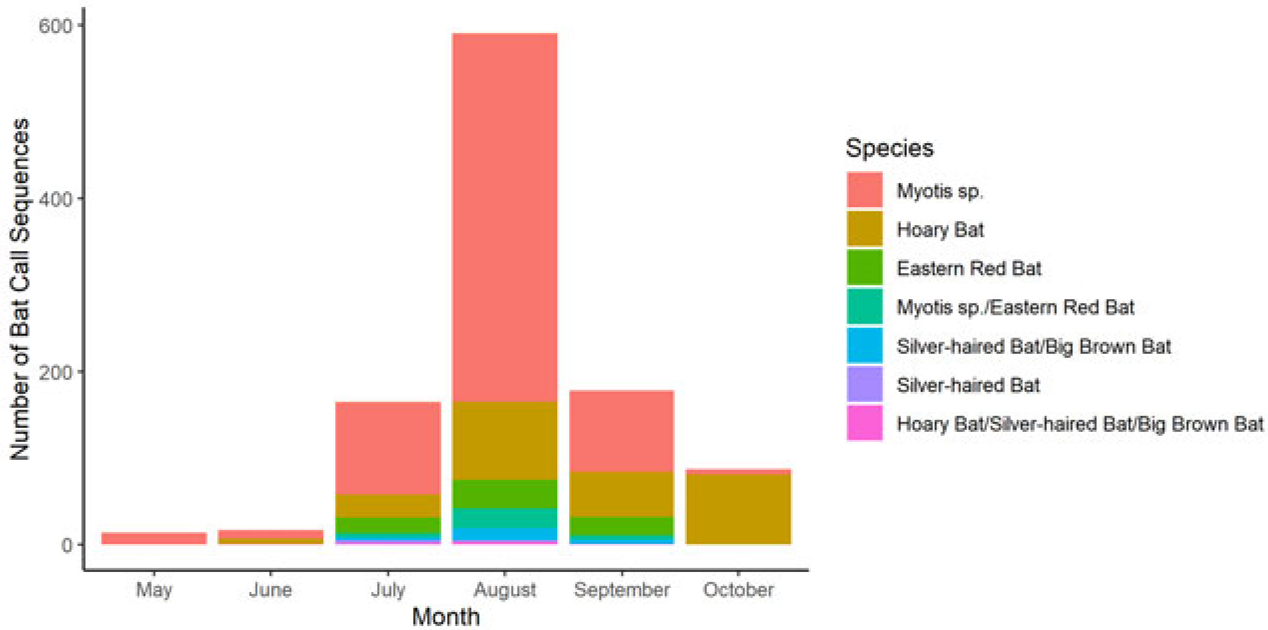


Figure E.1 Summary of Bat Call Sequences Detected at the Project Site by Month.

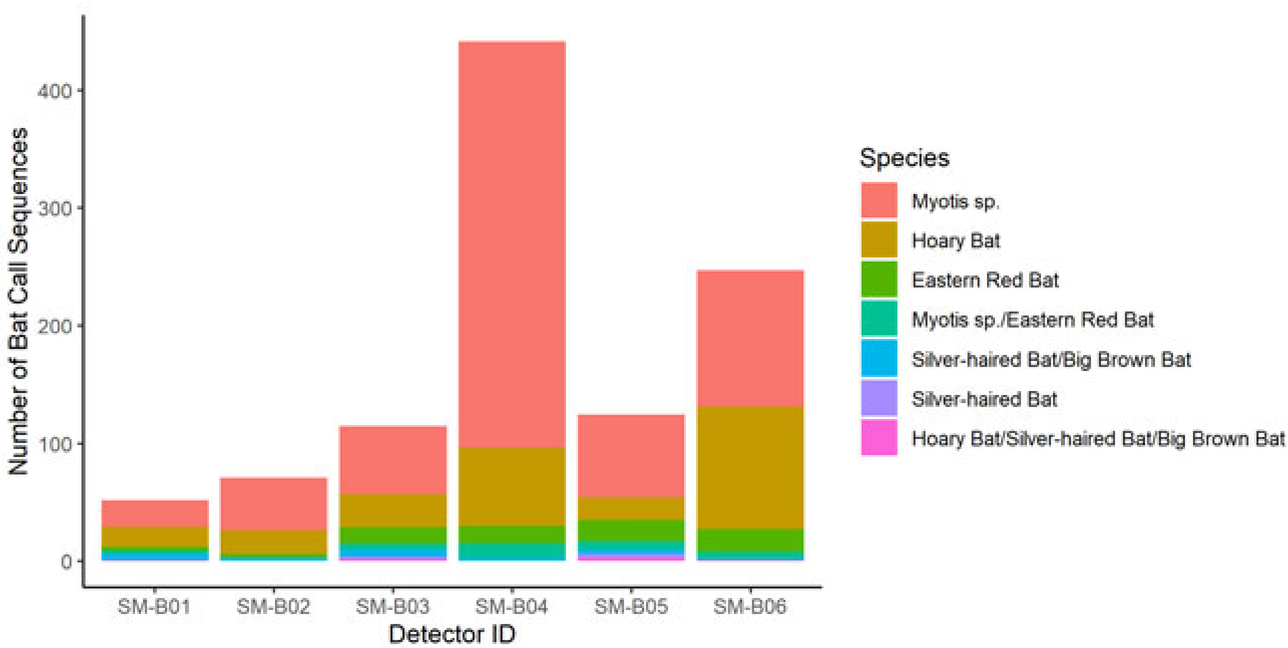
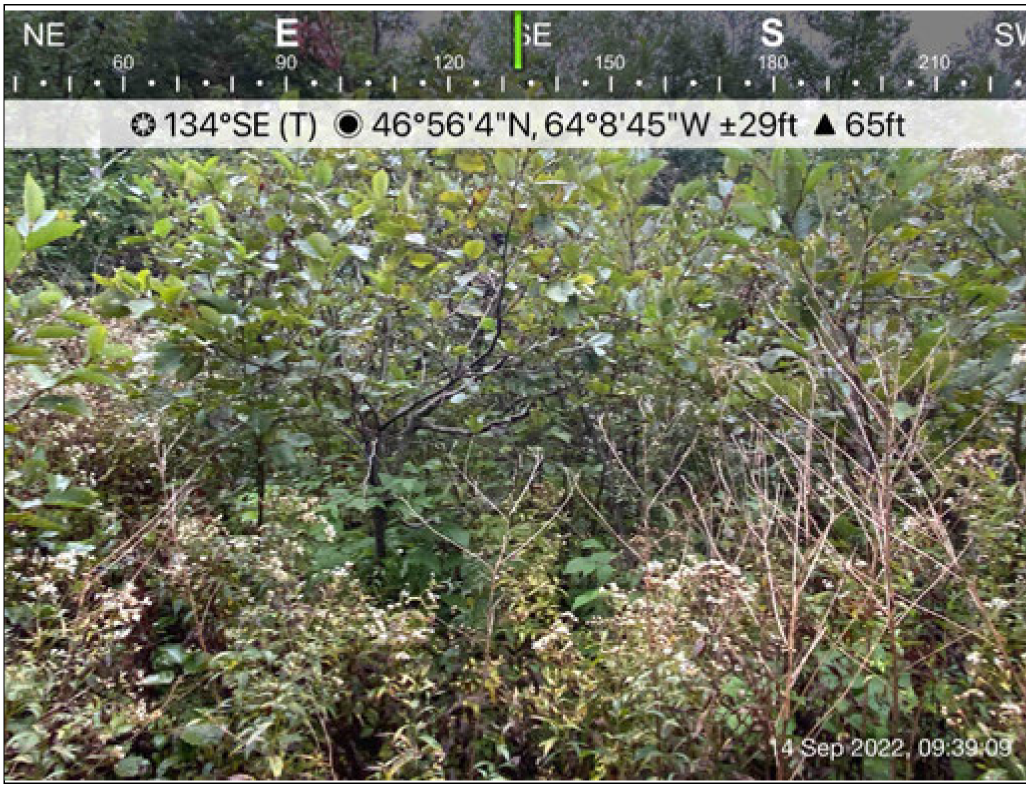


Figure E.2 Summary of all Bat Call Sequences Detected at the Project Site by Detector ID.

Appendix F

Watercourse Crossings

	**Photo 1:** RC-1 12 Sep 2022 **Direction:** Southwest
	**Photo 2:** RC-2 14 Sep 2022 **Direction:** Northeast

	**Photo 3:** RC-3 14 Sep 2022 **Direction:** Southeast
	**Photo 4:** RC-4 14 Sep 2022 **Direction:** East

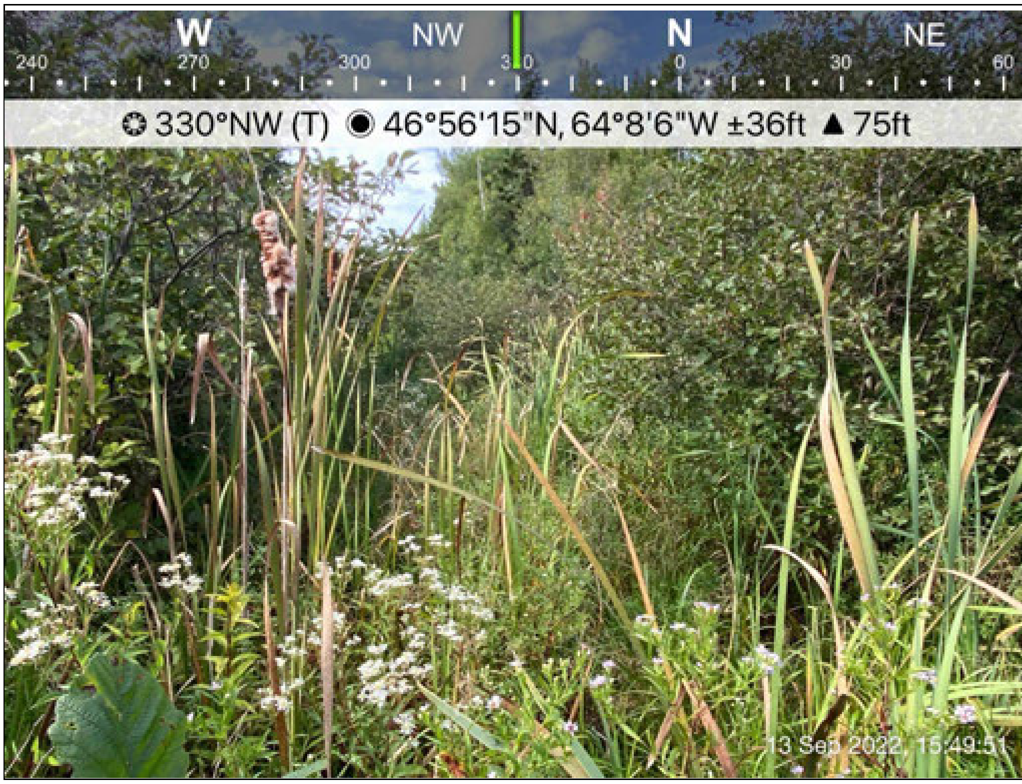


Photo 5:
RC-5

13 Sep 2022

Direction:
Northwest

Photo 6:
RC-6

15 Sep 2022

Direction:
West

Photo 7:
RC-7

14 Sep 2022

Direction:
Southwest

Photo 8:
PC-1

13 Sep 2022

Direction:
Northwest

Photo 9:
PC-6

14 Sep 2022

Direction:
North

Photo 10:
PC-8

15 Sep 2022

Direction:
East

	**Photo 11:** PC-9 15 Sep 2022 **Direction:** Northwest
	**Photo 12:** PC-10 15 Sep 2022 **Direction:** Northeast

Photo 13:
PC-11

15 Sep 2022

Direction:
Northwest

Photo 14:
PC-12

14 Sep 2022

Direction:
Northwest

Photo 15:
PC-13

12 Sep 2022

Direction:
Northwest

Photo 16:
PC-14a

12 Sep 2022

Direction:
Southwest

Photo 17:
PC-14b

12 Sep 2022

Direction:
Northwest

Photo 18:
EF-1

15 Sep 2022

Direction:
East

Photo 19:
MT-1

25 Aug 2021

Direction:
East

Photo 20:
MT-2

26 Aug 2021

Direction:
Southwest

Photo 21:
MT-3

15 Sep 2022

Direction:
West

Photo 23:
MT-5

26 Aug 2021

Direction:
East

Photo 24:
Brook Trout caught at MT-5

26 Aug 2021

Appendix G

Fish Survey

Table 1: Complete list of fish species recorded

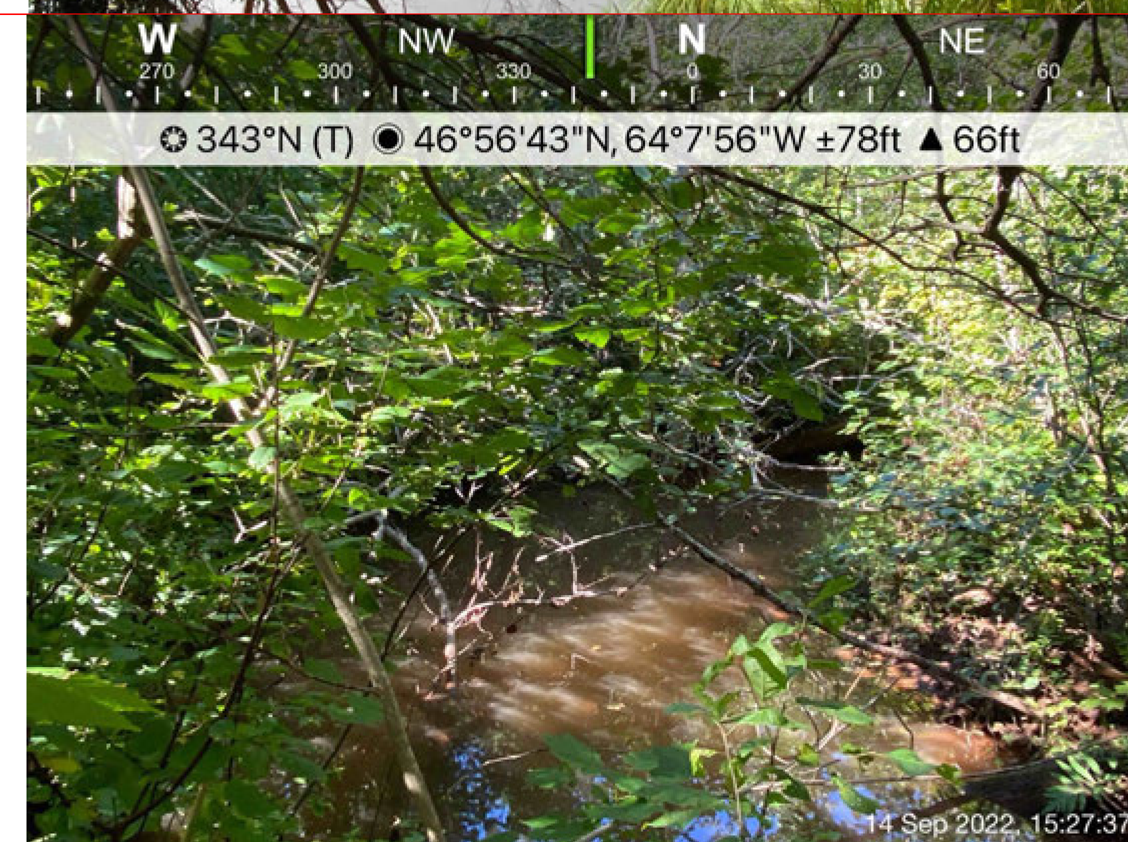
Species	Scientific Name	Location		Fishing Type
		Easting	Northing	
Brook Trout	*Salvelinus fontinalis*	414834.32	5201646.78	Minnow Trap
Brook Trout	*Salvelinus fontinalis*	411256.96	5196717.11	Electrofishing
Brook Trout	*Salvelinus fontinalis*	411256.96	5196717.11	Electrofishing
Three-spine Stickleback	*Gasterosteus aculeatus*	411256.96	5196717.11	Electrofishing
Creek Chub	*Semotilus atromaculatus*	414458.91	5198726.03	Electrofishing

WC Crossing	Date	UTM Coordinates		Description	Representative Photo
		Easting	Northing		
RC-1	12 Sept 22	411724.08	5199658.81	No channel present upstream or downstream of the crossing. Small amount of ponded water in ditch, no flow or connectivity. No watercourse to assess. Photo looking downstream at crossing.	

RC-2	14 Sept 22	412484.55	5198877.36	Large beaver impoundment upstream at crossing. No channel upstream. Beaver deadwater noted at downstream extent of buffer – unsafe to e-fish from banks. Habitat assessed, no fish community assessment. Photo taken at downstream buffer extent looking upstream.		
RC-3	14 Sept 22	412794.90	5198573.39	Large shrub swamp present. No watercourse at any location in buffer. No channelization, some small ponding of water indicative of swamp wetland.		

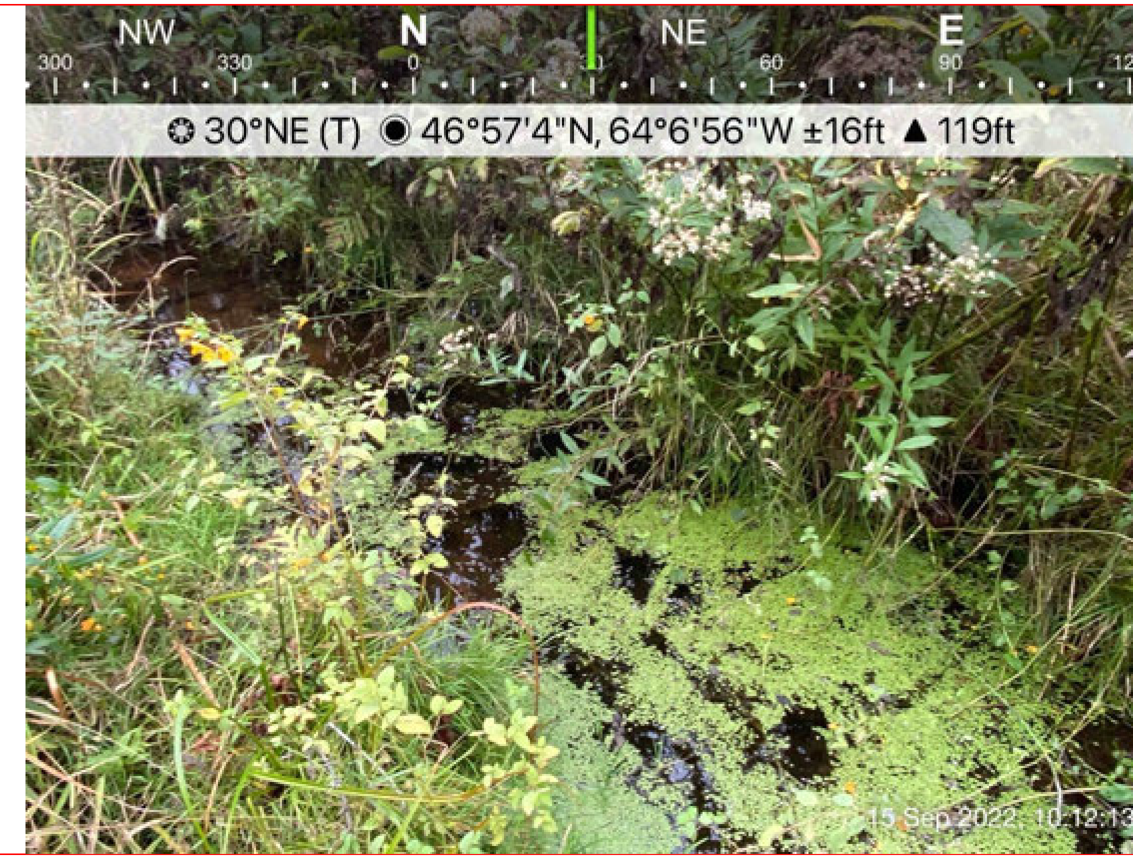
RC-4	Sept 22	413599.08	5198888.35	Cattail marsh – No watercourse present, wetland extends upstream and downstream in the buffer. Facing east.		
RC-5	Sept 22	413138.10	5199592.94	Wetland – no watercourse present within the buffer.		

RC-6	15 Sept 22	414285.59	5200110.74	WC channel present, intermittent flow. No defined channel upstream of centreline – wetland throughflow. Assessed the intermittent pockets of water downstream – **302 sec of e-fish effort, no catch.** Photo looking upstream at downstream buffer extent.		
RC-7	14 Sept 22	414805.21	5199668.93	Channel was trench-like and overgrown with dogwood and rose – unsafe to e-fish (steep banks and no visibility of channel through shrubs) downstream. No flow present upstream – intermittent drainage would likely occur through wetland.		
RC-8	May 22	412973.43	5198661.81	Large shrub swamp extends up to this area – no watercourse present. Habitat is the same as RC-3.		

PC-1	13 Sept 22	412105.01	5198047.66	Beaver impoundment bounded by cattail marsh. Unsafe to e-fish.		
PC-6	14 Sept 22	413831.41	5199730.38	Large beaver pond present at the upstream extent. **Safe to e-fish downstream in few spots. 100 sec eff. No catch, noted one chub.**		

PC-8	15 Sept 22	415078.24	5200047.72	Wetland – no channel	

PC-9	15 Sept 22	415070.85	5200117.07	Wetland – no channel		

PC-10	15 Sept 22	415120.85	5200368.21	Wetland – intermittent flow turning into cattail marsh. **Possible to e-fish, 105 sec eff, no catch.**		

PC-11	15 Sept 22	414902.45	5199100.36	Upstream – intermittent drainage. Ditch too steep to enter. Downstream was a ditch freshly excavated by landowner. Intermittent pockets of standing water, combination of too steep and too muddy to attempt fishing. Facing downstream to excavated channel.		

PC-12	14 Sept 22	414458.91	5198726.03	Appears to be an agricultural drainage ditch. Flow after storm event. **211 sec eff – 1 fish (chub sp.)** Facing downstream at crossing.	
PC-13	12 Sept 22	413989.19	5198277.19	0.5-1 m wide channel with sand, gravel and cobble. **123 sec eff – no catch.** Facing downstream.	

PC-14a	12 Sept 22	412705.05	5198275.38	Beaver impounded – **unsafe to e-fish, 2 x MTs set for 4 hrs, no catch.** Facing downstream.	
PC-14b	12 Sept 22	413026.22	5198319.48	Beaver impounded – cattail marsh. No fishing. Facing downstream.	

Supplemental E-fishing reach	15 Sept 22	411256.96	5196717.11	**283 sec effort, 3 caught, 4th observed. 2 Brook Trout and 1 Three-spine Stickleback.** Facing downstream. New bridge installed, evidence of sedimentation in the watercourse. Layer of silt on hard substrate.	

Supplemental Minnow Trapping	16 Sept 22	414834.32	5201646.78	**Set 2xMTs overnight. 1 Brook Trout.** Facing downstream.		

Appendix H

WSP Golder: Skinners Pond Wind Centre Socio-Economic Assessment

Skinners Pond Wind Centre
Socio-Economic Assessment

Final Report

3 March 2023

Prepared for: Invenergy

CELEBRATING 20 YEARS
OF ACCELERATING THE
CLEAN ENERGY FUTURE

GENERAL DISCLAIMER

The material contained in this report reflects WSP Golder's best judgment based on the information available and provided at the time of preparation. Information contained within this report was gathered from a variety of credible sources, including Statistics Canada, the Province of Prince Edward Island, the West Prince Chamber of Commerce, the Canadian Energy Regulator, Bank of Canada, and Invenergy. To the best of our ability, WSP Canada has attempted to ensure that the data reflects accurate estimates that are current to Prince Edward Island, Prince County, and the West Prince regions as of 2021. This year was selected as the reference year because of the availability and reliability of data for various geographical regions needed to complete this report, particularly as it relates to information on smaller regions such as Prince County and the West Prince area more generally. However, where possible, for some series, 2022 data was also included.

For some series, the methodologies and procedures for collecting and modelling data differs amongst sources, which may in turn yield slight variations in published figures. As one example, with regard to population figures, the most recent Canadian Census, which reflects information as of 2021, is intended to provide detailed information on the population at a single point in time. However, some individuals are not counted, either because their household did not receive a census questionnaire (for example, if a structurally separated dwelling is not easily identifiable) or because they were not included in the questionnaire completed for the household (for example, the omission of a boarder or a lodger). As a result, census counts may differ from published population estimates for the same reference year and geography .To resolve these potential sampling errors, Statistics Canada conducts postcensal coverage studies to update their figures overtime.

The reported information is believed to provide a reasonable representation of the Project being proposed at this time and the general environmental conditions at the Project location. Any use of this report, or any reliance on or decisions based on this report, by a third party is the responsibility of such third party. WSP Golder will not be held responsible or liable for any damages which may have occurred from actions of decisions based upon any of the information within this report.

RECORD OF REVIEW

	Name, Title
Report prepared by	Alex Thomson, Economic Consultant Sara Jarrett, Senior Social Scientist Matthew Breakey, Wind Energy Specialist
Report approved by	Anne-Marie Gaudet, National Vice President, Social Sciences

EXECUTIVE SUMMARY

SUMMARY OF MAIN FINDINGS AND RESULTS

Simulated economic impacts of the Skinners Pond Wind Centre are displayed in **Table 1** and **Table 2**. Total impacts represent the Centre's simulated direct and indirect impacts and exclude any induced related impacts.

Accounting for both direct and indirect impacts, results suggest that over the development, construction, and decommissioning periods of the Skinners Pond Wind Centre, approximately CAD 24.9 million in Gross Domestic Product (GDP) contributions, 311 Full Time Equivalent (FTE) person years of employment, and CAD 0.6 million in partial government tax revenues could be realized. Due to the timing of these expenditures, peak capital impacts are expected to occur in the year 2025. In terms of direct jobs only, modelling suggests that on average, over the Centre's development and construction periods only, approximately 143 direct FTE jobs are expected to be sustained annually.

Table 1. Capital Expenditure Impacts

Impact	GDP (CAD, Millions)	Employment (FTE Person Years)	Taxes (CAD, Millions)
Total	24.9	311	0.6

Notes: Employment expressed in FTE jobs, while GDP and taxes expressed in CAD 2022 millions of dollars. Taxes only account for partial tax revenues received, and exclude any personal or corporate income tax that maybe realized as a result of the operations of the Skinners Pond Wind Centre. Impacts derived from discounted lifetime capital expenditures and may not add due to rounding. Impacts reflect direct and indirect impacts only and exclude induced impacts.
Sources: WSP analysis using Statistics Canada economic multipliers.

Table 2. Annual Operational Expenditure Impacts

Impact	GDP (CAD, Millions)	Employment (FTE Jobs)	Taxes (CAD, Millions)
Total	1.7	5	0.5

Notes: Employment expressed in FTE jobs, while GDP and taxes expressed in CAD 2022 millions of dollars. Taxes only account for partial tax revenues received, and exclude any personal or corporate income tax that maybe realized as a result of the operations of the Skinners Pond Wind Centre. Impacts derived from discounted lifetime operational expenditures and have been rounded. Impacts reflect direct and indirect impacts only and exclude induced impacts.
Sources: WSP analysis using Statistics Canada economic multipliers.

Similarly, **Table 2** displays the annual operating impacts associated with the Skinners Pond Wind Centre. The results indicate that when accounting for direct and indirect impacts only, on an annual basis, the operating activities of the Skinners Pond Wind Centre could contribute up to CAD 1.7 million in GDP contributions, 5 FTE-jobs, and CAD 0.5 million in partial government tax revenues. Over the entire operational lifecycle of the Centre, which is expected to occur over a 30-year period from 2026 to 2056, total operational impacts could equate to approximately CAD 51.5 million in GDP contributions, 150 FTE person years of employment, and CAD 15.1 million in partial government tax revenues. Lifetime operational impacts assume that the annual operational expenditures of the Centre will be consistent between years.

Moreover, through its Community Benefit Fund (CBF), Invenergy will contribute approximately CAD 49,500 annually, or CAD 1.49 million over the operational lifecycle of the Skinners Pond Wind Centre to various community initiatives and programs throughout PEI and the West Prince region. Likewise, landowner royalties are expected to total approximately CAD 40.9 million over the Centres operational lifecycle, which averages out to approximately CAD 1.4 million annually. Expenditures associated with both CBF and landowner payments have not been directly accounted for in deriving the economic impacts listed in **Table 1** and **Table 2**, but are discussed in the "Economic Impact Assessment" section of this report.

The Project is not anticipated to interfere with existing land uses, which are primarily agricultural, nor affect recreational uses.

TABLE OF CONTENTS

1. PROJECT OVERVIEW

WSP Golder Canada (WSP Golder) was engaged by Invenergy to perform a socio-economic assessment of the proposed Skinners Pond Wind Centre (the Project). The Project entails the development, construction, operations, maintenance, and decommissioning of a 99MW wind farm located in West Prince, the Province of Prince Edward Island (PEI). A bird's eye view of the proposed Project site is presented on **Figure 1** below. Specifically, the Project will consist of the following key infrastructures:

- → Approximately 15 Siemens SG 6.6-17 turbines spread out across the Project site as indicated in **Figure 1**;
- → A MET tower, along with electrical collector lines and access laneways;
- → A Project substation; and
- → An operations & Maintenance (O&M) building, etc.

The project is planning to connect to a 138 kV transmission line that is planned between East Point to Charlottetown. Skinners Pond Wind Project is located approximately 25 km north of the transmission expansion project. The transmission expansion is currently supported by both the provincial and federal government, but has not been accounted for when deriving the impacts of our analysis.

Development of the Project is ongoing. Construction is anticipated to take place over 2024 and 2025, while operations will commence in 2026 and is anticipated to continue through 2056, representing a 30-year period. Finally, decommissioning of the Project is anticipated for the final year of operations in late 2056.

Figure 1. Location of the Skinners Pond Wind Centre Project Site

Sources: Invenergy.

As indicated by Invenergy, the Project was initially conceived by a large group of landowners currently residing within the West Prince area. Currently, there are 85 signed land agreements representing over 100 landowners throughout the region.

The socio-economic assessment performed by WSP Golder included the following tasks:

→ A baseline economic assessment of the local, regional, and provincial economies;

→ A literature review assessing the benefits of existing utility-scale wind projects in Canada;

→ A land-use assessment; and

→ A high - level economic impact assessment determining the impacts of the Project in terms of provincial GDP contributions, FTE employment, and partial government tax revenues.

Methodologies and sources used to complete each of the above tasks are outlined throughout the report and in **Appendix A – Appendix E**.

2. OVERVIEW OF WEST PRINCE

With a total land area of approximately 1,110 square kilometers, the West Prince region of PEI is made up of the following six distinct communities: Alberton, Lennox Island, Miminegash/St. Louis, O'Leary, Tignish, and Tyne Valley. As indicated by the West Prince Chamber of Commerce, residents of the region are largely a cultural mix of Acadian, Irish, Mi'kmaq, and Scottish heritages. Similarly, the economic base of the region primarily lies in agriculture, fishing, and tourism. An overview of the various regions is labelled on **Figure 2**.

Figure 2. Geographic Overview of West Prince, PEI.

Sources: West Prince Chamber of Commerce.

Alberton

Alberton is recognized as a primarily farming and fishing region, with a large fishing wharf conveniently located near the downtown core. The region also has a prosperous and thriving commercial sector to complement its rural roots. Currently, the region has many resources and services available to residents and visitors, including a local hospital, pharmacies, retail shops, and several restaurants.

Lennox Island

Lennox Island is home to the Bideford Shellfish Hatchery, which provides high quality seed in oysters, clams, scallops, and quahogs, and is the only Indigenous owned and operated oyster seed facility in Atlantic Canada. The Hatchery is currently located within the retrofitted and refurbished Bideford River Marine Centre, which was initially a Federal Government research station focused on oyster sustainability. The region is predominantly made up of those with Mi'kmaq First Nation heritage.

Miminegash/St. Louis

Located approximately 8 miles northwest of Alberton and 11 miles southwest of Tignish, Miminegash is a small community with several schools, churches, and parks.

O’Leary

Named after one of the region’s earliest settlers, O’Leary is home to several notable establishments within PEI, including the Canadian Potato Museum, which houses one of the largest collections of farming machinery related to growing and harvesting potatoes. In 2015, CNN rated the Museum as one of the top 11 food museums in the world[i]. The museum's services now include food, tourist information, and gift shop. Other notable enterprises include Career Bridges, O’Leary Public Library, and O’Leary Produce Co. Ltd.

Tignish

First settled by Acadian settlers, Tignish is the region where the Skinners Pond Wind Centre will be located According to the West Prince Chamber of Commerce, the region is recognized as a "Cooperative Community", having established a tradition of formal and successful cooperatives. One notable business, Royal Star Seafoods, which is a subsidiary of Tignish Fisheries Co-op Association Ltd., is the largest Atlantic lobster processor on PEI and is owned and operated by several fishers throughout the area. Another staple facility in the community is the Stompin' Tom Centre, which was the former schoolhouse, and later purchased by iconic Canadian folk-country singer Stompin’ Tom Connors. The venue is used for showcasing local music talent.

Tyne Valley

Tyne Valley is notably the home of the Canadian Oyster Shucking Championship and Rock the Boat Music Festival. The region is also home to several noticeable businesses including Valley Pearly Oysters, Backwoods Burger- Craft Beer Cookhouse, the West Isle Enterprise Ltd., and the Cavendish Farms Community Events Centre, which houses a National Hockey League (NHL) sized rink and state of the art gym facility, among others.

3. OVERVIEW OF WIND ENERGY IN PEI

Through its 10-year energy strategy, PEI has committed to achieving the following goals and objectives with regard to the province's energy landscape:

- → Provide cleaner and more locally produced energy sources;
- → Moderate and maintain future energy price increases;
- → Continue developing robust relationships and partnerships with domestic and international partners;
- → Develop a stronger, more sustainable, and independent energy province; and
- → Increase electrical production from wind based resources.

Given the province's comparative advantages and needs, Invenergy's proposed Skinners Pond Wind Centre will play a critical role in achieving these objectives.

As of today, PEI is a leader in the generation of wind energy, which offers a variety of benefits including price stability, and a source of non-carbon-emitting energy generation. Moreover, given PEI's wind resources, the costs of wind power are relatively low when compared to other forms of renewable technologies.

Currently, the province has two options regarding wind power: either utility-scale wind projects; or individual smaller-scale turbines. When comparing the two, the economics of smaller scale wind projects tend to be less favorable given their higher unit costs, higher per unit maintenance costs, lower unit availability, and lower energy capture rates. Because the province has such advantageous wind resources, utility-scale wind projects are a viable option for providing additional renewable capacity and energy for both domestic and export uses. Given PEI's favorable wind climate and resources, integrating additional

Table 3. Wind Farms in PEI, 2022

Wind Farm	Capacity (MW)	Owner
Aeolus Wind	3	PEI Energy Corporation
East Point Wind Farm	30	PEI Energy Corporation
Hermanville/Clear Springs Wind Farm	30	PEI Energy Corporation
North Cape Wind Farm	10.6	PEI Energy Corporation
Norway Park Wind Farm	9	ENGIE
Summerside Wind Farm	12	City of Summerside/ Summerside Electric
West Cape Wind Park	99	ENGIE
WEICan Wind R&D Park	10	WEICan

Notes: Reflects wind farm developments within PEI as of 2022.
Sources: Government of Prince Edward Island.

wind capacity will assist in supporting the Island's full economic potential.

As of 2022, there were approximately eight wind farm developments with a total capacity of approximately 204 MW. While wind represents a significant amount of energy generation for the province, it only accounts for approximately 25% of the province's energy supply. These wind farms, along with their respective location, capacity, and ownership entities are displayed in **Table 3**[2].

4. BASELINE ECONOMIC ASSESSMENT

The following section contains a baseline economic assessment of the local, regional, and provincial economies. Information highlighted throughout this section relates to the following series:

→ Demographics and labour markets;

→ Key industry and sector clusters;

→ Economic growth;

→ Wages and education levels;

→ Government revenues and expenditures;

→ Energy sector profile;

→ Trends in Indigenous populations; and

→ Trends in immigration populations.

Sources of information and data used to complete this section were gathered from Statistics Canada, PEI, and the Canadian Energy Regulator. A full list of sources is available in **Appendix E**. Due to data availability, where possible, WSP has attempted to provide detailed information on both the Prince County and West Prince regions. However, where information was unavailable, scarce, or unreliable, analysis has been performed at the provincial level only.

Table 4. Demographic Statistics for Canada, PEI, and Prince County, 2021

Series	Canada	PEI	Prince County
Population (2021)	38,226,498	164,758	46,234
Population (2016)	36,109,487	146,969	43,910
5 Year Pop Change (%)	6%	12%	5%
Median Household After Tax Income ($2020)	73,000	64,000	61,200
Unemployment Rate (%)	8%	9%	N/A

Notes: Median tax after-income statistics reflect 2020 values. Figures and percentages have been rounded. N/A indicates that information for the series is currently unavailable. Unemployment rate includes those ages 15 years and older. Pop- Population. PEI- Prince Edward Island.
Sources: Statistics Canada and WSP analysis.

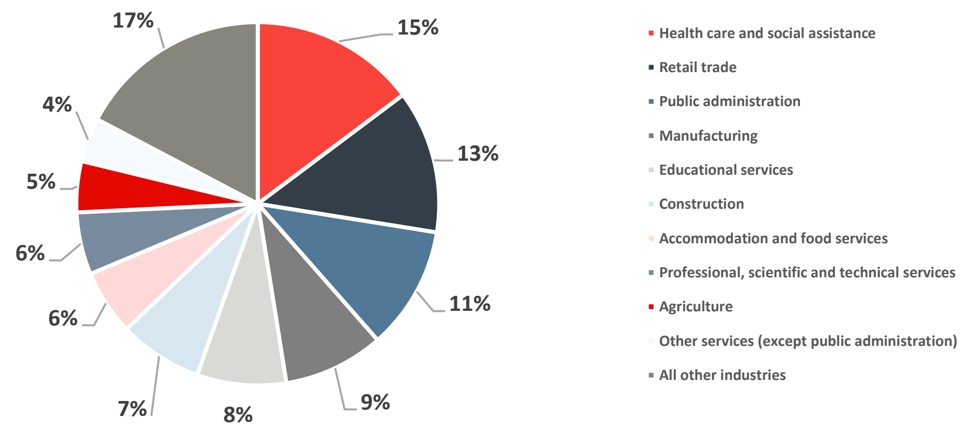
DEMOGRAPHICS AND LABOUR MARKET

With a population of approximately 165,000, PEI represents a small-open island economy located within the Atlantic region of Canada. As of 2021, median after-tax household income in the province was approximately CAD 64,000, while the unemployment rate was approximately 9%. Over the last 5 years, the population of the province has grown by approximately 12%.

In terms of population growth and unemployment, the former is approximately double the national figure while the latter is on par. However, when looking at income, median after-tax household income in PEI was approximately CAD 9,000 below the national median[3].

A high-level labour market breakdown for the province is presented on **Figure 3**, indicating the top 10 industries with the largest provincial employment shares. In this case, the three industries which employ the most PEI residents are health care and social assistance (~15%), retail trade (~13%), and public administration (~11%). Industries which employ the lowest share of provincial workers include forestry and logging support activities, utilities, and mining, quarrying, and oil extraction. In this case, each of these industries employ slightly under 1% of the provincial workforce[4].

Figure 3. Labour Market Breakdown for PEI, 2021



Notes: Represents only the top 10 industries with highest employment shares within PEI.
Sources: Statistics Canada and WSP analysis.

Within Prince County, the population as of 2021 was approximately 46,000, which is an approximately 5% increase from its 2016 totals. However, this growth is lower that what has been realized at the provincial level over the same time period. Furthermore, the median after-tax household income is approximately CAD 61,200, slightly below the provincial median (CAD 64,000).

Various demographic statistics for each of the West Prince regions are displayed in **Table 5** below. The population of the six regions that make up West Prince totalled approximately 8,662 in 2021, representing an increase of approximately 3% from the regions 2016 numbers. Median after-tax household income for these area ranges from CAD 58,400 to CAD 74,500.[5]

While not quantified, key industries within Prince County, and more specifically the West Prince area, include farming, agriculture, fishing, and tourism.

In a recently completed Labour Market Needs Assessment, through the Rural PEI Labour Market Development Partnership, which is formed between the West Prince Chamber of Commerce and Eastern PEI Chamber of Commerce to promote opportunities for rural PEI businesses, the following takeaways were identified with regard to the current labour market outlook of the region[6]:

- → There have been significant issues related to filling jobs over the last several issues , much of which is a result of low supply (i.e., applicants) and persistent skill shortages;
- → Aside from a lack of supply and skill gap, Government wage subsidies have also hindered businesses being able to find workers to fill open roles; and

Table 5. Demographic Statistics for West Prince PEI, 2021

Series	Alberton	Lennox Island	Miminegash	O'Leary	Tignish	Tyne Valley
Population (2021)	2,230	308	1,089	2,566	1,800	669
Population (2016)	2,166	323	1,126	2,394	1,812	623
5 Year Pop Change (%)	3%	-5%	-3%	7%	-1%	7%
Population Density	14	55	11	7	17	8
Median Household After Tax Income ($2020)	71,000	62,400	58,400	61,600	74,500	68,500

Notes: Information contained within the table reflects that for Alberton (Fire district), Lennox Island 1 (Indian reserve), Miminegash (Fire district), O'Leary (Fire district), Tignish (Fire district), and Tyne Valley (Fire district) as indicated by Statistics Canada Census. Median tax after-income statistics are representative of 2020 figures. Population density measured in persons per square kilometer and have been rounded. N.A indicates that the information is unavailable. Pop-population.
Sources: Statistics Canada and WSP analysis.

- → Access and availability to adequate training would help alleviate some of these labour market inefficiencies.

KEY INDUSTRY AND SECTOR CLUSTERS

In order to identify key industry and sector clusters within PEI, a location quotient (LQ) analysis was performed. A cluster is identified if it has a relatively large share of employment in comparison with the country as a whole. In focusing on a cluster, LQ analysis is valuable in providing insights as it relates to:

- → **Determine local or regional specialization:** the LQ effectively identifies those industries and occupations that stand out because of their higher-than-average per capita employment, clearly identifying the unique and comparative strengths of the regional economy examined. More specifically, the LQ helps identify the regions industrial specialization and economic base.

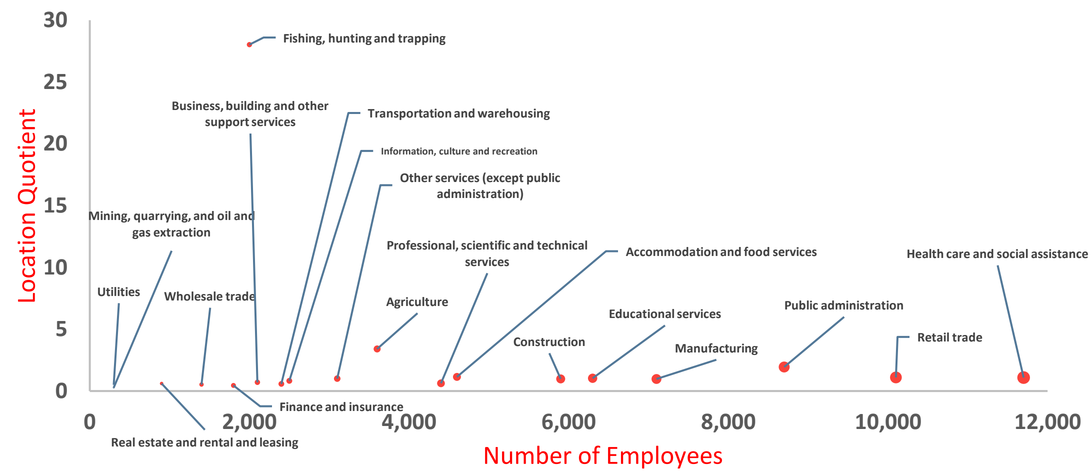
→ **Identifying key export industries:** industries with a high LQ are often those that export goods and services out of the region.

→ **Identifying key import industries:** In contrast to the point above, industries with low LQ typical import goods and services.

→ **Identifying industries that maybe on the decline:** identify endangered export industries that could erode the region's economic base.

Industries with an LQ greater than 1 are said to be more concentrated within the province and provide an important link between PEI and the rest of Canada. Moreover, industries with an LQ less than 1 suggests that these particular sectors are not meeting local needs and that gaps maybe present. A description of the calculations and methodology behind deriving LQs is available in **Appendix C**.

Figure 4. Industry Location Quotients for Prince Edward Island, 2021



Notes: Represent industry location quotients at the provincial level.
Sources: Statistics Canada and WSP analysis.

To illustrate, as indicated in **Figure 4** and in **Table 21** in **Appendix C**, the fishing, hunting, and trapping industry is approximately 28 times more concentrated within PEI relative to Canada on average, while the agricultural industry is approximately 3.4 times more concentrated on average, suggesting that both industries represent a significant pillar of the PEI economy and are major exporting industries for the province. To illustrate, according to export data from Statistics Canada for the year 2021, 6 of the top 10 exported commodities for the province, measured in total dollars, included goods or services either in the generally specified agricultural, farming or fishing industries.

ECONOMIC GROWTH

GDP for all industries across PEI in chained 2012 dollars was valued at approximately CAD 6.3 billion in 2021, an increase of approximately 8% per cent from 2020. This was the largest and fastest growth for PEI over the last 40 years. Over this time, real GDP levels for the province's goods and services sector expanded by approximately 9% and 7% respectively. The uptick in growth over this period was largely attributed to the easing of provincial and national COVID-19 restrictions, along with reductions in interests rates, among others. Historical real GDP levels and growth rates from 2010 to 2021 for PEI are displayed on **Figure 5**[7].

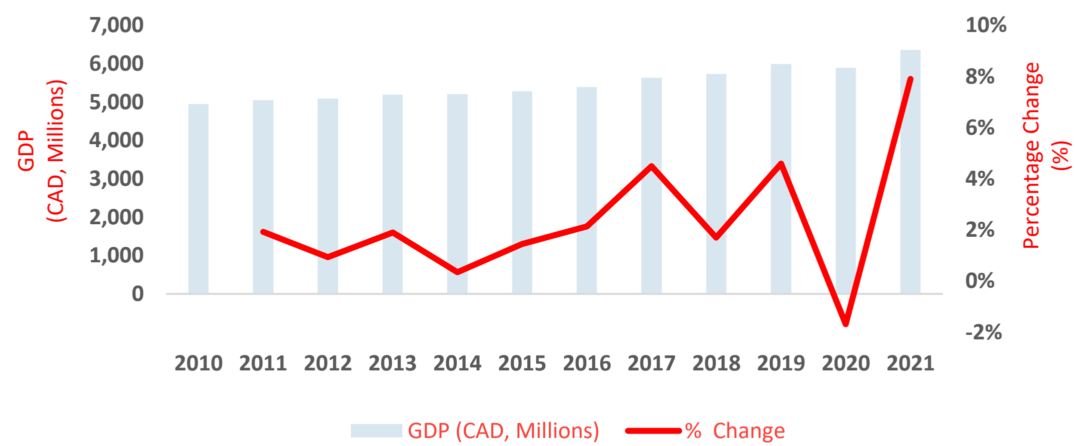
Industries which saw the largest year over-year percentage increase in real GDP accounted for the accommodation and food services (~27%), agriculture, forestry, fishing, and hunting (~16%), and wholesale trade (~15%). Sectors which saw a further contraction include the management of companies and enterprises (~-28%) mining, quarrying,

Table 6. Top 10 PEI Exported Commodities by Dollar Value, 2021

Commodity	Total Exports (CAD, Millions)
Potatoes prepared or preserved other than by vinegar or acetic acid, frozen	365
Lobsters, frozen	256
Repairs	181
Lobster, prepared or preserved, frozen	113
Potatoes, fresh or chilled	109
Composite diagnostic or laboratory reagents	69
Parts of turbo-jets or turbo-propellers	65
Mussels, live, farmed, fresh or chilled	39
Blueberries, wild, uncooked, steam or boil in water, sweetened or not, frozen	37
Turbo-propellers, of a power not exceeding 1,100 kW	32

Notes: Values have been rounded and represent global export figures for PEI in 2021 only.
Sources: Statistics Canada International Merchandise Trade Data Base.

Figure 5. GDP for PEI, 2010-2021



Notes: Values expressed in chained 2021 dollars and have been rounded.
Sources: Statistics Canada and WSP analysis.

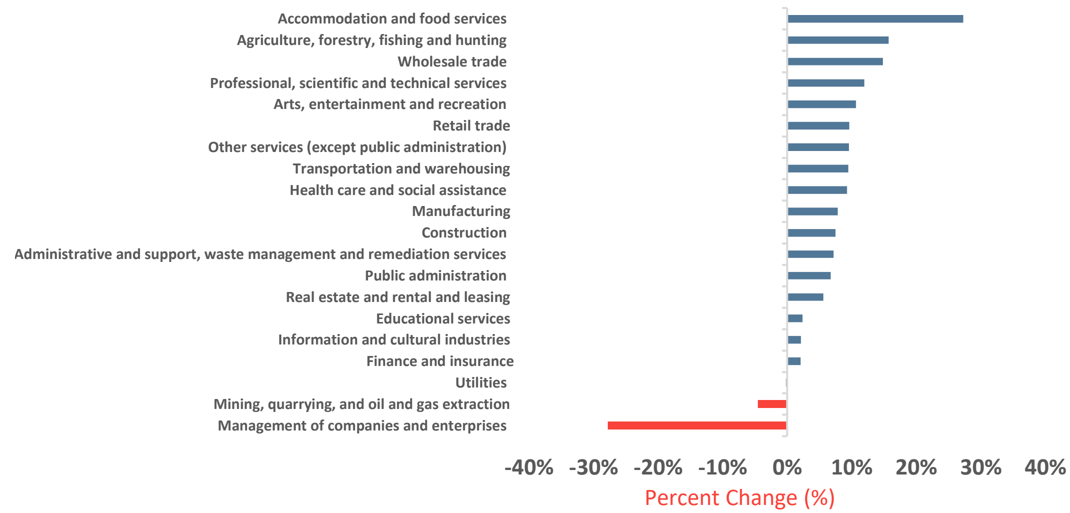
and oil and gas extraction (~-5%), and utilities (~- 0.2%)[8].

WAGES AND EDUCATION LEVELS

As indicated on **Figure 7**, median after-tax household income for PEI, as with Canada's other Atlantic provinces, was below the national figure. In this case, median after tax household income for PEI was approximately CAD 64,000, while for Canada as a whole, the figure was CAD 73,000. While in absolute terms the figure maybe lower, over the last 5-years, the growth in median after-tax income for PEI was roughly on par with Canada as a whole, where median after-tax incomes have increased by approximately 10%.

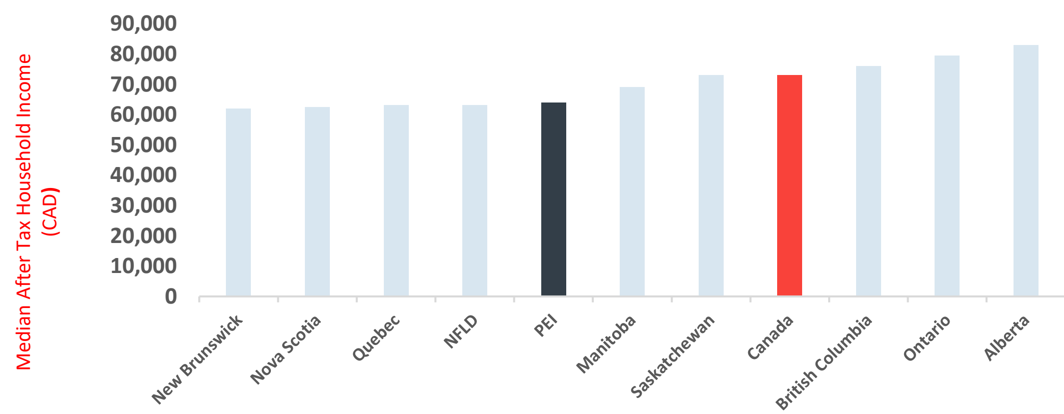
From an education perspective, **Figure 8** shows the breakdown of education levels for the PEI labour force over the last 8-years. In this case, over the last 8-years, on average, almost two-thirds of the province's labour force has obtained an education level beyond that of high school, indicated by either having a university degree or post-secondary certificate/diploma[9].

Figure 6. Percent Change in GDP by Industry in PEI, 2021



Notes: Percentages have been rounded. Represent changes in GDP by industry from 2020 to 2021.
Sources: Statistics Canada and WSP analysis.

Figure 7. Median After Tax Household Income for Canada and Provinces



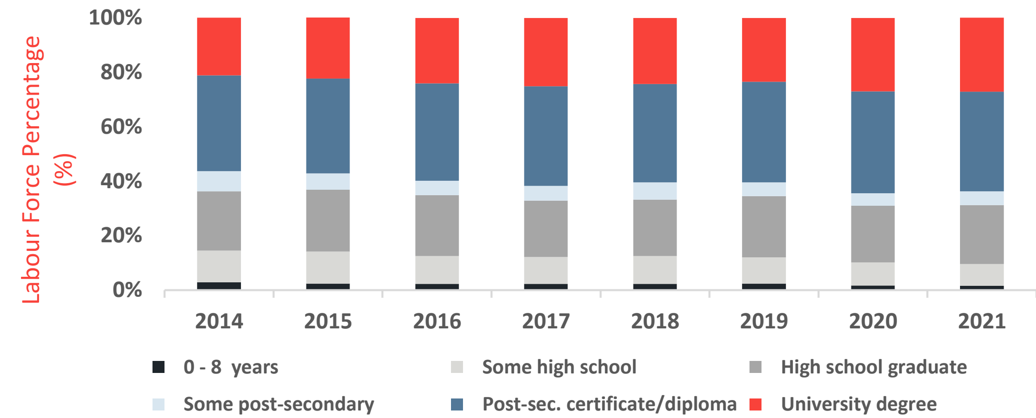
Notes: Values expressed in 2020 dollars and does not include information on Yukon, Nunavut, and the Northwest Territories. PEI – Prince Edward Island, NFLD – Newfoundland and Labrador. Values represent average incomes in 2020 Canadian dollars.
Sources: Statistics Canada and WSP analysis.

GOVERNMENT REVENUES AND EXPENDITURES

According to the most recent 2022-2023 operating budget estimates, government revenues are expected to total approximately CAD 2.6 billion, representing a slight decrease of approximately 0.2% from the previous 2021-2022 fiscal year. On the other hand, government expenditures are expected to total approximately CAD 2.4 billion, which is a 2% increase from 2021-2022 estimates. After accounting for interest and amortization related payments, the province is projected to have a deficit of approximately CAD 93 million for the current fiscal year[10].

Of the total 2022-2023 revenues, approximately 39% are expected to be sourced from the Government of Canada, while the remaining 61% is expected to be generated through various provincial channels and initiatives such as taxation, licenses & permits, fees & services, and investments, etc. A breakdown of these revenues is available in **Table 8**.

Figure 8. Labour Force by Educational Attainment in PEI, 2014 – 2021



Notes: Figures have been rounded.
Sources: Province of PEI and WSP analysis.

Table 7. Overview of Provincial Budget Estimates, 2021-2022 & 2022-2023 FY

Line Item	2022-2023 (CAD, Millions)	2021-2022 (CAD, Millions)	Change (%)
Revenues	2,569	2,573	-0.2%
Expenditures	2,428	2,382	2%
Interest and Amortization	234	217	7%
Surplus (Deficit)	(93)	(26)	

Notes: Values and percentages have been rounded.
Sources: Government of PEI - Ministry of Finance and WSP Golder analysis.

For all provincial revenue sources, taxation represents that single largest source, making up approximately 49% of all revenues[11].

In this case, according to **Figure 9**, the four largest sources of tax revenues, as a percentage of total tax revenues received, accounts for personal income tax (~38%), sales tax (~30%), real property tax (~12%), and corporate income tax (~8%). All other remaining sources of provincial government tax revenues included but not limited to gasoline tax, liquor tax, cannabis tax, and environment tax make up the remaining 12%[12].

In terms of revenue received from the Government of Canada, most funds are expected to come in the form of the equalization payment system and various transfer programs. This includes for example the Canada Health Transfer, federal infrastructure programs, and Canada Social Transfer, amongst others.

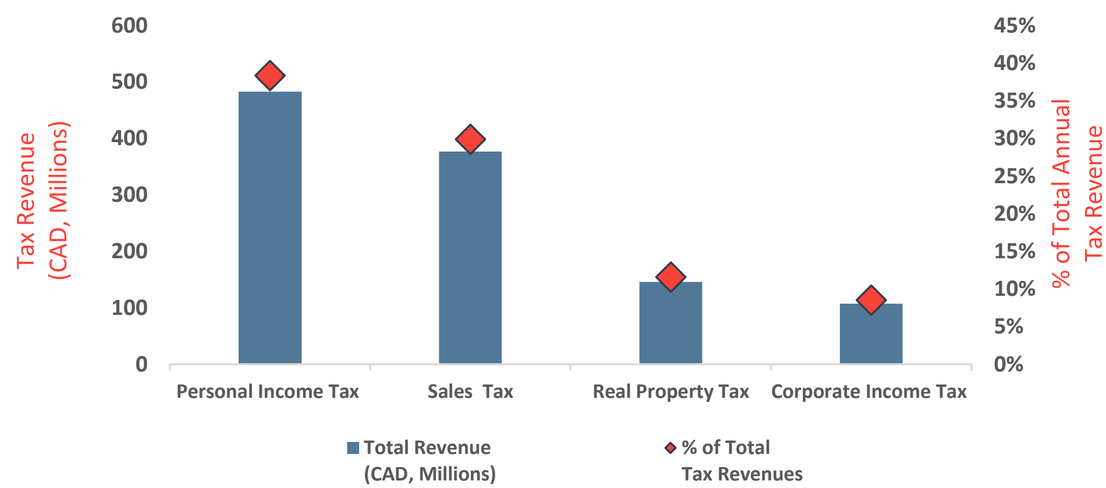
Figure 10 provides a breakdown of anticipated revenues received by the Province of Prince Edward Island from the Government of Canada by source for the 2022-2023 fiscal year. In this case, of total expected federal government revenues received, approximately 50% will come from equalization payments, with the second largest source being Canada Health Transfers (~19%).[13]

Table 8. Provincial Revenue Estimates Comparison for 2022-2023 & 2021-2022 FY

Revenue Item	2022-2023 (CAD, Millions)	2021-2022 (CAD, Millions)	Change (%)
Taxes	1,260	1,235	2%
Licenses and Permits	40	40	-2%
Fees and Services	96	116	-16%
Investments	19	20	-4%
Other provincial sources	11	26	-58%
Other consolidated revenues	66	56	18%
Government business enterprises	65	64	1%
Government of Canada	1,013	1,017	-0.3%
Total	2,569	2,573	-0.2%

Notes: Values and percentages have been rounded.
Sources: Government of Prince Edward Island - Ministry of Finance and WSP analysis.

Figure 9. Sources of Government Tax Revenues in PEI, 2022-2023 FY



Notes: Values and percentages have been rounded.
Sources: Government of Prince Edward Island - Ministry of Finance and WSP analysis.

ENERGY SECTOR PROFILE

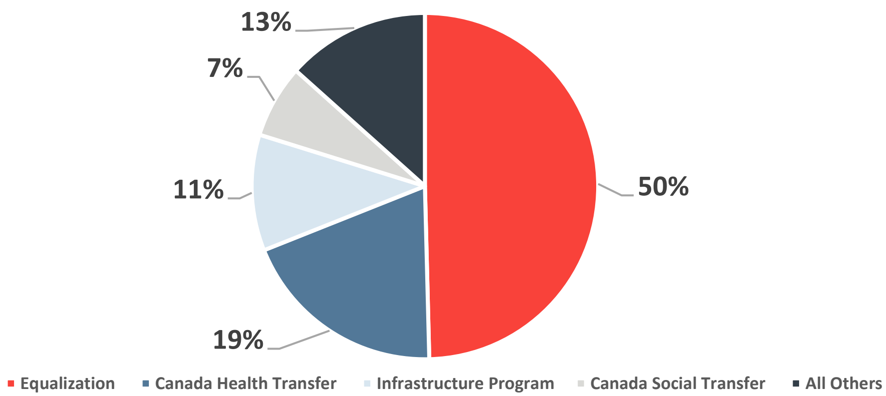
As indicated on **Figure 11**, for the year 2021 only, wind power made up approximately 95% of all energy generation within PEI, with the remaining 5% coming from a combination of both oil and biomass/geothermal related sources. Historically, this number has not fluctuated significantly, where on average, over the last 10-years, approximately 98% of all energy generation within the province was sourced from wind. In this case, diesel and oil-fired facilities are used to meet periods of peak power demand when wind generation or off-island imports are interrupted. However, such facilities accounted for only a small fraction of the province's total energy needs[14].

Similarly, in terms of installed capacity across all sources, on average, over the last 10-years, approximately 54% of the province's energy base is wind and is highlighted on **Figure 12**[15].

From a demand perspective, key end-uses by sector within the province accounts for the residential, commercial, industrial, and transportation sectors. In terms of total demand, over the last 10-years, in general, the transportation sector has been the largest consumer of energy within the province (~43%), followed by residential (~24%), industrial (~21%), and finally commercial (~11%). A breakdown of end use demand from 2010 to 2021 by sector is highlighted on **Figure 13**[16].

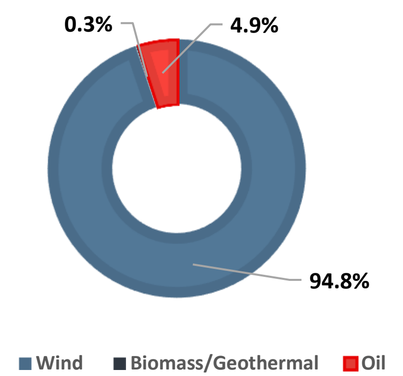
From a fuel perspective, refined petroleum products have accounted for the largest share of demand over the

Figure 10. Federal Government Revenue by Source for PEI, 2022-2023 FY



Notes: Percentages have been rounded. Other – all other forms of federal revenue not including equalization payments, Canada Health Transfer, Infrastructure Program, and Canada Social Transfer. FY- fiscal year.
Sources: Government of Prince Edward Island and WSP analysis.

Figure 11. Energy Generation by Source in PEI, 2021



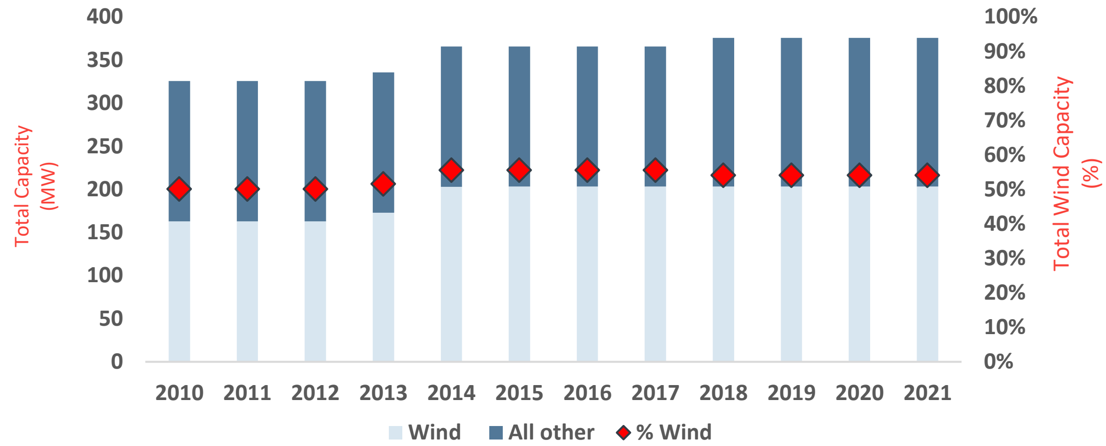
Notes: For conservative purposes, values reflect the Canadian Energy Regulators current policy outlook.
Sources: Canadian Energy Regulator and WSP Golder analysis.

last 10-years (~67%) followed by electricity (~21%), biofuels (~8%), natural gas (~4%), and others (~1%).

Most of PEI's electricity generation, transmission, and distribution is provided by Maritime Electric Company Ltd. Historically speaking, PEI has been an importer of energy, with inflows of approximately 0.9 TWh in 2021. Provincial energy imports are primarily sourced from the province of New Brunswick, where electricity is transmitted through subsea cables under the Northumberland Strait[17].

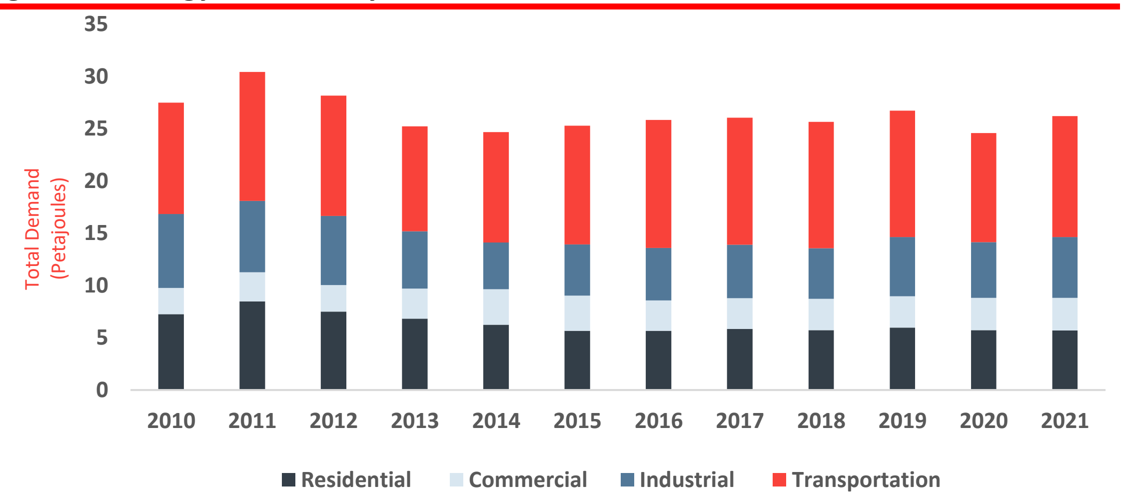
In 2017, the province completed the Interconnection Upgrade Project, which was one of the most significant projects undertaken by Maritime Electric. The project is designed to allow PEI to import electricity from New Brunswick through two new submarine cables, overhead transmission lines, substation upgrades, and more. An overview of inflows, outflows, and net outflows for the province are displayed in **Figure 14**[18].

Figure 12. Total Energy Capacity by Source in PEI, 2010 – 2021



Notes: For conservative purposes, values reflect the Canadian Energy Regulators current policy outlook.
Sources: Canadian Energy Regulator and WSP analysis.

Figure 13. Energy End-Uses by Sector for PEI, 2010-2021



Notes: For conservative purposes, values reflect the Canadian Energy Regulators current policy outlook. Values have been rounded
Sources: Canadian Energy Regulator and WSP Golder analysis.

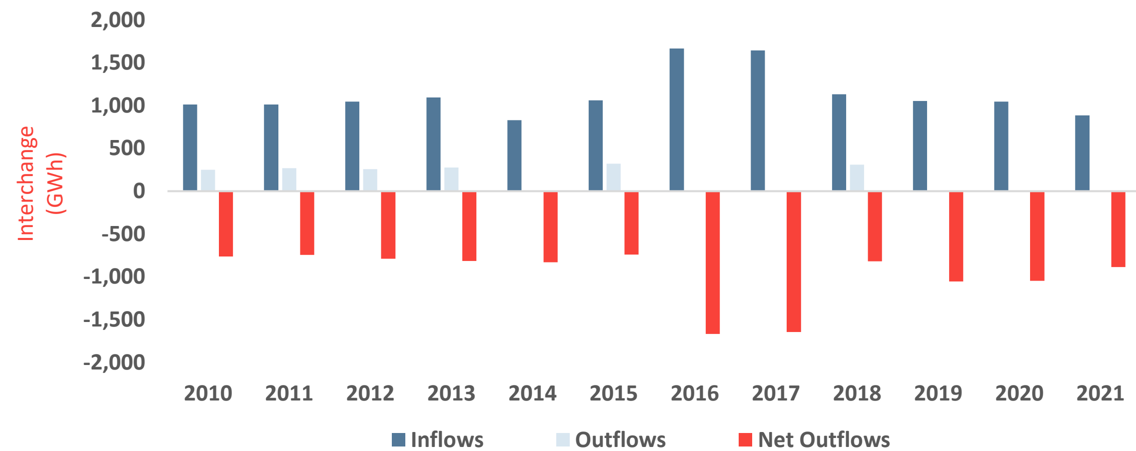
TRENDS IN THE INDIGENOUS POPULATION

According to the national 2021 census, province wide, approximately 3,385 individuals identify as Indigenous. Similarly, for Prince County, approximately 1,095 individuals identify as Indigenous. For both jurisdictions, these figures represent approximately 2% of the total population[19].

Of the total Indigenous populations, for both the province and Prince County, approximately 64%-65% identify as First Nations, while approximately 21%-25% identify as Métis and the remaining either Inuit or other. In this particular case, "other" represents those who either identify with one or more of the Indigenous groups mention above or do not identify as either First Nation, Métis, or Inuit. The 5 year percentage change in Indigenous populations was approximately 24% for PEI and 21% for Prince County[20].

A breakdown of the Indigenous populations for each jurisdiction within the West Prince area is presented in

Figure 14. Energy Outflows and Inflows for PEI, 2010-2021



Notes: For conservative purposes, values reflect the Canadian Energy Regulators current policy outlook. Net Outflows calculated as energy outflows – energy inflows.
Sources: Canadian Energy Regulator and WSP Golder analysis.

Table 9. Indigenous Profile for PEI and Prince County, 2021

Series	PEI	Prince County
Indigenous population	3,385	1,095
% Indigenous population	2%	2%
% Indigenous identified as First Nation only	64%	65%
% Indigenous classified as Métis only	25%	21%
% Indigenous classified as Inuk (Inuit) only	5%	7%
% Indigenous classified as other	6%	7%
5-Year Change (%)	24%	21%

Notes: Figures have been rounded.
Sources: Statistics Canada and WSP Golder analvsis.

Table 10. In terms of regional Indigenous populations, Lennox Island has the largest percentage of its overall population that identifies as Indigenous (~88%)[21].

TRENDS IN THE IMMIGRANT POPULATION

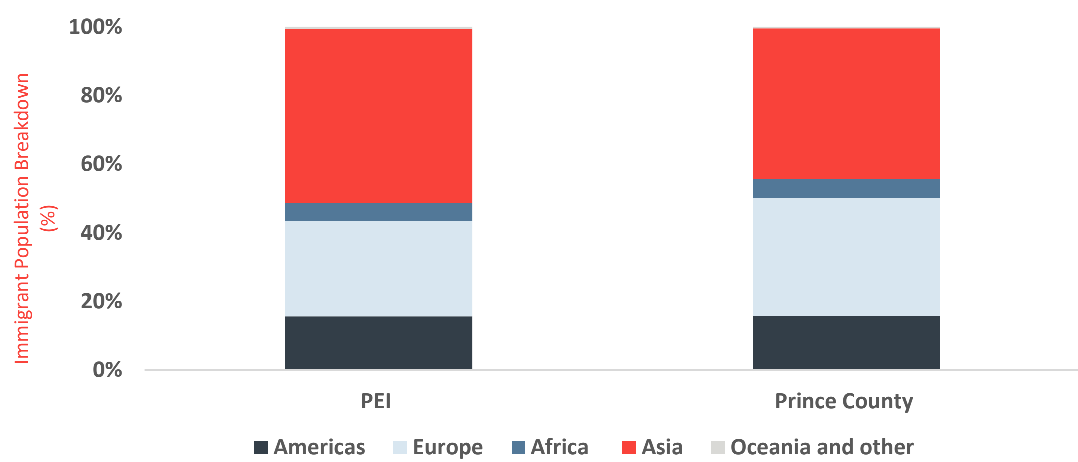
Immigrants made up approximately 8% of PEI total population in 2021and 4% of the Prince County population. For both regions, as indicated on **Figure 15**, most of the immigrant populations originated from either Asia, Europe, or the Americas, while a small fraction originated from either Africa, Oceania, or other regions. In this particular case, immigrants are persons who are, or who have ever been, landed immigrants or permanent residents. This includes persons who have been granted the right to live in Canada permanently by immigration authorities and who have obtained Canadian citizenship by naturalization.

Table 10. Indigenous Profile for West Prince, 2021

	Alberton	Lennox Island	Miminegash	O'Leary	Tignish	Tyne Valley
Population	2,230	308	1,089	2,566	1,800	669
Total Indigenous Population	50	270	0	75	25	0
% Indigenous Population	2%	88%	0%	3%	1%	0%

Notes: Figures and percentages have been rounded. Information contained relates to information for Alberton (Fire district), Lennox Island 1 (Indian reserve), Miminegash (Fire district),O'Leary (Fire district), Tignish (Fire district), and Tyne Valley (Fire district) as indicated by Statistics Canada Census. Percentages have been rounded.
Sources: Statistics Canada and WSP analysis.

Figure 15. Immigration Breakdown by Origin for PEI and Prince County, 2021



Notes: Percentages have been rounded.
Sources: Statistics Canada and WSP analysis.

The location of origin for immigrants in PEI is diverse. In this case, the top three places of birth for immigrants for PEI include China (~14%), the United Kingdom (~12%), and the United States of America (~10%). **Table 11** also highlights the remaining seven locations[22].

At the local level, **Table 12** below displays immigration statistics for the West Prince municipalities and regions. Of the regions that comprise the West Prince region, Miminegash has the largest share of immigrants as a total of its population, at approximately 4%.[23]

Table 11. Top 10 Places of Birth for Immigrants in PEI, 2021

Country of Origin	Number of Immigrants (Persons)	% of total immigrant Pop. (%)
China	1,675	14%
U.K	1,385	12%
U.S.A	1,205	10%
Philippines	1,010	9%
India	840	7%
Viet Nam	525	5%
Netherlands	430	4%
Syria	400	3%
Germany	185	2%
Iran	185	2%

Notes: Percentages have been rounded. Pop – population, UK – United Kingdom, USA – United States of America. Percentages will not add to 100.
Sources: Statistics Canada.

Table 12. Immigration Profile for West Prince, 2021

Series	Alberton	Lennox Island	Miminegash	O'Leary	Tignish	Tyne Valley
Total Population	2,230	308	1,089	2,566	1,800	669
Total Immigrant Population	75	0	40	85	25	20
% Immigrant Population	3%	0%	4%	3%	1%	3%

Notes: Figures and percentages have been rounded. Information contained relates to information for Alberton (Fire district), Lennox Island 1 (Indian reserve), Miminegash (Fire district),O'Leary (Fire district), Tignish (Fire district), and Tyne Valley (Fire district) as indicated by Statistics Canada Census.
Sources: Statistics Canada and WSP analysis.

5. LITERATURE REVIEW

Literature surrounding the development, construction, operations, and decommissioning of utility–scale wind farms in Canada suggests that the outcomes associated with these developments is positive. While the contributions of these structures are vast, for the most part, they are often credited with generating positive outcomes through the following key channels:

- Economic, stakeholder, and community benefits; and
- Environmental benefits.

Over the last several decades, utility-scale wind farms have been deployed by corporations, First Nations, municipalities, and community organizations. Globally, there has been a recent push to increase the development and deployment of larger offshore wind developments that take advantage of stronger and more consistent winds blowing over the ocean. While there are no current examples of such projects in Canada, some projects have been proposed for further analysis and development.

For the purpose of this review however, to align with the potential benefits of the Skinners Pond Wind Centre, focus was placed on onshore utility-scale wind farms capable of generating 50MW of power or more[24].

ECONOMIC, STAKEHOLDER, AND COMMUNITY BENEFITS

Upon review of the literature, it was observed that the economic, stakeholder, and community benefits associated with the Skinners Pond Wind Centre are reasonable. That is, based on previously completed assessments and reports, the economic, stakeholder and community contributions of the Centre are, generally speaking, conservatively estimated for what is to be expected of utility-scale wind farms of this size in Canada.

Important to note however with regard to the economic contributions of utility-scale wind farms, they must be evaluated based on the inputs, conditions, and criteria in which they were derived. In this case, when determining the economic effects associated with such developments, one must consider the following:

- Overall levels of expenditures, both from a development, construction, operations, and decommissioning perspective;
- Types of impacts examined (i.e., direct, indirect, or induced);
- Amount of local expenditures that are likely to be captured within the region in which they are constructed and operate;
- The duration of the wind farms capital and operations periods;

- The geography and location in which they are being developed; and
- Their overall size and capacity, among others.

To provide some additional context, in this case, as an example only, a similar sized wind farm developed in Alberta may yield different economic benefits than one built in PEI or Newfoundland, etc.

Moreover, with regard to stakeholder benefits, total contributions, in the form of landowner payments and community benefits, typically vary on a project-by-project basis. That is, these agreements usually differ based on the intended agreement with the wind farm developer and local community. Furthermore, the way in which these funds are distributed may also differ, where in the case of landowner payments, such payments are typically structured in one of three ways: fixed payments, revenue-based payments, or a combination of the two.

ENVIRONMENTAL BENEFITS

Generating power from wind is one of the cleanest and most sustainable pathways to generating electricity. Wind is also inexhaustible and affordable, making it a viable and useful alternative to fossil fuels for the purpose of generating power. Moreover, utility-scale wind development is considered to be an important component and tool in helping Canada and PEI achieve its carbon reduction targets, where each have committed to achieving net zero GHG emissions by 2050 and 2040 respectively. In terms of the latter, according to its *2040 Net Zero Framework: Accelerating Our Transition to a Clean, Sustainable Economy* , the province highlighted the following as it related to wind generation assets[25]:

> "Wind energy generation is an important part of PEI's sustainable energy portfolio, and continued investment within this industry will be integral to achieving the provinces net zero energy target."

Environmental benefits associated with utility-scale-wind developments often centre around their contribution in reducing GHG emissions and other harmful air contaminants, including but not limited to sulphur dioxide (SO2), oxides of nitrogen (NOx), mercury, volatile organic compounds (VOCs), etc. In this case, the environmental impact of these developments however is often determined by several factors, including but not limited to:

- Their overall capacity and size;
- Height of the individual turbines used;
- Rotor diameter of the turbines used; and
- Their geographical locations, among others.

While quantifying the actual environmental benefits of the Skinners Pond Wind Centre was out of scope for this assessment, for similar sized utility-scale wind farms in Canada, it was observed that these developments can potentially offset more than 100,000 tons of carbon dioxide annually. Again, however, the environmental benefits of these developments must take into consideration a variety of factors, some of which are highlighted above.

6. LAND USE ASSESSMENT

LEGISLATION

In PEI, land use planning is legislated at the provincial level. The process involves land users, community members and leaders, professional planners, and decision makers (Government of Prince Edward Island 2022)[26]. The *Planning Act* (2021) provides legislation for land use planning in PEI. Under the *Planning Act*, thirty-two municipalities accepted responsibility for planning and created official plans and land-use bylaws. The *Planning Act* guides the development of these documents. The Project is not located within an area that falls under an Official Plan.

EXISTING LAND USES AND POTENTIAL CHANGES

The Project is predominantly located within the 104.3 square kilometres (km^2) Fire District (FD) of Tignish. The nearest municipality is the Town of Tignish.

The project area is bounded by existing roads (Thompson Road, Palmer Road, Ascension Road and Route 14) lined with residential homes and a few commercial properties. One unpaved road, Knox Lane, traverses the project area itself with one home; this road is unlikely to be used for access to the Project footprint. Portions of an old logging road that crosses the project area, John O'Haron Road, will be used as an access laneway, with the Palmer Road entrance marking the site of connection to the main power grid. Most of the area is shrubby and forested with agricultural fields centrally concentrated around Knox Lane and lining the roads. Current land use is primarily agriculture, forestry, and the enjoyment and personal recreation of the owners. With the exception of the small area occupied by turbines, the turbine laneways, and the area around the substation, no change of land use for landowners is anticipated or required.

West Prince is a largely rural area, with the majority of industrial land uses located in the adjacent lands in East Prince. Population density in Prince County is 23 people per km^2 (Statistics Canada 2021)[27].

Land uses on the lands that the Project will be sited on are not anticipated to change or be affected by the Project. Agricultural operators will continue to use the land to farm produce such as potatoes. Residents and recreational land users may experience some nuisance effects from sound or traffic during Project construction and potentially limited effects during operations from sound or shadows created by the turbine blades. Full assessment of effects to residents is included in the Environmental Assessment (EA) for the Project which is currently being completed.

7. ECONOMIC IMPACT ASSESSMENT

PREFACE

Financial and economic inputs used to derive the GDP, employment, and partial government tax revenue effects associated with the Skinners Pond Wind Centre was based on currently available information provided by Invenergy. This data and information has not been audited by an independent third party for accuracy or completeness. As a result, WSP Golder reserves the right to revise any analysis, observations, or comments should additional information or documentation become available.

While multiplier analysis is a widely used method for assessing economic benefits associated with project developments such as the Skinners Pond Wind Centre, the methodology contains a number of limitations and shortcomings that readers should be aware of when interpreting the results and are encouraged to consult the section titled, "Economic Model Limitations and Assumptions" of this document. The basis of the modelling relies on information contained within Statistics Canada provincial supply and use tables for PEI.

As indicated above, the impacts are derived based on the structure of the PEI economy in 2018. The 2018 multipliers represent the most recent figures available at the time the report was written[1]. As the timing of expenditures move further away from this base year, the less precise and reliable these economic impacts are likely to be. This is further exacerbated due to the recent COVID-19 pandemic, which significantly altered the way in which businesses and sectors of the economy are likely to operate on a year-to-year basis. In consideration of the limitations outlined, the economic impacts presented in this report should be understood as suggestive rather than predictive of what is likely to arise. Furthermore, the results presented from the economic analysis are limited and only represent one possible scenario among many.

The methodology and assumptions used within this document were intended to be as conservative as possible. Impacts are likely to deviate if there are any large swings in development, construction, operational, maintenance, or decommissioning expenditures associated with the Skinners Pond Wind Centre. All monetary values are expressed in CAD 2022 dollars unless otherwise mentioned.

[1] Supply – use tables for 2019 have recently been released by Statistics Canada. However, the 2019 multipliers were unavailable at the time of model development and report writing.

METHODOLOGY OVERVIEW

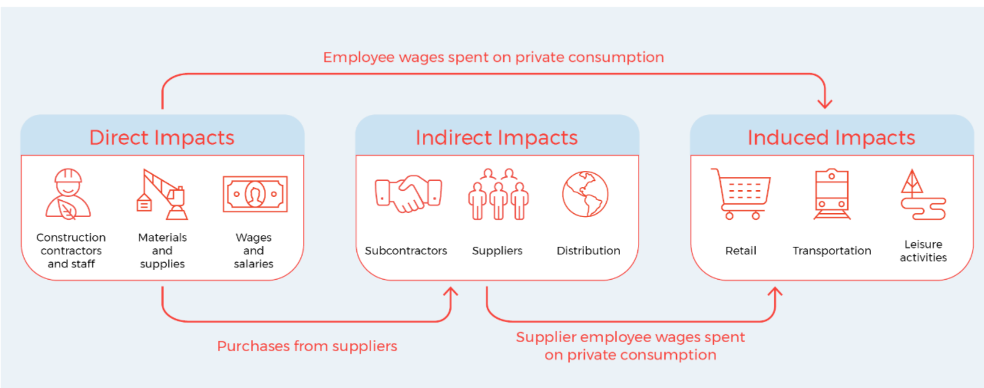
For the purpose of this analysis, WSP Golder's proprietary economic impact model and Statistics Canada provincial multipliers for PEI were used to assess the economic effects associated with the development, construction, operations, maintenance, and decommissioning of the Skinners Pond Wind Centre. These multipliers reflect the diverse nature, structure, interdependencies, and industry linkages of the PEI economy and are used to assess impacts associated with exogenous expenditure shocks.

Using appropriate multipliers that reflect the expenditure activities of the Skinners Pond Wind Centre, the model captures the effects of these expenditures on the provincial economy through three primary channels: direct, indirect, and induced impacts. The relationship between these impacts is displayed on **Figure 16**. Broadly speaking, these impacts are defined as follows:

- → **Direct impacts:** Measures the initial requirements for an extra dollar's worth of output of a given industry impact resulting from additional output in directly affected industry (e.g., industry under study). The direct impact on the output of an industry is a one dollar change in output to meet the change of one dollar in final demand. Essentially, these impacts measure those effects associated with the initial development, construction, operation, maintenance, and decommissioning expenditures of the Skinners Pond Wind Centre.

- → **Indirect impacts:** Measures the changes due to inter-industry purchases as they respond to the new demands of the directly affected industries. This includes all the chain reaction of output up the production stream, since each of the products purchased will require, in turn, the production of various inputs. These impacts are sometimes referred to as supply-chain effects.

Figure 16. Overview of Economic Impacts



Notes: For illustrative purposes. For this analysis, induced impacts have not been directly accounted for.
Sources: WSP Golder.

- **Induced impacts:** Measures the changes in the production of goods and services in response to consumer expenditures induced by household incomes (i.e., wages) generated by the production of the direct and indirect requirements.

Due to the generality and high-level nature of this analysis, as well as noted issues surrounding induced multipliers, these impacts have not been directly accounted for as part of the analysis. Key series captured and quantified by the model for this analysis include:

- **Gross Domestic Product (GDP):** A measure of the total, unduplicated value of the goods and services produced in PEI because of activities attributable to the Skinners Pond Wind Centre.
- **Employment (Full-Time Equivalent Jobs):** Employment represented in full-time equivalence. Each FTE counts one year of full-time work as one job. As an example, one job during the operation stage of the project that lasts for 10 years will be counted as 10 FTEs. As such, the number of FTEs created during each phase of the Project has to be considered along with their respective time durations.
- **Government Revenues (Tax Revenues):** Indirect taxes in the form of product and production related tax revenues. This value excludes any wealth or income related taxes that maybe realized as a result of the Skinners Pond Wind Centre, including both personal and corporate income taxes, among others. As a result, the tax revenues presented in this report are likely an underrepresentation of the potential total tax revenues that could be realized as a result of the Skinners Pond Wind Centre.

The sum of the direct and indirect impacts represents the total economic effect associated with Skinners Pond Wind Centre on PEI.

While not directly included in the analysis, **Appendix B** presents an overview of the expected change in economic impacts for PEI should induced impacts be considered. These impacts are intended for illustrative purposes only, and should be interpreted with caution.

DESCRIPTION OF MODEL EXPENDITURES

The following section describes an overview of the expenditure inputs incorporated within the model used to derive the economic impact of the Skinners Pond Wind Centre. When deriving these impacts, the following assumptions and adjustments were considered:

- All capital and operational expenditures on goods and services sourced outside PEI were removed from the analysis. This was to ensure that the impacts derived in this report are not intentionally overstated.

- → Expenditures were separated into those associated with the Project's development, construction, operations, maintenance, and decommissioning phases to ensure appropriate final demand multipliers were used.
- → For conservative purposes, contingency expenditures were not included in the capital cost estimates.
- → Expenditures associated with tax, interest, and other finance-related payments (e.g., debt payments, developer fee, etc.) were not accounted for when deriving the economic impacts.
- → Community benefit expenditures and landowner payments, which represent an annual operational expenditure for the Centre, have been removed when deriving economic impacts. However, these expenditures are discussed qualitatively further within the report.
- → For some expenditures, figures may reflect consumer prices as opposed to producer prices. That is, transportation, wholesale, and retail margins have not been removed and, as a result, economic impact may be slightly biased upwards.
- → No transmission related capital expenditures were included in the analysis.
- → Annual maintenance related expenditures have been treated as an operational related cost.
- → Decommissioning related expenditures have been estimate at a cost of CAD 75,000 per wind turbine generator.
- → All expenditures have been discounted using a rate of 6%, to account for future expenditure risks, uncertainties, and potential opportunity costs associated with the Centre's expenditures. Based on published literature and WSP Golder experience, this was considered a sensible discount rate for onshore wind projects in Canada.[28]

With regard to the last point mentioned above, the selected discount rate can have a large effect on the overall economic impacts associated with the Project. As a result, sensitivity analysis of the final results has been performed and is highlighted in **Appendix A**.

The capital and operational expenditures in this analysis are assumed over a finite period. Operational expenditures are expected to be incurred on a recurring basis over a 30-year period from 2026 to 2056, although could last longer depending on whether major maintenance and parts replacement for the Skinners Pond Wind Centre occurs.

Capital Expenditures

Development and construction of the Skinners Pond Wind Farm is expected to occur over a 2-year period, from 2024 to 2025. Decommissioning of the facility is expected to occur towards the end of 2056. The combined total expenditures of these activities are estimated at CAD 43.3 million. Expenditures in this case accounts for development, turbine, civil and electrical work, decommissioning, and other related capital costs. In total, it was estimated that approximately 20% of expected capital expenditures would be spent within PEI.

Operational Expenditures

Full-year operations of the Skinners Pond Wind Centre is expected to begin in the year 2026, when the Centre is fully constructed and at operational capacity for a full calendar year. In-province operation and maintenance related costs associated with the

Table 13. Overview of Project Capital Expenditures

Type of Expenditure	Total (CAD, Millions)
Development, Construction and Decommissioning	43.3

Notes: Values represent the discounted lifetime development, construction, and decommissioning costs of the Skinners Pond Wind Centre at 6%. Figures have been rounded.
Sources: Invenergy and WSP Golder analysis.

Table 14. Overview of Project Operational and Maintenance Expenditures

Type of Expenditure	Annual (CAD, Millions)	Total (CAD, Millions)
Operations and Maintenance	2.4	73.9

Notes: Values represent the discounted lifetime operational and maintenance costs of the Skinners Pond Wind Centre at
Figures have been rounded. Total O&M costs assume a 30-year operational lifecycle.
O&M – operations and maintenance.
Sources: Invenergy and WSP Golder analysis.

Project are expected to be approximately CAD 2.4 million dollars annually, equating to approximately CAD 73.9 million over the lifetime of the Project assuming a 30-year lifecycle. The operational costs in this case account for annual wind farm expenditures including on site O&M, post construction bird and bat monitoring, and retail power supply expenditures. In total, approximately 72% of all O&M expenditures are expected to be spent within PEI.

RESULTS

Capital Expenditure Impacts

As indicated in **Table 15**, over its development, construction, and decommissioning periods, the Skinners Pond Wind Centre is expected to contribute approximately CAD 24.9 million in GDP contributions and employ approximately 311 FTE person-years of employment for PEI. Moreover, partial government tax revenues during this period are expected to total approximately CAD 0.6 million. Based on the timing of the expenditures for the Project, most of these impacts are expected to occur during the year 2025, while a small percentage are expected to occur during the year 2024 and 2056, where the latter accounts for decommissioning related impacts.

Operational Expenditure Impacts

Annual operational impacts, in terms of GDP contributions, FTE jobs, and partial government tax revenues are displayed in **Table 16**. Results suggest that on an annual basis, operations of the Skinners Pond Wind Centre will generate approximately CAD 1.7 million in GDP contributions for PEI, and employ approximately 5 FTE jobs, along with contributing CAD 0.5 million in partial government tax revenues. Over the lifetime of the Project, from 2026 to 2056, the Project is expected to contribute to total CAD 51.5 million in GDP contributions for the province, sustain approximately 150 FTE-person years of employment, and CAD 15.1 million in partial government tax revenues.

Table 15. Capital Expenditure Impact Results

Impact	GDP (CAD, Millions)	Employment (FTE Person Years)	Taxes (CAD, Millions)
Direct	22.5	286	0.4
Indirect	2.4	25	0.2
Total	24.9	311	0.6

Notes: Employment expressed in FTE jobs, while GDP and taxes expressed in CAD 2022 millions of dollars.
Taxes only account for partial municipal, provincial, and federal tax revenues received, and exclude any personal or corporat income tax that maybe realized as a result of the operations of the Skinners Pond Wind Centre. Impacts derived from discounted development, construction, decommissioning expenditures. Figures may not add du to rounding.
Sources: WSP Golder analysis using Statistics Canada economic multipliers.

Table 16. Annual Operational Expenditure Impact Results

Impact	GDP (CAD, Millions)	Employment (FTE Jobs)	Taxes (CAD, Millions)
Direct	1.6	3	0.5
Indirect	0.1	2	0.01
Total	1.7	5	0.5

Notes: Employment expressed in FTE jobs, while GDP and taxes expressed in CAD 2022 millions of dollars.
Taxes only account for partial municipal, provincial, and federal tax revenues received, and exclude any personal or corporate income tax that maybe realized as a result of the operations of the Skinners Pond Wind Centre. Impacts derived from discounted lifetime operational expenditures. Figures may not add due to rounding.
Sources: WSP Golder analysis using Statistics Canada economic multipliers.

MODEL LIMITATIONS AND ASSUMPTIONS

As with any economic model, certain limitations apply and should be considered when interpreting the results. Below are key model limitations of the analysis:

- **Financial and economic data:** Financial and economic expenditure data has been provided by Invenergy. Any change in these cost estimates will subsequently result in a change of simulated economic impacts.

- **Choice of discount rate:** Due to the duration and time outlays of potential expenditures, costs were discounted to reflect the various risks, uncertainties, and opportunity costs associated with future expenditures of the Project. The choice of discount rate can have a large effect on the overall economic results. After consideration, a discount rate of 6% was used. As the Project develops, additional research should be carried out to update this rate to refine these estimates.

- **Selected provincial multipliers:** Final demand industry multipliers were selected based on the primary capital and operational expenditure activities of the Project. These multipliers reflect the general economic effects generated from additional expenditures given a shock within that sector. These multipliers are quite general in nature, and do not necessarily reflect the expected impacts as a result of expenditures associated with the Skinners Pond Wind Project. As a result, a more comprehensive and detailed modelling exercise should be undertaken as the Project continues to develop. As indicated previously, the results should be assessed based on their reasonableness, sensibility and directional correctness, as opposed to their exact preciseness.

- **Opportunity costs:** The model does not provide any insights regarding potential opportunity costs associated with the examined expenditures. More specifically, the primary use of the model is unable to distinguish between the potential economic effects resulting from allocating project expenditures elsewhere in the economy.

- **Employment (FTE Jobs).** Jobs have been reported in FTE-person years. Therefore, for this series, jobs should not be interpreted as a headcount of jobs. As an example, one job during the operation stage of the project that lasts for 10 years will be counted as 10 FTEs. As such, the number of FTEs created during the development, construction, operation, maintenance, and decommissioning phase should be considered along with their respective time duration. Moreover, jobs sustained as a result of the Project do not necessarily represent new or created jobs, but rather a shift in employment from one sector of the economy to the another.

→ **Forecast precision:** The results have been derived based on events that may occur several years into the future. Economic multipliers provide no means of measuring the uncertainty around such estimates. This becomes even more of an issue the further out these events take place relative to the base year of the multipliers, which in this case are based on Statistics Canada 2018 input-output tables.

→ **Causal effects:** Results should not be interpreted as causal.

→ **Multipliers do not tell us how long the impacts will last:** Projects typically have a number of distinct phases: pre-construction (design/planning), construction, start-up (commissioning), and operation. Each phase has its own multiplier effect. Construction phase impacts can often be significant, but relatively short-lived compared to the operation phase impacts, which can be smaller but sustained over the period of several decades.

→ **Induced impacts and double counting:** To estimate induced effects, the model takes wages and salary income and recycles that into additional rounds of spending throughout the economy. This can potentially lead to a double counting of impacts and should be interpreted with caution. For this reason, induced impacts are not directly considered as part of this analysis. Moreover, using multipliers that consider induced effects implicitly assume that households and government consumption is not subject to budget constraints, an assumption that does not hold in theory or application.

→ **Out of Province Expenditures:** Based on information provided, a % estimate of the Project's capital and operational expenditures was removed from the analysis to account for potential out of province expenditures. Given the current information and data available, this percentage contains a high degree of uncertainty. As a result, given any change or update in these percentages could lead to a change in potential economic impacts for PEI.

- **Technology improvements:** The model is unable to capture, or does not account for, technology improvements. That is, any potential technology learning curves or discounts cannot be captured.
- **The model is static:** Input-output models are static and do not consider the amount of time required for changes to happen
- **Producer versus purchaser prices:** Due to the high-level nature of the expenditure estimates, costs for potential transportation, wholesale and retail trade margins have not been considered or removed.
- **Lack of supply-side constraints:** The model assumes that the economy has no supply-side constraints. For example, it assumes an infinite supply of workers available, which is not consistent with economic theory. As a result, estimates for some of the impacts (e.g., employment) could potentially be biased upwards.
- **The model is linear:** The relationship between industry inputs and outputs is linear and fixed, meaning that a change in demand for a commodity, or for the outputs of any industry, will result in a proportional change in production. The model is not able to capture potential economies/diseconomies of scale, or structural changes in production technologies.
- **Fixed ratios for intermediate inputs and production:** Input proportions are fixed in the production process. Economic impact analysis using multipliers implicitly assumes that there is a fixed input structure in each industry and fixed ratios for production.
- **Traditionally defined economic multipliers treat all expenditures as creating positive economic benefits:** Economic multiplier analyses typically fail to acknowledge that spending can negatively impact other economic agents (e.g., businesses that lose market share due to the new entrant) or the environment (e.g., air or water pollution). Similarly, spending to remediate an event or activity that has negatively impacted the environment or the economy (e.g., the cost to clean up an oil spill), taken in isolation, will appear as an economic benefit.
- **Lack of supply-side constraints:** The model assumes that the economy has no supply-side constraints. For example, it

assumes an infinite supply of workers available, which is not consistent with economic theory. As a result, estimates for some of the impacts (e.g., employment) could potentially be biased upwards.

ADDITIONAL BENEFITS

Landowner Payments and Community Benefit Fund Contributions

The Project is expected to generate additional economic benefits through both Invenergy's Community Benefit Fund (CBF) contributions and landowner payments. In terms of the former, Invenergy plans to commit approximately CAD $500/MW. Given the size of the Centre, these community benefit contributions are expected to total approximately CAD $49,500 annually, with total CBF contributions expected to total CAD 1.5 million over the lifetime of the Centres operations. The initial contribution will be dispersed on or around the time the Centre begins production and will be pro-rated if required. These funds will be distributed to local initiatives, including community works and services, local fire halls, after school, and senior programs, amongst others.

Table 17. Annual and Total Community Benefit Fund and Landowner Payments from Skinners Pond Wind Centre

Series	Annual (CAD, Millions)	Total (CAD, Millions)
Community Benefit Fund	0.5	1.5
Landowner Payments	1.4	40.9

Notes: Values represent the undiscounted lifetime annual and lifetime CBF and landowner payments. Total costs assume a 30-year operational lifecycle.
Sources: Invenergy and WSP Golder analysis.

In terms of the latter, Project revenues will be distributed semi-annually amongst the participating landowners, primarily on the basis of acres contributed by each respective landowner, with additional funds provided to owners of land hosting Project components (e.g., wind turbines and towers, etc.). As indicated in **Table 17**, total landowner payments are expected to equal approximately CAD 40.9 million over the operational period of the Centre, where on an annual basis, these payments work out to an average value of approximately CAD 1.4 million.

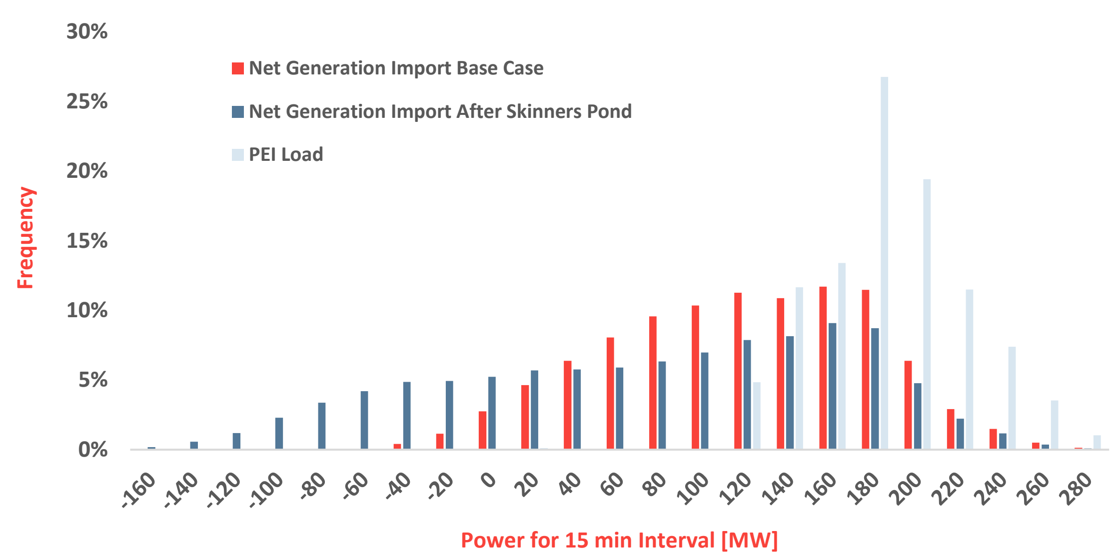
Given the overall and seasonality of the economic base of West Prince, where most of their primary industries flourish from May to October, these additional streams of payments represent important cashflows.[29] In this case, these payments represent additional economic stimulus for the region and PEI as a whole, which in turn will generate additional direct and indirect benefits in and above those outlined in both **Table 16** and **Table 17**. Key series to be positively impacted include GDP, jobs, and government tax revenue.

While speculative at this stage, these additional benefits will be generated through additional consumer related expenditures. However, given the uncertainty in profiling exactly how these expenditures are likely to be distributed, impacts have not been directly quantified.

Reduction in Energy Imports

The PEI grid is a net importer of energy, importing just over 60% of energy needs from 2019 to the end of 2021. Therefore, PEI has significant exposure to energy markets to obtain the power the province needs. An economic advantage of the Skinners Pond Wind Centre is that it reduces the exposure of PEI residents to external energy markets. Given the energy squeeze that is occurring across the world, and the rapid rate of change in energy generation that is attributed to de-carbonization the future price of energy is uncertain. Due to this volatility, past energy prices are no longer a good indication of future energy prices, and many markets are seeing large increases in energy prices.

Figure 17. Net Energy Imports Before and After Skinners Pond Generation



Sources: Government of PEI and WSP analysis.

Skinners Pond Wind Centre energy rates are currently under negotiation but are expected to be equal to or below historic average energy costs. An analysis of 15-minute load data was completed and assuming full correlation of Skinners Pond generation with existing generation, the Project reduced imports by 26% with 65% of the Project's energy being generated at times when it can be utilized by the province. The Project would help insulate PEI to future price shocks by meaningfully reducing the need for energy imports. **Figure 17** compares PEI load with PEI generation before and after the construction of Skinners Pond.

APPENDIX A. SENSITIVITY OF RESULTS

As indicated in the body of the report, the use of a discount rate is common in economic analyses because of the many uncertainties the future holds, where a discount rate is chosen to reflect the level of risk and lost opportunity cost of potential investments.

The choice of discount rates can significantly change the outcome of the analysis leading to higher than-expected benefits. In this particular case, a high discount rate would lead to lower present value, and in the context of this analysis, would mean lower economic benefits to PEI as a result.

For illustrative purposes, **Table 18** shows how the long-term economic growth impacts (GDP) of the Skinners Pond Wind Centre could change depending upon the discount rate used. Similar trends would also be expected for employment and partial tax revenues.

Table 18. Sensitivity of GDP Results to Selected Discount Rates

Discount Rate (%)	Total Capital GDP (CAD, Millions)	Total Operational GDP (CAD, Millions)	Annual Operation GDP (CAD, Millions)
10%	19	26	1
6%	25	52	2
5%	27	63	2
2.7%	31	101	3
0%	37	191	6

Notes: Figures expressed in 2022 CAD millions of dollars and have been rounded. The results using the 6% discount rate reflect the figures in the body of the report. Values may not add due to rounding and total operational figures assume a 30-year operational period.

Sources: Bank of Canada, WSP Golder analysis using Statistics Canada economic multipliers.

The 10% and 5% discount rates have been arbitrarily selected for comparative purposes, while the 2.7% represents the average long-term Government of Canada bond rate from November 2021 to November 2022[30]. The latter is widely considered to be a social discount rate but assumes that the future is relatively risk free, which is not appropriate for most analysis. The above GDP impacts are the sum of the direct and indirect economic impacts associated with the Project under various discount rate assumptions.

The above highlights the sensitivity of the selected methodology approach, and therefore careful consideration should be made when performing these analysis and selecting an appropriate discount rate.

APPENDIX B. INCLUSION OF INDUCED IMPACTS

While not directly accounted for in the main analysis, the economic model used was also able to simulate induced effects associated with the development, construction, operations and maintenance, and decommissioning phase of the Skinners Pond Wind Centre.

In this case, and as previously outlined, induced impacts are defined as the following:

- **Induced impacts:** changes in the production of goods and services in response to consumer expenditures induced by household incomes (i.e., wages) generated by the production of the direct and indirect requirements.

Induced effects within input-output models are often criticized in the sense that they are poorly specified, and depending on the modelling approach, could potentially lead to a doubling counting of impacts.

Table 19. Simulated Induced GDP and Job Impacts of the Skinners Pond Wind Centr

Expenditure	GDP (CAD, Millions)	Jobs (FTE Person Years)
Development	22%	15%
Construction & Decommissioning	18%	13%
O&M	10%	32%

Notes: Percentages have been rounded. O&M – Operations and maintenance and represent % annual change in impacts with inclusion of induced impacts. %'s are derived using a 6% discount rate.
Sources: WSP Golder analysis using Statistics Canada economic multipliers.

The values in **Table 19** represent the % increase in total anticipated GDP and jobs impacts associated with the various phases of the Skinner Pond Wind Centre should induced impacts be accounted for in the analysis. These should be interpreted and considered with caution, and purely meant for illustrative purposes.

APPENDIX C. LOCATION QUOTIENT METHODOLOGY

Generally speaking, location quotients (LQ) are analytical statistics that measures a region's economic specializations relative to a larger geographic unit (typically at the national level). An LQ is computed as an industry's share of a regional total for some economic statistic (earnings, GDP, employment, etc.) divided by the industry's share of the national total for the same statistic. For illustrative purposes, an LQ of 1.0 in the manufacturing sector indicates that the region and the nation are equally specialized in manufacturing; while an LQ of 1.8 means that the region has a higher concentration of employment in manufacturing than the nation. LQs are useful in identifying a region or areas key industry clusters. As a general rule of thumb, **Table 20** provides an overview of how to interpret the scale of LQ coefficients[31]. LQs can be expressed using the following equation:

$$LQ_i = \frac{\%\ of\ regional\ employment\ in\ industry\ i}{\%\ of\ national\ employment\ in\ industry\ i}$$

LQs for each key industry highlighted on **Figure 4** in the body of the report for PEI are displayed in **Table 21** below. As indicated previously, the results suggest the industries such as agriculture, fishing, hunting, and trapping, public administration, and healthcare services are more concentrated within the province when compared to Canada as a whole. On the other hand, industries such as utilities, mining, quarrying, and oil and gas extraction, and wholesale trade are less concentrated within the province.

Table 20. Overview of LQ Ranges and Interpretation

LQ Value/Range	Interpretation
0 ≤ LQ ≤ 0.70	Industry is very underrepresented regionally
0.70 ≤ LQ ≤ 0.90	Industry is moderately underrepresented regionally
0.90 ≤ LQ ≤ 1.10	Industry is averagely represented regionally
1.10≤ LQ ≤ 1.30	Industry is moderately overrepresented regionally
1.30≤LQ	Industry is overrepresented regionally

Notes: For illustrative purposes only.
Source: Source: Miller, M.M, Gibson, L.J. and Wright, N.G. (1991).

Table 21. Industry Location Quotients for Prince Edward Island, 2021

Industry	Location Quotient (LQ)
Agriculture	3.41
Fishing, hunting and trapping	28.0
Mining, quarrying, and oil and gas extraction8	0.28
Utilities	0.51
Construction	0.98
Manufacturing	0.97
Wholesale trade	0.53
Retail trade	1.10
Transportation and warehousing	0.58
Finance and insurance	0.45
Real estate and rental and leasing	0.61
Professional, scientific and technical services	0.63
Educational services	1.03
Health care and social assistance	1.09
Information, culture and recreation	0.83
Accommodation and food services	1.14
Other services (except public administration)	1.01
Public administration	1.94
Business, building and other support services	0.71

Notes: Values have been rounded.
Sources: Statistics Canada and WSP analysis.

APPENDIX D. ADDITIONAL AREAS OF RESEARCH AND CONSIDERATION

As indicated previously, the analysis within this report is intended to provide a general picture of the economic impacts and benefits associated with the Skinners Pond Wind Centre. Areas of future research and modelling that could improve, and or add to, the estimates presented are outlined below.

PROVINCIAL EXPENDITURE SHARES

A % factor was applied to each of the Project's development, construction, operations and maintenance, and decommissioning costs to account for expenditures within PEI. As these costs are refined and the location of the expenditures is known and finalized, the economic estimates in this report should be updated.

REGIONAL ECONOMIC IMPACTS

The model is restricted to providing provincial impacts for the Project. Therefore, in its current state, the model is unable to provide estimates that would be restricted to Prince County or the West Prince area. Deriving regional economic multipliers requires a much more sophisticated modelling procedure, which is out of scope for this analysis. However, this represents an area of additional research that could provide further insight into the regional benefits and impacts of the Project.

CHOICE OF DISCOUNT RATE

As indicated in **Appendix A**, the choice of discount rate matters in terms of deriving overall economic impacts for this type of analysis. For this analysis, a discount rate of 6% was selected. However, as the project progresses, additional research and refinement of this rate should be performed.

APPENDIX E. REFERENCES

[i] CNN (2015). *11 of the Worlds Top Food Museums*. Retrieved from 11 of the world's top food museums | CNN Travel

[2] Government of Prince Edward Island. (2022). Wind Energy in Prince Edward Island. Retrieved from Wind Energy in Prince Edward Island | Government of Prince Edward Island

[3] Statistics Canada. (2021).Census of the Population. Retrieved from Census of Population (statcan.gc.ca)

[4] Ibid.

[5] Ibid.

[6] Rural PEI Labour Market Partnership. (2021). Labour Market Needs Assessment. Retrieved from FINAL_Labour+Market+Needs+Assessment+(1).pdf (squarespace.com)

[7] Statistics Canada (2021). Gross Domestic Product at Basic Prices, by industry, provinces and territories. Retrieved from Gross domestic product (GDP) at basic prices, by industry, provinces and territories (statcan.gc.ca)

[8] Ibid.

[9] Government of Prince Edward Island. (2021). Annual Statistical Review Data Table 2021. Retrieved from Annual Statistical Review Data Tables 2021 | Government of Prince Edward Island

[10] Government of Prince Edward Island. (2022). Estimates of Revenue and Expenditures 2022-2023 (Restated). Retrieved from Estimates of Revenue and Expenditures 2022-2023 (Restated) | Government of Prince Edward Island

[11] Ibid.

[12] Ibid.

[13] Ibid.

[14] Canadian Energy Regulator (2021). Canada's Energy Future 2021. Retrieved from CER – Canada's Energy Future 2021 (cer-rec.gc.ca)

[15] Ibid.

[16] Ibid.

[17] Canadian Energy Regulator (2019). Provincial and Territorial Energy Profiles- Prince Edward Island. Retrieved from CER – Provincial and Territorial Energy Profiles – Prince Edward Island (cer-rec.gc.ca)

[18] Maritime Electric Ltd. (2017). *Interconnection Upgrade Project*. Retrieved from Maritime Electric - Interconnection Upgrade Project

[19] Statistics Canada. (2021).Census of the Population. Retrieved from Census of Population (statcan.gc.ca)

[20]Ibid.

[21] Ibid.

[22] Ibid.

[23] Ibid.

[24] Canadian Energy Regulator. (2022, July 8th). *Market Snapshot: The costs to install wind and solar power in Canada is projected to significantly fall over the long term.* Retrieved from CER – Market Snapshot: The cost to install wind and solar power in Canada is projected to significantly fall over the long term (cer-rec.gc.ca)

[25] Government of Prince Edward Island. (2022). *2040 Net Zero Framework: Accelerating Our Transition to a Clean, Sustainable Economy.* 2040_net_zero_framework.pdf (princeedwardisland.ca)

[26] Government of Prince Edward Island (2022). Land Use Planning. Retrieved from https://www.princeedwardisland.ca/en/information/agriculture-and-land/land-use-planning-prince-edward-island

[27] Statistics Canada (2021). Population and Dwelling Counts: Prince County, PEI. Retrieved from https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=9810000701

[28] Grant Thornton. (2018). Renewable energy discount rate survey 2018. Retrieved from Renewable energy discount rate survey | Grant Thornton Australia

[29] West Prince Chamber of Commerce. Live/Visit. Retrieved from Live/Visit – West Prince Chamber of Commerce

[30] Bank of Canada (2022). Select Bond Yields. Retrieved from Selected Bond Yields - Bank of Canada

[31] Miller, M.M, Gibson, L.J. and Wright, N.G. (1991): Location quotient: A Basic Tool for Economic Development Studies. Economic Development Review, 9, 65-68

Appendix I

Assessment of Potential Impact on Radiocommunication and Radar Systems

Assessment of Potential Impact on Radiocommunication & Radar Systems

R1 – L016 Layout

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Last updated:
March 13, 2023
Dave Brothers, P.Eng.

March 2023

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1. Introduction

As part of Frontier's Technical Assessment for the EIA Study, a radiocommunication and radar system analysis (study) was undertaken. The process analyses the system impacts as described in the *Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems* (manual). This manual is produced by the Radio Advisory Board of Canada (RABC) and the Canadian Wind Energy Association (CanWEA) and can be found by following the link in [1].

All potential impacts on radar, satellite, and radiocommunication systems within the vicinity of the project area were assessed, with findings described in the following sections.

2. Project Description

Frontier used the turbine layout supplied by Invenergy on February 10, 2023, for the study. Below is a map indicating turbine locations within the project area, with Table 1 listing turbine locations in UTM coordinates – Zone 20 WGS84.

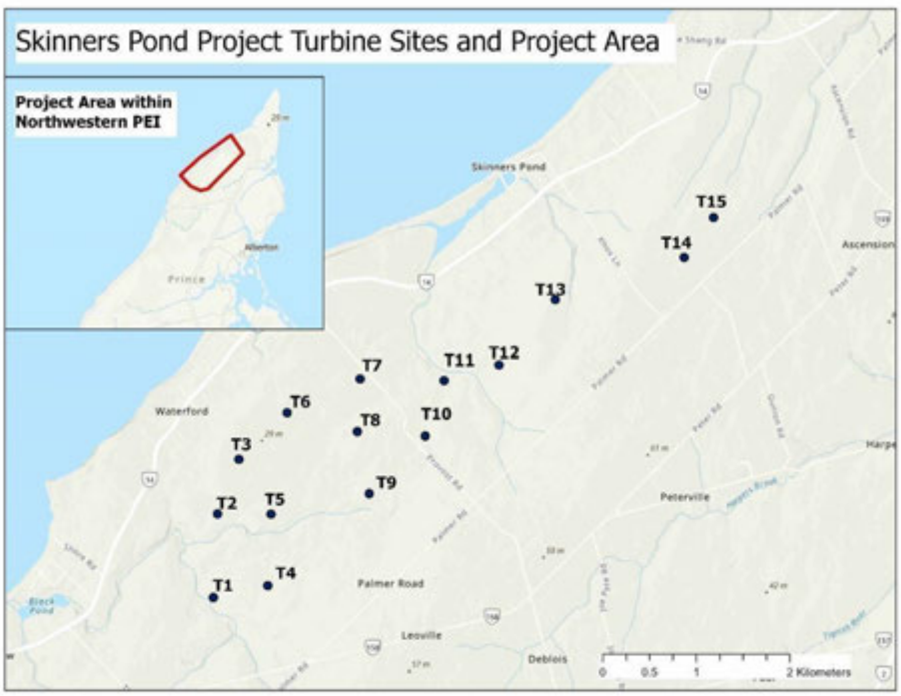

Figure 1. Skinners Pond Wind Project – Site Layout 014

UTM Zone 20 WGS84			
Turbine	**Easting (m)**	**Northing (m)**	**Elevation (m ASL)**
1	411327	5197333	12
2	411370	5198229	16
3	411598	5198811	22
4	411908	5197460	17
5	411942	5198225	18
6	412114	5199311	22

7	412864	5199109	23
8	412894	5199672	18
9	412991	5198445	20
10	413589	5199061	23
11	413792	5199653	18
12	414379	5199821	23
13	414981	5200510	33
14	416358	5200961	38
15	416672	5201388	33

Table 1. Skinners Pond Turbine UTM Coordinates

During the study, two turbines were being considered by Invenergy. The details on the turbines in consideration can be found below in Table 2.

Turbine	Vestas V162.2	Siemens Gamesa SG 6.6-170
Hut Height (m)	119	110.5
Rotor Diameter (m)	162	170
Total Height (m)	200	195.5
Turbine Capacity (MW)	6.2	6.6
Project Capacity (MW)	93	99

Table 2. Turbines Under Consideration

3. Impact Analysis

3.1. Radio Broadcast Systems

Radio broadcast systems in the vicinity of the project area were determined by using Industry Canada's Spectrum Management System Database [2].

3.1.1. Point-to-Point Systems

For point-to-point systems broadcasting below frequencies of 890 MHz, the setback from broadcast towers to turbines is 1 km. There are no broadcast towers within 1 km of any turbine in the development area.

Above 890 MHz, a consultation zone between two point-to-point systems is determined. The consultation zone consists of a 1 km radius from both the broadcasting and receiving station, along with a cylinder of diameter L_C linking the two stations. The diameter L_C is calculated using the below equation.

$$L_C = R + 52\sqrt{\frac{D}{F}}$$

L_C = Diameter of cylinder in meters
R = Rotor diameter of turbine in m
D = Distance between broadcasting and receiving stations in km
F = Frequency of signal in GHz

For the project area, the point-to-point system of largest concern are wireless internet providers for rural areas. There are two known providers of wireless internet in the area: Xplornet and Bell. A survey of internet antennae was performed in parallel with a receptor survey.

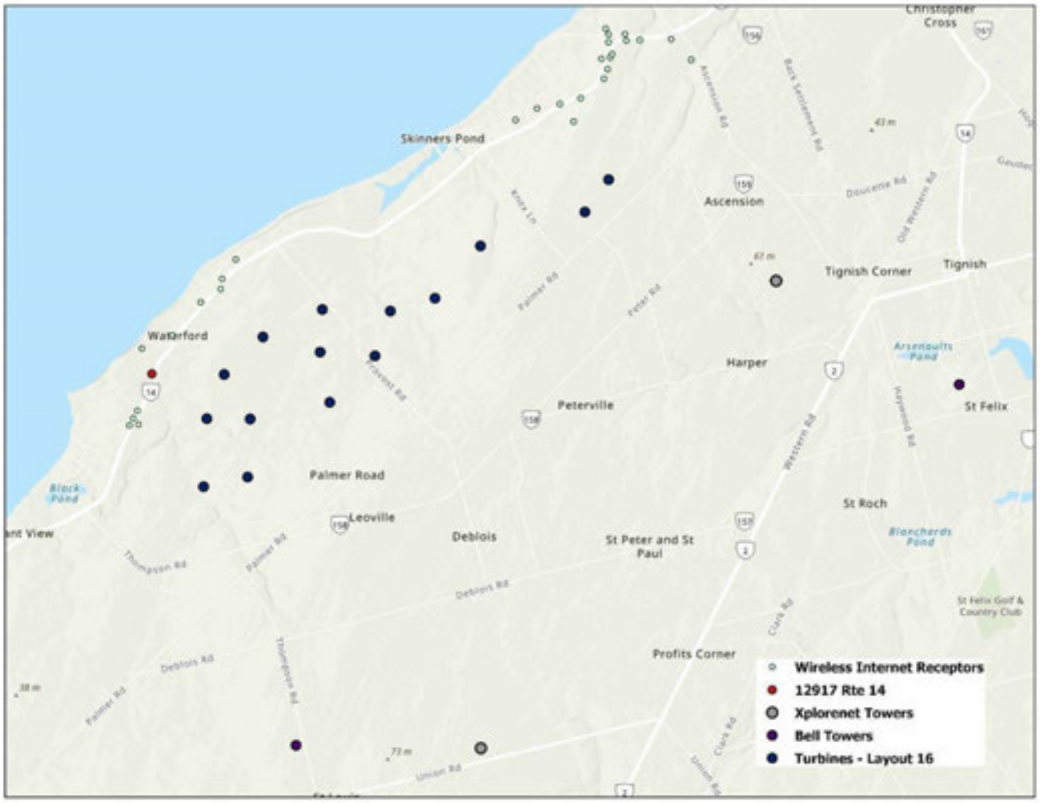

Figure 2. Wireless Internet Users - Wireless Internet Towers

Figure 2 highlights turbine locations, identified wireless internet subscribers along Route 14, as well as locations of signal broadcasting towers. Receptors to the south and east of turbines were not surveyed given relative position to broadcasting towers.

Consultation zones exist between multiple subscribers and providers along Route 14. Customer data is not obtainable; however, Figures 3-6 illustrate that consultation zones exist regardless of internet provider.

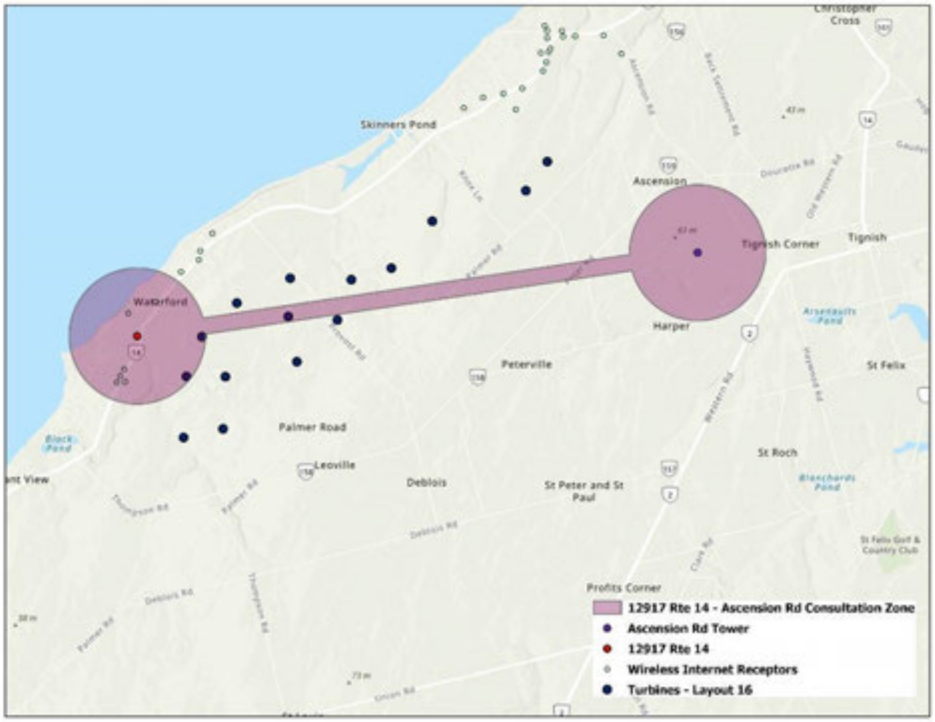

Figure 3. Consultation Zone 12917 Route 14 - Ascension Rd (Xplornet)

Figure 4. Consultation Zone 12917 Route 14 - Mill Rd (Bell)

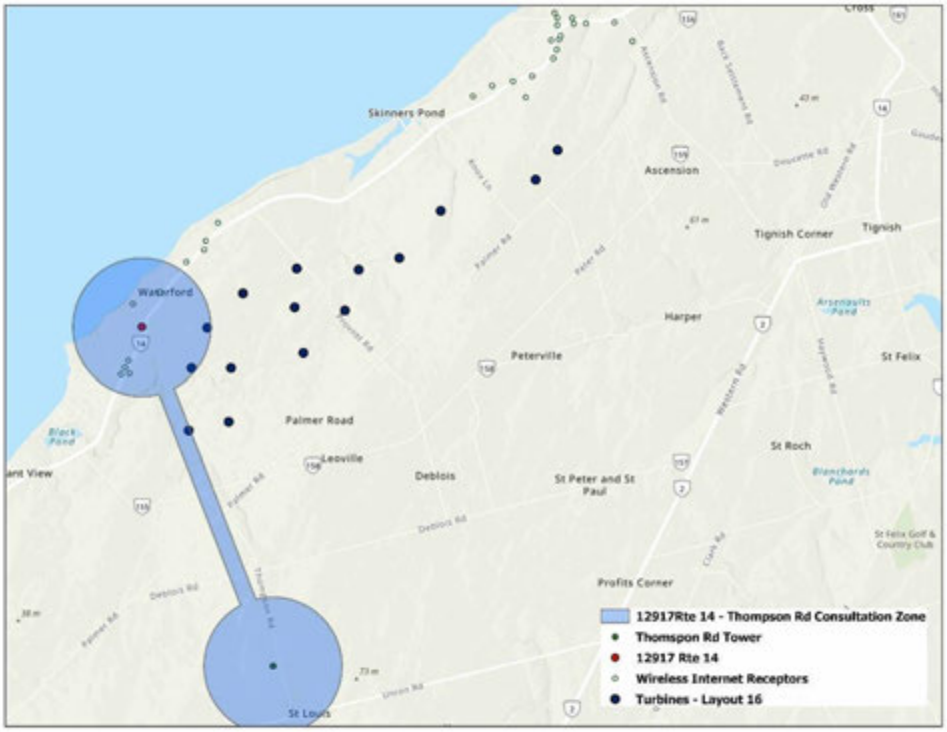

Figure 5. Consultation Zone 12917 Route 14 - Thompson Rd (Bell)

Figure 6. Consultation Zone 12917 Route 14 - Union Rd (Xplornet)

The receptor at 12917 Route 14 is an example of a single receptor showing the need for further consultation with wireless internet providers.

Consultation Zone Cylinder Diameters (L_C) for 12917 Route 14				
Turbine	**Rotor Diameter (m)**			
Vestas V162.2	162			
Siemens Gamesa SG 6.6-170	170			
Tower Location	**Ascension Rd**	**Mill Rd**	**Thompson Rd**	**Union Rd**
Low Broadcast Frequency (GHz)	3.565	2.535	2.535	3.565
High Broadcast Frequency (GHz)	3.690	2.685	2.685	3.690
Distance to Tower (km)	8.320	10.65	5.260	6.580
Min L_C (m)	240.1	265.6	234.8	231.4
Max L_C (m)	249.4	276.6	244.9	240.7

Table 3. Point-to-Point Consultation Zone Calculations

Xplornet Feedback

Contact was made with Xplornet via phone on December 6, 2022. Technical support within Xplornet had never considered this issue before and had no comment to make regarding the placement of wind turbines in the vicinity of existing wireless internet subscribers.

Bell Feedback

Discussions with Bell took place throughout December 2022 and into February of 2023, with email correspondence provided as an attachment. Bell identified two customers of their wireless internet service who could experience degradation of service due to turbine layouts. Bell communicated that they consider the project developer to be responsible for any degradation in service turbines have on local wireless internet subscribers.

While service degradation to local subscribers is possible, there is no way to confirm what – if any – degradation of service will transpire until the turbines are installed and operational. With that in mind, Frontier recommends Invenergy to move forward with the project with the knowledge that any local internet subscribers who experience degradation in their internet service will be the responsibility of Invenergy to rectify. Rectification of issues may involve working with existing internet providers to implement a solution, or to compensate subscribers in a transition to a new internet service whose signal is not degraded by the presence of wind turbines in the area. For communications with Bell specifically, Emma Landry would be the point of contact for Invenergy. Emma can be reached at emma.landry@bell.ca.

3.1.2. Broadcast Transmitters

As per guidelines set out in the manual, the broadcast transmitters to consider are AM stations, FM stations, and TV stations. Any turbines falling within 15 km of an AM broadcast station require consultation with the service provider. Turbines falling within 2 km of either an FM broadcast station or

TV broadcast station require consultation with the service provider for their respective systems. There are no towers broadcasting AM, FM, or TV signals that fall within the consultation zones required.

3.1.3. Over-the-Air Reception

Over-the-Air Reception relates to TV transmitters broadcasting both analog and digital signals with the station's service contour potentially being negatively impacted by wind turbines. Analog broadcasts are no longer used within Canada. There are no digital stations falling within the consultation zone of 10 km for this project.

3.1.4. Cellular and Land Mobile Radio Systems

For cellular and land mobile radio systems broadcasting below 890 MHz, the manual recommends a consultation zone of a 1 km radius to the nearest wind turbine. There are no towers within this consultation zone.

3.2. Satellite Stations

Satellite Stations include household satellite dishes used for TV. A survey of receptors with satellite dishes was undertaken in parallel with receptor and radio internet user surveys.

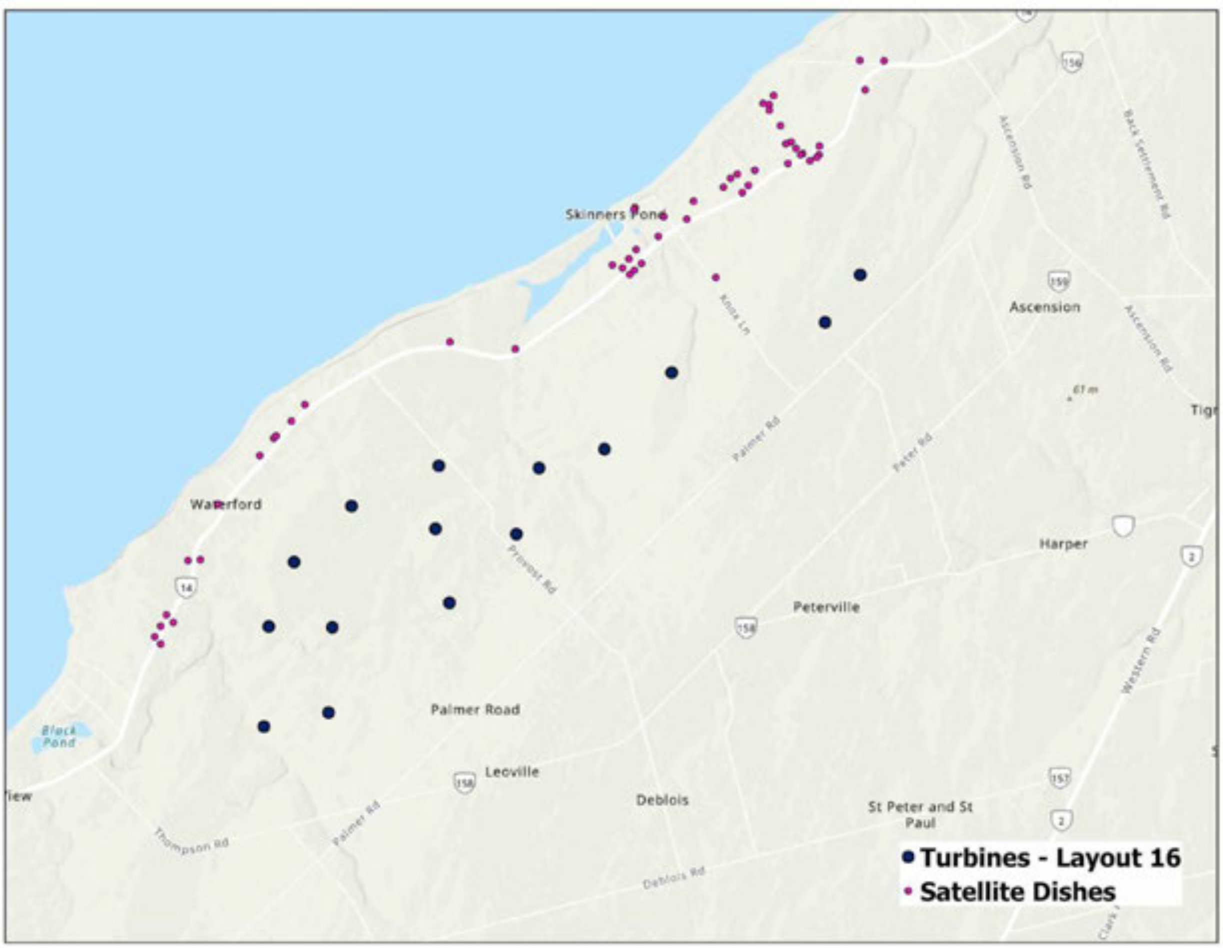

Figure 7. Satellite Dish Receptors

The satellite TV providers in the local area are Shaw and Bell Satellite. Shaw uses two satellites in geostationary orbit at 0° N: 107.3° W, and 0°N: 111.1°W respectively [3]. Bell uses two satellites in geostationary orbit at 0° N: 82° W [4], and 0°N: 91.1°W [5] respectively. Because of the satellite positioning, no homes located to the south of the wind turbines were considered in the survey.

The consultation zone of satellite ground stations is determined by setting a 500 m radius consultation zone from a given satellite dish, and by calculating a second consultation zone using equation 2:

$$L_C = R + 104\sqrt{\frac{D}{F}}$$

L_C = Diameter of cylinder in meters
R = Rotor diameter of turbine in m
D = Distance from ground satellite in km (max distance of 10 km)
F = Frequency of signal in GHz

The second consultation zone centres along the path between the satellite dish and the broadcasting satellite and is positioned orthogonally to the path of communication as shown in Figure 8.

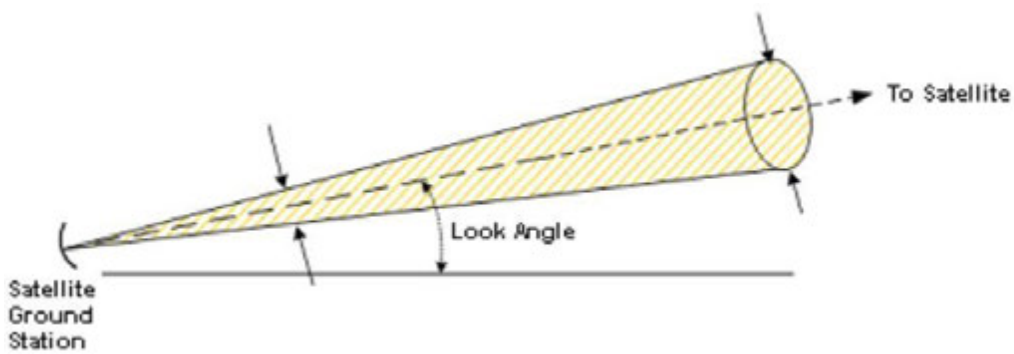

Figure 8. Satellite Consultation Zone Graphic

From [4]; Bell Nimiq 4 operates at Ku band frequency of 12.224 GHz.

For the SG 6.6-170 turbine; a conservative calculation for consultation zone cylinder diameter at maximum distance is:

$$L_C = 170 + 104\sqrt{\frac{10}{12.224}}$$

L_C = 264 m.

The location of the centre point of the consultation zone is dependent on the satellite look angle. The look angle for satellites in the project area is 30° [6].

The centre point of the consultation zone at a distance of 10 km is 5,773.5 m above ground level. A consultation zone of diameter 264 m centred 5,773.5 m above ground level (AGL) will not be impacted by a Siemens Gamesa SG 6.6-170 as the highest point of the turbine is 200 m AGL.

From the survey, the closest receptor to a potentially impactful turbine is located at 274 Knox Ln with T13 being the turbine to consider. The distance between that receptor and T13 is 950 m. Applying the same calculations to this specific circumstance, the consultation zone for 274 Knox Ln at a distance of 950 m would be 199 m in diameter, centred at an elevation of 548.5 m AGL. The lower edge of the consultation zone in this circumstance would be 449 m AGL; a higher elevation than the 200 m AGL reach of the Siemens Gamesa SG 6.6-170.

3.3. Environment Canada Weather Radar

A letter was submitted to Environment and Climate Change Canada (ECCC) requesting comment on possible negative impacts of the current layout on ECCC weather radar systems. ECCC's response, attached, states the ECCC does not foresee any issues with the location of these turbines and does not object to the proposal.

3.4. Air Defense, Vessel Traffic, and Air Traffic Control Radar Systems

There are no known radar systems within the consultation zones as laid out in the manual. All required contacts have been reached. A tabulated list of responses is available below in Section 4.

4. Mandatory Contact Summary

A list of mandatory contacts is provided in the manual. All parties on the list were contacted either through phone communication, or email with a letter outlining the project and the nature of the study. A copy of one of the letters, along with copies of the responses, is attached as Appendix. Communications with mandatory contacts were made prior to Invenergy issuing the latest turbine layout on February 10, 2023. Due to time constraints and the relatively minor changes to turbine locations in the latest layout, Frontier did not request updated responses from contacts.

Agency	Contact	Date Contacted	Response
DND - Military Radiocommunicatin Users	WindTurbines@forces.gc.ca	21-Oct-22	Acknowledged receipt - no final response 230223
DND - Military Air Defence and Air Traffic Control Radars	WindTurbines@forces.gc.ca	21-Oct-22	Acknowledged receipt - no final response 230223
RCMP	Windfarm_Coordinator@rcmp-grc.gc.ca	21-Oct-22	No concerns
Canadian Coast Guard - Vessel Traffic System Radars	windfarm.coordinator@dfo-mpo.gc.ca	21-Oct-22	No concerns
Environment Canada	weatherradars@ec.gc.ca	21-Oct-22	No concerns
NAV Canada	landuse@navcanada.ca	21-Oct-22	Acknowledged receipt - no final response 230223
Public Safety Agencies			
Tignish Fire Department	tfd@live.ca	21-Oct-22	No response - 230223
Pat Kelly PEI Department of Public Safety	pjkelly@gov.pe.ca	21-Oct-22	No concerns
Island EMS	info@islandems.ca	21-Oct-22	No response - 230223

Table 4. Mandatory Contacts and Responses

5. Conclusions

This radiocommunication and radar system analysis has provided the following conclusions:

1. Degradation of internet signals for local wireless internet subscribers is a real possibility due to the location of turbines relative to receiver and broadcaster infrastructure. There is no way to determine this definitively until turbines are installed and operational. In the event that local internet service is degraded, Invenergy shall work in good faith with subscribers and providers to find a suitable solution.
2. No negative impacts are anticipated for any point-to-point radio systems outside wireless internet services. Additionally, no negative impacts are anticipated for broadcast transmitters, over-the-air reception, cellular and land mobile radio systems and public radio systems.
3. No negative impacts are anticipated for public safety radio broadcasting.
4. No negative impacts are anticipated for Environment Canada weather radars.
5. From contacts who responded in a timely manner, no negative impacts are expected on other radar and communication systems.
6. There are still outstanding responses from the mandatory contact list. Information received at a later date will be forwarded to Bruce Fraser of WSP.

6. References

[1] Radio Advisory Board of Canada Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems (2022, October 10). *RABC CANWEA Guidelines_Updated 2020.* Retrieved from https://www.rabc-cccr.ca/about/publications/wind-turbines-radio-radar/

[2] Industry Canada Spectrum Management System (2022, November 8). *Geographical Search Area*. Retrieved from https://sms-sgs.ic.gc.ca/frequencySearch/searchByGeographicArea?execution=e1s1.

[3] Shaw Direct (2022, November 15). *Shaw Direct Self Installation Manual Supplement*. Retrieved from https://assets.aws.shawdirect.ca/uploadedfiles/shawdirect/content/shawdirect_c/equipment/accessories/self_install_kit_manual_eng.pdf.

[4] Sat Beams (2022, November 15). *Nimiq 4 Details.* Retrieved from https://www.satbeams.com/channels?norad=33373.

[5] Sat Beams (2022, November 15). *Nimiq 6 Details*. Retrieved from https://www.satbeams.com/satellites?norad=38342.

[6] Satellite Signals (2022, November 15) *Satellite Antenna Aiming and Dish Pointing Calculator for Canada*. Retrieved from https://www.satsig.net/maps/satellite-tv-dish-pointing-canada.htm.

Appendix J

Visualization Report

6. Visualization Report

The following four figures present photographic views of the project area taken from multiple locations.

The photos were taken during field analysis on November 10-11, 2022, with data recorded at each location. Data included:

- Coordinates at which photo was taken
- Ground elevation ASL
- Camera height AGL
- Camera bearing during photo
- Date, time, and weather conditions during photograph
- Camera parameters for photos

Using photos and the recorded data as inputs; WindFarmer produces images of local views with turbines embedded into the viewscapes.

FRONTIER POWER SYSTEMS

Figure 7: Montage Photo 1 – Route 14 Waterford

Figure 8: Montage Photo 2 – Church View Rd

Figure 9: Montage Photo 3 – Palmer Rd

Figure 10: Montage Photo 4 – Route 14 Skinners Pond

Photo	Easting (m)	Northing (m)	Bearing
Montage Photo 1	410693	5198747	144°
Montage Photo 2	411585	5196456	33.5°
Montage Photo 3	416488	5200801	237°
Montage Photo 4	414168	5201071	224°

Table 3: Montage Photos Details

Appendix K

Heritage and Archaeological Survey Photos

Heritage and Archaeological Survey Photos:

Photograph 1: Section of HPA 1; looking southwest.

Photograph 2: Section of HPA2l looking west.

Photograph 3: View towards HPA3: note taller shrubs in possible depression. Looking northwest.

Photograph 4: Section of HPA4; looking northwest.

Photograph 5; Section of HPA5; looking northeast.

Appendix L

Noise Impact Assessment for the Proposed Skinners Pond Wind Energy Centre

Noise Impact Assessment for the Proposed Skinners Pond Wind Farm

R1 – L016 Layout

Prepared for:
WSP E&I Canada Ltd.

Prepared by:
Frontier Power Systems
341 Georgetown Rd
Georgetown, PE

Last updated:
March 13, 2023
Adam Sandler, P.Eng.

March 2023

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1. Introduction

Frontier Power Systems Inc (Frontier) has been engaged by the WSP E&I Canada Ltd (the Client) to conduct a noise impact assessment of the proposed Skinners Pond Wind Project, located in Skinners Pond, Prince County, Prince Edward Island.

The proposed project is to consist of 15 wind turbines and have a total generating capacity of 93 - 99 MW. The proposed turbines have a rotor diameter of 162 – 170 m, a hub height of 110 – 119 m, and generating capacity of 6.2 – 6.6 MW each.

This report outlines the following activities which were required to complete the noise impact assessment:

- Acquisition and review of noise data for the proposed wind turbine generator.
- Identification of all noise sensitive areas (noise receptors) within 1500 meters of the proposed turbine sites.
- Noise propagation modeling using the ISO 9613-2 calculation method.
- Prediction of noise levels at each noise receptor, mapping of noise contours, and comparison to regulatory limits.

2. Site Description

The project area is roughly bordered by Route 14, Thompson Rd, Palmer Rd, and Ascension Rd. The project area is entirely rural, containing a mix of farmland, forests, rural homes, a campground, a working harbour, a cultural/music centre, a church, and community halls. A map showing the current proposed turbine layout within the project area is shown in Figure 1.

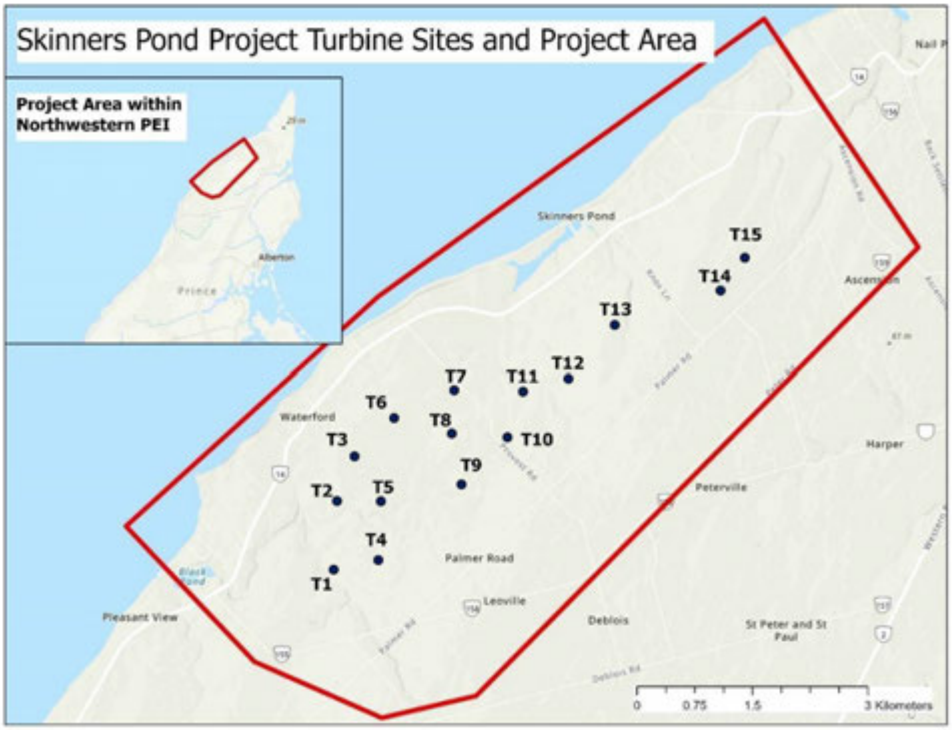

Figure 1. Proposed Turbine Layout

3. Noise Sources

3.1. Turbine Description

Two wind turbine models are under consideration for the proposed project. Both are conventional 3 bladed, up-wind, pitch regulated turbines, mounted on tubular steel towers. The Siemens-Gamesa SG6.6-170 has a 170 m rotor diameter, a generating capacity of 6.6 MW, and a hub height of 110.5 m. The Vestas V162-6.2 has a 162 m rotor diameter, a generating capacity of 6.2 MW and a hub height of 119 m. These general specifications are summarized in Table 1.

General Spec	SG6.6-170	V162-6.2
Rotor Diameter (m)	170	162
Hub Height (m)	110.5	119
Generating Capacity (MW)	6.6	6.2
Cut-in Wind Speed (m/s)	3	3
Cut-out Wind Speed (m/s)	25	25
Wind Speed for Rated Power (m/s)	11.5	Not indicated
Rotor Speed (RPM)	Variable	Variable

Table 1. Turbine General Specifications

3.2. Turbine Noise Data

Noise emission data for the SG6.6-170 turbine was extracted from the Siemens-Gamesa documentation provided by the Client. This document provides sound power data over a range of hub height wind speeds, in octave bands, and indicates they are presented with reference to the IEC 61400-11 ed. 3.0 (2012) code, as necessary for typical sound propagation modeling for wind farms. This turbine can operate in several reduced noise operating modes. The highest expected sound power level is 106.0 dB(A) and was used for noise propagation modeling.

Noise emission data for the V162-6.2 turbine was extracted from the Vestas documentation provided by the Client. This document provides sound power data over a range of hub height wind speeds, in one third octave bands. The data is presented for 2 different types of blades, those having serrated trailing edges, and those without serrated trailing edges. It was assumed the higher noise; non-serrated trailing edge blades would be used. The highest expected sound power level is 107.6 dB(A) and was used for noise propagation modeling.

3.2.1. Octave Sound Power Levels

The ISO 9613-2 noise model calculates atmospheric attenuation by octave band and therefore, octave sound power levels are required as input to the model. Octave sound power levels for each prospective turbine are summarized in Table 2 below.

Turbine Type	SG6.6-170	V162-6.2
Octave Band, Hz	L_{wa}, dB(A)	L_{wa}, dB(A)
31.5	0.0	74.8
63	86.5	86.8
125	93.4	95.4
250	96.1	100.8
500	97.9	102.9
1000	101.8	101.8
2000	99.9	97.5
4000	93.3	89.9
8000	83.0	79.0

Table 2. Octave Sound Power Data

3.2.2. Tonality

Tonality is a characteristic of noise which is caused by high sound power levels at a narrow band of frequencies, when compared to the rest of the frequency spectrum. Generally, noise containing tones is more perceptible to the human ear and increases the likelihood of annoyance. Most wind turbine noise is broadband and distributed across the audible frequency spectrum. However, mechanical noise from the gearbox, generator, and other ancillary equipment in the nacelle has the potential to contain tones.

The measurement of tonal audibility is a requirement under the IEC 61400-11 standard. Tonal audibility less than 4 dB is not considered significant under ISO 1996-2, Annex C, “Objective method for assessing the audibility of tones in noise”.

Tonality and tonal audibility are not quantified or discussed in the documentation provided for either of the prospective turbines and is therefore not considered in these analyses.

3.2.3. Low Frequency Noise

Low frequency noise or ‘infrasound’ has not been considered in this noise impact assessment. Low frequency noise testing is not required under IEC 61400-11. In general, modern wind turbines do not exhibit significant low frequency noise emissions.

3.3. Wind Farm Layout

The proposed turbine layout was provided by the Client. The same layout is proposed for either of the prospective turbine types. The proposed wind farm layout is shown in Figure 1 and UTM coordinates for the 15-turbine site are summarized in Table 3.

Turbine Coordinates (UTM Zone 20 WGS84)			
Turbine ID	Easting (m)	Northing (m)	Elevation (m asl.)
1	411327	5197334	12
2	411370	5198229	16
3	411598	5198811	22
4	411908	5197460	17
5	411942	5198225	18
6	412114	5199311	22
7	412864	5199109	23
8	412894	5199673	18
9	412991	5198445	20
10	413589	5199061	23
11	413792	5199653	18
12	414379	5199821	23
13	414981	5200510	33
14	416358	5200961	38
15	416673	5201388	34

Table 3. Turbine Coordinates

4. Noise Receptors

The project area was assessed to identify all noise sensitive areas (receptors) within 1500m of the proposed turbine sites. In most cases receptors up to 2000m or more were also included. A total 269 receptors were identified, consisting primarily of permanent residences, seasonal residences, and rental properties. Figure 2 shows the receptor database in relation to the proposed turbine sites. The receptor coordinates are summarized in Table 4. Receptors 44 and 189 are less than the regulatory 4 times total height setback from the nearest turbine. It's unclear if/how the Invenergy intends to address this.

Noise Receptor Coordinates (UTM Zone 20 WGS84)									
Receptor ID	Easting (m)	Northing (m)	Elevation (m asl.)	Distance to Nearest Turbine (m)	Receptor ID	Easting (m)	Northing (m)	Elevation (m asl.)	Distance to Nearest Turbine (m)
1	410284	5196316	24.9	1457.3	136	415856	5202915	5.8	1731.6
2	409893	5196814	14	1525.4	137	415802	5202926	5.1	1767.3
3	409855	5196882	12.8	1539.8	138	415897	5202994	6	1783.4
4	409819	5196907	12.3	1567.3	139	415952	5202994	6.4	1760.2
5	409673	5197034	9.3	1681	140	416608	5202722	28	1335.6
6	409508	5196984	8	1852.4	141	416659	5202848	28	1460.1
7	410067	5197212	10	1266	142	416578	5202984	23.7	1598.8
8	410087	5197275	10	1241.5	143	416693	5202998	27.9	1610.1
9	410011	5197276	9.3	1317.4	144	416717	5203047	26.6	1659.6
10	410109	5197287	10	1219	145	416671	5203205	23.4	1817
11	410099	5197315	10	1228.2	146	416670	5203309	19.8	1921
12	410010	5197399	9.9	1318.7	147	416632	5203381	15.2	1993.4
13	410021	5197453	9.8	1311.5	148	416729	5203343	23.1	1955.8
14	410103	5197505	10	1236	149	416885	5203308	24	1931.7
15	410118	5197560	10	1230.1	150	416904	5203226	24	1852.5
16	410152	5197696	10.5	1229.7	151	417083	5203231	18.5	1888.2
17	410294	5197665	10.4	1084.9	152	416482	5203534	10	2154.4
18	410180	5197771	11.1	1227.6	153	417140	5203516	19.3	2178.7

19	410281	5197772	11.9	1134.2	154	417251	5203313	18.2	2010
20	410197	5197856	12	1231	155	417408	5203233	22.6	1986.2
21	409811	5197492	8	1524.3	156	417498	5203242	23.1	2029.5
22	409495	5197553	6	1845.2	157	417466	5203486	20	2243
23	409419	5197556	4.9	1921	158	417692	5203137	22.7	2024.4
24	409527	5197638	6.2	1825.6	159	417758	5202972	21.8	1920.3
25	409542	5197654	6.3	1813.6	160	418057	5202739	30	1934.4
26	409613	5197696	6.8	1752	161	417902	5202414	29.2	1601.4
27	409561	5197760	6.1	1816.8	162	417854	5202318	29.9	1503.6
28	409686	5197782	6.8	1701.2	163	417817	5202177	30.8	1390.1
29	409643	5197804	6.4	1748.5	164	417864	5202088	32.5	1381.9
30	410356	5197981	14	1044.1	165	417777	5202095	30.8	1311.4
31	410404	5198074	14	978.5	166	417838	5202018	33.9	1324.9
32	410349	5198138	14	1025.2	167	417805	5201318	33.4	1134.7
33	410469	5198152	14.6	904.5	168	417831	5201066	32	1202.4
34	410403	5198235	15.5	967.2	169	417880	5200927	32	1292.5
35	410514	5198268	16.7	857.1	170	418149	5201023	34.3	1520.9
36	410455	5198336	17.3	921.4	171	418213	5201058	32.8	1575.4
37	410271	5198349	16.3	1105.7	172	418288	5201166	32.8	1630.7
38	409865	5198658	11.1	1565.2	173	418390	5201431	32.2	1718
39	410621	5198625	20	847.5	174	418256	5201589	34.6	1596.2
40	410648	5198823	22	935.2	175	418292	5201808	32.6	1673.1
41	410760	5198829	20.9	838.3	176	418340	5201758	32.1	1708.1
42	410675	5198933	21.5	931.1	177	418536	5201538	30.3	1869.5
43	410518	5199158	18.4	1134.4	178	418635	5201493	30	1965.3
44	411030	5199177	20	675.6	179	418114	5200663	31.2	1613.6
45	410913	5199328	16.4	858.1	180	418050	5200622	31.6	1576.2
46	411015	5199435	15.1	853.8	181	417784	5200515	31.4	1413.4
47	411142	5199684	14	984.7	182	417889	5200412	30	1559.6
48	411292	5199765	13	939	183	417670	5200384	31.9	1415.3

49	411417	5199921	12	926.3	184	417720	5200298	32	1511.7
50	411437	5199940	12	924.2	185	417368	5200075	31.6	1343.4
51	411419	5199947	12	942.1	186	417244	5199946	34	1347.1
52	411429	5199955	12	940.3	187	417071	5199809	36	1354.5
53	411253	5199937	10.2	1064.5	188	416930	5199664	36.5	1417.2
54	411238	5199932	10.1	1073.8	189	416253	5200358	39.7	611.5
55	411226	5199927	10	1080.7	190	415677	5200056	42	830.8
56	411214	5199922	10	1087.8	191	415668	5199901	41.4	917.9
57	411259	5199975	10	1082.6	192	415382	5199691	40	911.9
58	411264	5199988	10	1086.7	193	415333	5199608	40	968.2
59	411269	5200001	9.9	1091	194	415444	5199585	40	1034.4
60	411271	5200017	9.6	1099.6	195	415383	5199523	40	1047.2
61	411255	5200031	9	1120.9	196	415176	5199300	38.7	952
62	411551	5199944	12	847.2	197	414882	5199159	33.3	831.2
63	411584	5199987	12	859.1	198	415009	5198893	37.8	1121.4
64	411574	5200073	12	934.1	199	414784	5199029	32.6	889.3
65	411729	5200093	12	871.8	200	414750	5199010	32.7	891.6
66	411739	5200150	12	919.2	201	414660	5198923	32.9	940.7
67	411694	5200224	10.8	1005.2	202	414546	5198731	34	1011.9
68	411750	5200335	9.9	1087	203	414470	5198657	33.2	968.8
69	411764	5200362	10	1108	204	414441	5198532	36	1002.4
70	412372	5200477	16	959.2	205	414278	5198555	34.9	854.4
71	412259	5200618	16	1139.2	206	414078	5198251	38.2	945.8
72	412158	5200631	15.2	1208.7	207	413998	5198194	38	958.3
73	412696	5200675	16	1021.9	208	413902	5198219	38	898
74	412778	5200678	16	1012.2	209	413847	5198052	39.4	942
75	413000	5200700	14.2	1032.9	210	413722	5198035	36.1	838.3
76	412993	5200783	14	1114.9	211	413516	5197813	35.2	821.8
77	412927	5201080	11.4	1407.9	212	413458	5197763	35.1	826.7
78	413581	5200719	5.8	1086.2	213	413410	5197720	34.9	837.5

79	414009	5200998	6.6	1087.8	214	413504	5197731	37.9	879.3
80	414450	5201476	6.3	1102.4	215	413515	5197650	39.1	952.3
81	414540	5201448	8	1036.5	216	413346	5197560	36.1	953.7
82	414607	5201392	8.6	958	217	413287	5197500	35.4	990.4
83	414645	5201427	8.9	976.6	218	412978	5197388	32	1057.2
84	414599	5201530	8.1	1089.2	219	412768	5197112	35.5	927.6
85	414653	5201532	8.4	1073.3	220	412540	5196900	33.8	844.3
86	414711	5201487	8.9	1013.6	221	416232	5198953	37.9	1997.2
87	414665	5201613	8	1147.4	222	416070	5198869	39	1940.4
88	414805	5201569	8.4	1073.5	223	415718	5198576	40.5	1828.2
89	414863	5201732	8.4	1227.6	224	415476	5198208	41.3	1950.4
90	414994	5201671	10	1161	225	415419	5198179	42	1943.4
91	415380	5201363	20.3	941.5	226	415216	5197911	40.4	1992
92	415108	5201756	10.2	1252.3	227	415154	5197871	40.7	1965.6
93	414971	5201810	9.7	1299.9	228	414924	5197627	42	1958.8
94	414962	5201843	9.4	1333	229	414885	5197580	42.1	1967.6
95	414945	5201865	9	1355.4	230	414683	5197401	42.1	1987.7
96	414926	5201890	8.5	1381	231	414612	5197317	42	1975
97	414910	5201907	8.2	1398.7	232	414519	5197225	41.8	1955.4
98	414896	5201933	8	1425.5	233	414504	5197147	41	1993.6
99	414877	5201968	7.6	1461.6	234	414426	5197118	41.4	1954.7
100	414643	5201974	3.8	1502.5	235	414439	5197197	42	1911.7
101	414653	5201991	4.2	1516.9	236	414407	5197189	42	1892.9
102	414805	5202049	6	1549	237	414315	5197175	42	1834.8
103	414730	5202006	4.1	1516.9	238	414241	5197254	42.9	1726.7
104	414831	5202049	6.2	1546.2	239	414170	5197068	42	1812.9
105	414858	5202089	6	1583.7	240	414026	5197104	42.7	1694.1
106	414881	5202062	6.7	1555.1	241	413597	5197006	44	1561.5
107	414904	5202047	7	1538.8	242	413054	5196764	45.1	1340.7
108	414943	5202063	7.1	1553.4	243	412914	5196818	42.8	1193.3

109	414934	5202112	6.5	1602.6	244	412875	5196805	42.6	1167.8
110	415117	5201886	10	1382.6	245	412844	5196709	43.6	1199.9
111	415179	5202046	10.2	1548.6	246	412201	5196633	30	877.4
112	415445	5202173	12.5	1457	247	411735	5196558	26	876.4
113	415616	5202124	14.1	1287.6	248	411690	5196449	30	956.2
114	415511	5202253	11.5	1448.2	249	411641	5196439	30.1	948.2
115	415669	5202189	13.2	1284	250	411608	5196418	29.8	957.8
116	415570	5202291	10.9	1425.1	251	411628	5196389	30.6	991.5
117	415726	5202325	11.4	1331.9	252	411507	5196390	28	960.7
118	416026	5202387	13.9	1189.9	253	411094	5196385	18	976.9
119	416212	5202155	28	894.6	254	411033	5196368	17.7	1009.5
120	416181	5202384	16	1110.7	255	411631	5196260	32.5	1115.9
121	416223	5202410	16.5	1116.5	256	412079	5196442	31.3	1032.3
122	416283	5202440	18	1121.8	257	412154	5196278	34	1207.4
123	416303	5202463	18	1136.7	258	411894	5196094	38	1363.2
124	416355	5202488	20.4	1144.9	259	411975	5196007	39	1454.6
125	416307	5202541	17.3	1209.5	260	411941	5195945	39.7	1515.5
126	416193	5202584	14	1288.5	261	412097	5195863	41.6	1608.2
127	416157	5202474	14	1202.1	262	412142	5195799	42	1677.5
128	416138	5202463	14	1200.5	263	417347	5199927	32.5	1430.7
129	416097	5202521	12.4	1270.8	264	412007	5195964	40	1499.4
130	416071	5202551	11.4	1309.3	265	411970	5195911	40	1550.3
131	416051	5202580	10.6	1344.3	266	416300	5199000	37	1961.3
132	416005	5202563	10.2	1351.4	267	416472	5199076	34	1888
133	416030	5202619	9.4	1388.6	268	416457	5199270	36	1693.4
134	415958	5202725	7.1	1515.9	269	416436	5199259	36	1703.3
135	415856	5202863	5.7	1685.9					

Table 4. Noise Receptor Coordinates

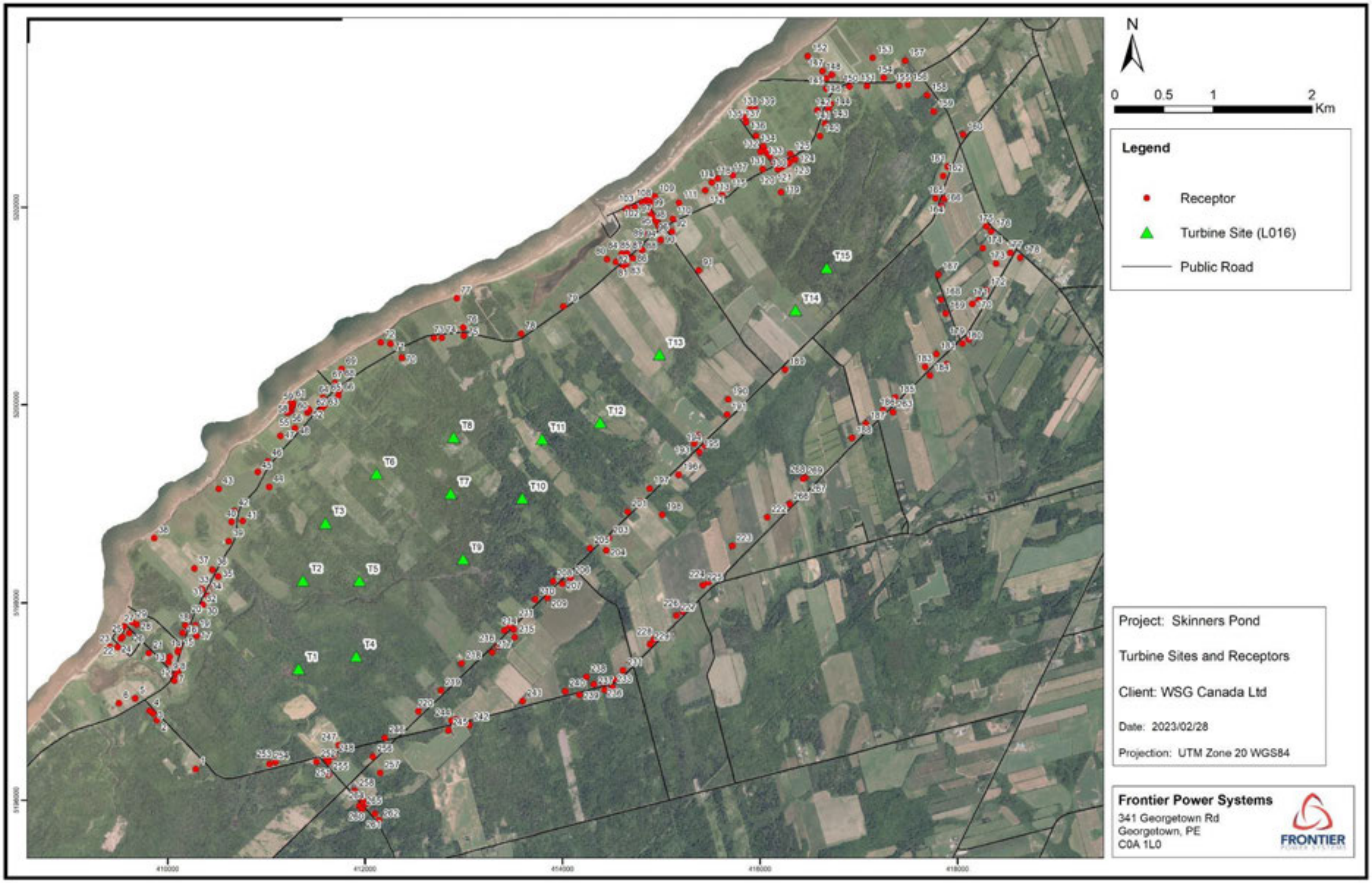

Figure 2. Turbine Sites and Noise Receptors

5. Noise Impact Assessment

5.1. Methodology

The noise impact assessment was conducted by predicting the sound pressure level (noise) from the wind turbines at each receptor location and comparing to a specified noise limit. The receptor noise levels were predicted using a 3-dimensional noise propagation model based on ISO 9613-2 “Acoustics - Attenuation of sound during propagation outdoors”. The noise model considers frequency dependent attenuation due to geometric divergence, atmospheric absorption, and ground effect. The model is valid for downwind propagation under a well-developed moderate ground-based temperature inversion, which are conditions favorable to noise propagation from source to receiver. The parameters for the noise model are explained in more detail below. The noise model does not consider building acoustics, and therefore the predicted noise levels are valid at the exterior of a receptor building.

5.2. Allowable Noise Limits

Currently there are no provincially or federally regulated noise limits for wind farms on Prince Edward Island. A noise limit of 45 dB(A) has been a commonly used guideline for this jurisdiction. The World Health Organization’s “Guidelines for Community Noise” identifies the main health risks associated with noise and derives acceptable environmental noise limits for various activities and environments. These noise limits identify 50 dB(A) as the point at which moderate annoyance can begin in outdoor living areas. 45 dB(A) is identified as the noise limit outside of a bedroom with the window open, before sleep disturbance can become an issue. The noise limit used for this noise impact assessment is 45 dB(A).

5.3. Model Parameters

5.3.1. Atmospheric Attenuation Coefficients

Atmospheric attenuation coefficients depend strongly on the frequency of the sound, ambient temperature, and the relative humidity of the air. The atmospheric attenuation coefficients used for this analysis are valid for 10ºC and 70% relative humidity. These values are commonly used and represent a conservative choice. Table 5 summarizes the atmospheric attenuation coefficients.

Atmospheric Attenuation Coefficients	
Octave Band	Attenuation Coefficient
(Hz)	(dB/km)
31.5	0.0
63	0.1
125	0.4
250	1.0
500	1.9
1000	3.7
2000	9.7
4000	32.8
8000	117.0

Table 5. Atmospheric Attenuation Coefficients

5.3.2. Ground Factor

Ground attenuation is mainly the result of sound reflected by the ground surface interfering with the sound propagating directly from the source to the receiver. Ground attenuation is included in the noise propagation model and requires specification of a ground factor (G). Hard ground, such as pavement, rock, concrete, water, ice, and tamped ground, has a ground factor G = 0. Hard ground results in higher noise levels at the receiver. Porous ground, such as ground covered by grass, trees, or suitable for the growth of vegetation, including farmland, has a ground factor G = 1. Porous ground results in lower noise levels at the receiver. Mixed ground is a combination of both hard and porous ground, and has a ground factor between 0 and 1, the value being the fraction of the ground that is porous.

A ground factor of 0.7 was used in this noise model. This value is conservative in that more than 70% of the ground within the modeling area could be considered suitable for the growth of vegetation.

5.3.3. Meteorological Correction Factor

The ISO 9613-2 method considers downwind meteorological conditions favorable to noise propagation from source to receiver. In the case of a wind farm, this results in the conservative assumption that all receivers are always downwind from every turbine. In reality this would require an omni-directional wind, or wind blowing from all directions simultaneously. A meteorological correction factor can be applied to predict the long-term average sound pressure levels encompassing a wider variety of meteorological conditions.

To maintain a conservative noise analysis, no meteorological correction factor was applied.

5.4. Results

5.4.1. Predicted Noise Levels SG6.6-170

The predicted noise level at the location of each receptor is presented in Table 6. A noise contour map was produced to show the predicted noise levels throughout the project area. The noise contour map is shown in Figure 3.

Predicted noise level is less than 40 dB(A) at all receptor locations. The maximum predicted noise level is 38.7 dB(A) at the location of receptor 44.

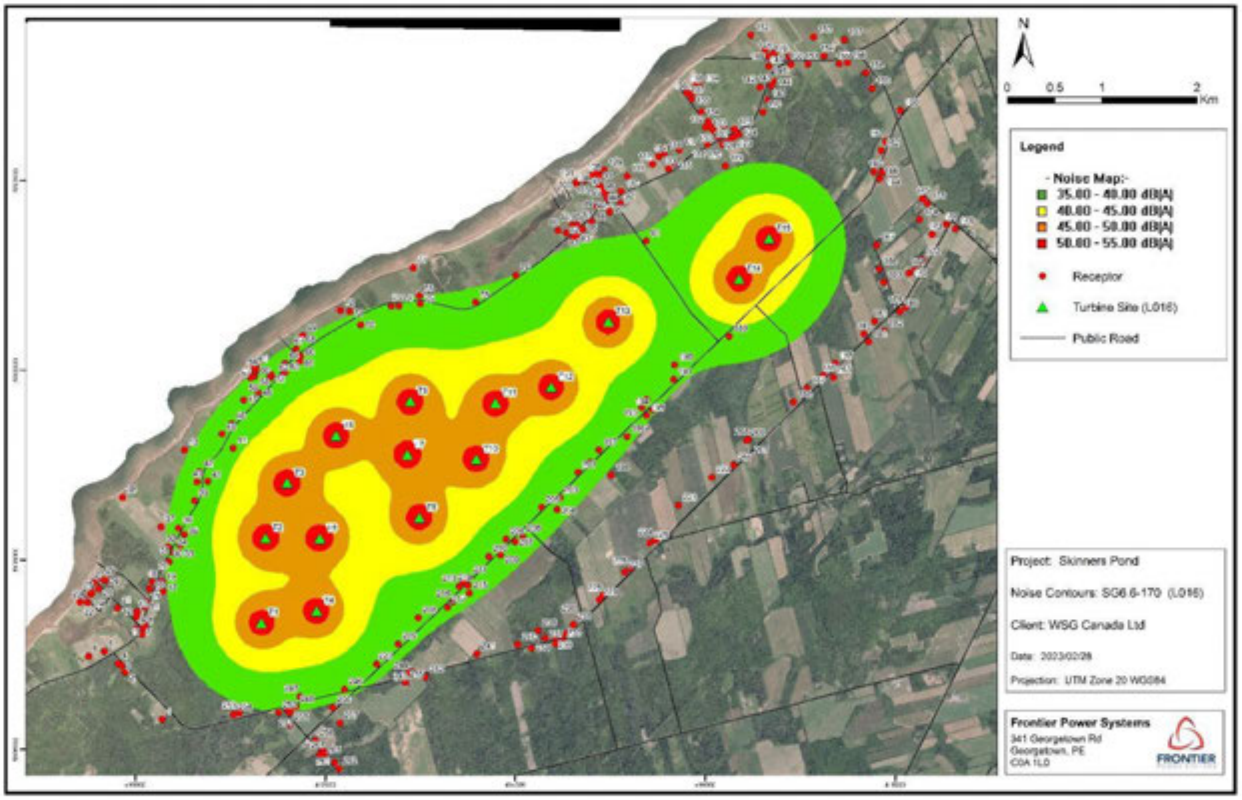

Figure 3. Noise Contour Map SG6.6-170

Predicted Noise Levels: Turbine Type SG6.6-170					
Receptor ID	Sound Pressure Level (dB(A)	Receptor ID	Sound Pressure Level (dB(A)	Receptor ID	Sound Pressure Level (dB(A)
1	30.16	91	35.70	181	30.31
2	30.04	92	32.74	182	29.31
3	30.02	93	32.17	183	30.58
4	29.88	94	31.96	184	29.94
5	29.37	95	31.81	185	30.94
6	28.41	96	31.64	186	30.87
7	32.18	97	31.52	187	30.86

8	32.45	98	31.35	188	30.58
9	31.92	99	31.14	189	38.14
10	32.64	100	30.72	190	36.42
11	32.62	101	30.65	191	35.66
12	32.14	102	30.60	192	36.24
13	32.29	103	30.69	193	36.13
14	32.95	104	30.64	194	35.34
15	33.13	105	30.48	195	35.41
16	33.52	106	30.66	196	35.66
17	34.62	107	30.77	197	36.86
18	33.79	108	30.76	198	34.66
19	34.59	109	30.50	199	36.69
20	33.97	110	32.03	200	36.79
21	30.96	111	31.32	201	36.82
22	29.18	112	31.35	202	36.45
23	28.78	113	32.18	203	36.52
24	29.44	114	31.10	204	36.04
25	29.53	115	31.98	205	37.20
26	29.97	116	31.06	206	36.60
27	29.71	117	31.33	207	36.72
28	30.45	118	31.82	208	37.44
29	30.21	119	34.44	209	36.71
30	35.29	120	32.26	210	37.35
31	35.72	121	32.14	211	37.01
32	35.24	122	32.01	212	36.94
33	36.30	123	31.85	213	36.85
34	35.67	124	31.72	214	36.48
35	36.68	125	31.22	215	35.87

36	36.07	126	30.72	216	35.99
37	34.48	127	31.48	217	35.84
38	31.32	128	31.53	218	36.41
39	37.13	129	31.00	219	36.11
40	36.78	130	30.73	220	36.28
41	37.81	131	30.49	221	29.71
42	36.63	132	30.52	222	29.96
43	34.58	133	30.19	223	30.29
44	38.73	134	29.39	224	30.02
45	36.79	135	28.43	225	30.14
46	36.92	136	28.15	226	30.00
47	36.23	137	28.02	227	30.09
48	36.63	138	27.78	228	30.07
49	36.31	139	27.84	229	30.05
50	36.29	140	29.94	230	30.10
51	36.14	141	29.01	231	30.03
52	36.14	142	28.16	232	29.99
53	35.31	143	28.01	233	29.76
54	35.26	144	27.69	234	29.89
55	35.23	145	26.81	235	30.15
56	35.19	146	26.25	236	30.22
57	35.11	147	25.91	237	30.47
58	35.06	148	26.04	238	31.02
59	35.01	149	26.06	239	30.51
60	34.92	150	26.47	240	31.12
61	34.76	151	26.19	241	32.11
62	36.90	152	25.25	242	32.92
63	36.75	153	24.75	243	33.78

64	36.07	154	25.49	244	33.88
65	36.66	155	25.55	245	33.50
66	36.26	156	25.31	246	35.91
67	35.53	157	24.32	247	36.47
68	34.98	158	25.28	248	35.41
69	34.86	159	25.79	249	35.35
70	36.07	160	25.68	250	35.16
71	34.70	161	27.66	251	34.88
72	34.33	162	28.32	252	34.90
73	35.31	163	29.15	253	34.13
74	35.43	164	29.23	254	33.78
75	35.55	165	29.77	255	33.71
76	34.93	166	29.68	256	34.63
77	32.92	167	31.63	257	33.14
78	36.04	168	31.27	258	32.21
79	35.10	169	30.67	259	31.51
80	33.30	170	28.81	260	31.13
81	33.72	171	28.40	261	30.44
82	34.31	172	27.95	262	30.00
83	34.14	173	27.24	263	30.29
84	33.28	174	27.93	264	31.19
85	33.38	175	27.35	265	30.88
86	33.83	176	27.15	266	29.65
87	32.85	177	26.30	267	29.40
88	33.41	178	25.80	268	30.15
89	32.44	179	28.54	269	30.17
90	33.04	180	28.86		

Table 6. Predicted Noise Levels SG6.6-170

5.4.2. Predicted Noise Levels V162-6.2

The predicted noise level at the location of each receptor is presented in Table 7. A noise contour map was produced to show the predicted noise levels throughout the project area. The noise contour map is shown in Figure 4.

Predicted noise level is less than 40 dB(A) at most receptor locations, with the exception of receptor 41 at 40.1 dB(A) and receptor 44 at 40.9 dB(A).

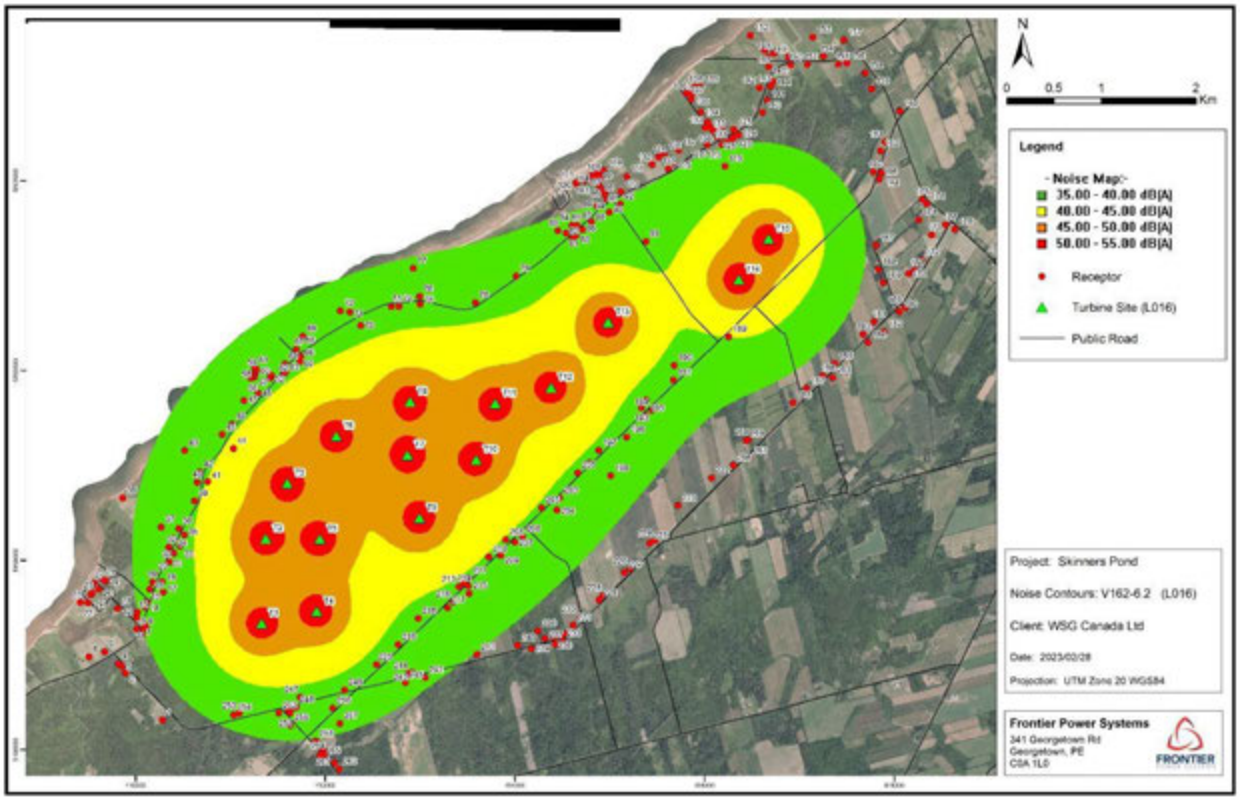

Figure 4. Noise Contour Map V162-6.2

Predicted Noise Levels: Turbine Type V162-6.2					
Receptor ID	Sound Pressure Level (dB(A)	Receptor ID	Sound Pressure Level (dB(A)	Receptor ID	Sound Pressure Level (dB(A)
1	32.89	91	38.03	181	32.89
2	32.79	92	35.32	182	31.96
3	32.77	93	34.81	183	33.15

4	32.65	94	34.62	184	32.56
5	32.18	95	34.48	185	33.52
6	31.27	96	34.32	186	33.47
7	34.81	97	34.21	187	33.49
8	35.07	98	34.05	188	33.26
9	34.58	99	33.85	189	40.18
10	35.24	100	33.48	190	38.73
11	35.22	101	33.41	191	38.05
12	34.78	102	33.35	192	38.60
13	34.93	103	33.45	193	38.51
14	35.55	104	33.39	194	37.79
15	35.72	105	33.24	195	37.86
16	36.09	106	33.41	196	38.10
17	37.10	107	33.51	197	39.21
18	36.34	108	33.50	198	37.22
19	37.08	109	33.25	199	39.07
20	36.51	110	34.66	200	39.16
21	33.69	111	34.00	201	39.21
22	32.02	112	33.99	202	38.88
23	31.64	113	34.73	203	38.96
24	32.26	114	33.74	204	38.52
25	32.35	115	34.54	205	39.57
26	32.77	116	33.70	206	39.04
27	32.53	117	33.92	207	39.14
28	33.23	118	34.33	208	39.81
29	33.00	119	36.71	209	39.14
30	37.74	120	34.71	210	39.72
31	38.14	121	34.60	211	39.40

32	37.70	122	34.47	212	39.34
33	38.68	123	34.32	213	39.26
34	38.10	124	34.19	214	38.92
35	39.03	125	33.74	215	38.36
36	38.47	126	33.29	216	38.48
37	37.01	127	34.00	217	38.35
38	34.07	128	34.04	218	38.88
39	39.45	129	33.56	219	38.55
40	39.13	130	33.32	220	38.65
41	40.08	131	33.09	221	32.57
42	39.00	132	33.12	222	32.82
43	37.11	133	32.81	223	33.15
44	40.92	134	32.08	224	32.91
45	39.15	135	31.19	225	33.02
46	39.28	136	30.93	226	32.90
47	38.65	137	30.81	227	32.98
48	39.02	138	30.57	228	32.97
49	38.73	139	30.62	229	32.95
50	38.72	140	32.52	230	33.00
51	38.58	141	31.66	231	32.94
52	38.58	142	30.87	232	32.91
53	37.82	143	30.72	233	32.68
54	37.77	144	30.41	234	32.81
55	37.74	145	29.59	235	33.05
56	37.71	146	29.06	236	33.12
57	37.63	147	28.74	237	33.35
58	37.59	148	28.85	238	33.88
59	37.54	149	28.87	239	33.39

60	37.46	150	29.26	240	33.97
61	37.31	151	28.98	241	34.89
62	39.27	152	28.11	242	35.61
63	39.14	153	27.59	243	36.40
64	38.51	154	28.30	244	36.49
65	39.06	155	28.36	245	36.13
66	38.70	156	28.12	246	38.27
67	38.03	157	27.17	247	38.75
68	37.53	158	28.08	248	37.78
69	37.41	159	28.58	249	37.72
70	38.53	160	28.47	250	37.54
71	37.27	161	30.34	251	37.28
72	36.94	162	30.97	252	37.29
73	37.84	163	31.74	253	36.56
74	37.94	164	31.82	254	36.23
75	38.06	165	32.32	255	36.21
76	37.49	166	32.24	256	37.09
77	35.64	167	34.06	257	35.72
78	38.51	168	33.75	258	34.84
79	37.60	169	33.19	259	34.19
80	35.87	170	31.46	260	33.84
81	36.25	171	31.07	261	33.20
82	36.78	172	30.64	262	32.79
83	36.62	173	29.96	263	32.93
84	35.84	174	30.60	264	33.89
85	35.93	175	30.05	265	33.60
86	36.33	176	29.87	266	32.51
87	35.45	177	29.07	267	32.25

88	35.95	178	28.59	268	32.95
89	35.06	179	31.22	269	32.97
90	35.61	180	31.52		

Table 7. Predicted Noise Levels: Turbine Type V162-6.2

5.5. Model Qualifications

The accuracy of the ISO 9613-2 method is limited to approximately +/- 3 dB. Due to the uncertainty associated with noise propagation modeling, it is important to use conservative input data and parameters for the model. The noise model and input data used for this analysis contain the following conservative input data:

- Worst case turbine sound power levels used under all operating conditions.
- A ground factor of 0.7 when the actual fraction of porous ground is actually in excess of 0.9.
- Modeling favorable downwind propagation conditions for all turbine sites simultaneously.

Given the conservativeness of the noise model inputs and parameters, the predicted noise levels at the receptors should be somewhat ‘worst case’ compared to the long-term average noise levels that are actually encountered. However, there may be certain conditions under which the noise level at a receptor is higher than, or is perceived to be higher than, what is predicted. These conditions could include periods of high atmospheric stability and high wind shear, leading to low background noise levels at ground level. Temperature inversions may also periodically increase the sound pressure level at a receptor.

6. Conclusions and Recommendations

The noise impact from the proposed Skinners Pond Wind Project has been assessed by modeling the noise propagation from the wind turbines and comparing the predicted noise levels to an established noise limit. The noise limit used for this assessment was 45 dB(A). The predicted noise levels do not exceed 45 dB(A) at any of the receptor locations surrounding the project area.

No adverse impact related to noise is expected during normal operation of the proposed wind farm.

Due to the variability in human perception of noise and the potential occurrence of higher noise levels during some meteorological conditions, certain noise complaint mitigation measures may be required. It is recommended that the wind farm operator establish a noise complaint mitigation protocol to receive, assess, and respond to potential noise complaints. An adaptive management approach may be appropriate. This could include upgrades to houses for improved noise impedance or installation of noise screens to provide additional noise attenuation. This could also include noise reduced operation (reduced power output) of certain turbines under certain conditions if they are identified as problematic.

7. References

[1] IEC 61400-11 (2012). Wind turbine generator systems – Part 11: Acoustic noise measurement techniques. Edition 3.1

[2] ISO 1996-2 (1997). Description, measurement, and assessment of environmental noise – Part 2: Determination of environmental noise levels. Second edition.

[3] ISO 9613-2 (1996). Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation. First edition.

[4] Ontario Ministry of Environment (2008). Noise guidelines for wind farms. Interpretation for applying MOE NPC publications to wind power generation facilities. MOE PIBS 4709e.

[5] World Health Organization (1999). Guidelines for Community Noise. http://www.who.int/docstore/peh/noise/guidelines2.html

Appendix M

Shadow Flicker Assessment for the Proposed Skinners Pond Wind Energy Centre

Shadow Flicker Assessment for the Proposed Skinners Pond Wind Farm

R2 – L016 Layout

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Last updated:
March 27, 2023
Adam Sandler, P.Eng.

March 2023

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1. Introduction

Frontier Power Systems (Frontier) has been engaged by the WSP E&I Canada Ltd (Client) to conduct a shadow flicker impact assessment of the proposed Skinners Pond Wind Project, located in Skinners Pond, Prince County, Prince Edward Island.

The proposed project is to consist of 15 wind turbines and have a total generating capacity of 93 - 99 MW. The proposed turbines have a rotor diameter of 162 – 170 m, a hub height of 110 – 119 m, and generating capacity of 6.2 – 6.6 MW each.

Residents living near the proposed project may experience shadow flicker from the wind turbines to various degrees.

This report:

- Describes the project site and turbine layout
- Provides a brief background on shadow flicker
- Identifies the potential shadow receptors near the proposed project
- Summarizes the shadow flicker analysis methodology
- Presents the results from the shadow flicker analysis
- Discusses potential mitigation measures to reduce shadow flicker impact

2. Project Details

2.1. Site Description

The project area is roughly bordered by Route 14, Thomson Rd, Palmer Rd, and Ascension Rd. The project area is entirely rural, containing a mix of farmland, forests, rural homes, a campground, a working harbour, a cultural/music centre, a church, and community halls. A map showing the current proposed turbine layout within the project area is shown in Figure 1.

2.2. Turbine Description

Two wind turbine models are under consideration for the proposed project. Both are conventional 3 bladed, up-wind, pitch regulated turbines, mounted on tubular steel towers. The Siemens-Gamesa SG6.6-170 has a 170 m rotor diameter, a generating capacity of 6.6 MW, and a hub height of 110.5 m. The Vestas V162-6.2 has a 162 m rotor diameter, a generating capacity of 6.2 MW and a hub height of 119 m. These general specifications are summarized in Table 1.

General Spec	SG6.6-170	V162-6.2
Rotor Diameter (m)	170	162
Hub Height (m)	110.5	119
Generating Capacity (MW)	6.6	6.2
Cut-in Wind Speed (m/s)	3	3
Cut-out Wind Speed (m/s)	25	25

Wind Speed for Rated Power (m/s)	11.5	Not indicated
Rotor Speed (RPM)	variable	variable

Table 1. Turbine General Specifications

2.3. Turbine Locations

The proposed turbine layout was provided by the Client. The same layout is proposed for either of the prospective turbine types. The proposed wind farm layout is shown in Figure 1 and UTM coordinates for the 15 turbine sites are summarized in Table 2.

Turbine Coordinates (UTM Zone 20 WGS84)			
Turbine ID	Easting (m)	Northing (m)	Elevation (m asl.)
1	411327	5197334	12
2	411370	5198229	16
3	411598	5198811	22
4	411908	5197460	17
5	411942	5198225	18
6	412114	5199311	22
7	412864	5199109	23
8	412894	5199673	18
9	412991	5198445	20
10	413589	5199061	23
11	413792	5199653	18
12	414379	5199821	23
13	414981	5200510	33
14	416358	5200961	38
15	416673	5201388	34

Table 2. Turbine Coordinates (L016)

3. Background on Shadow Flicker

Shadow flicker from a wind turbine can be defined as alternating changes in light intensity caused by shadows cast from the moving blades. Shadow flicker only occurs under certain conditions and only affects a limited area surrounding a wind farm. However, shadow flicker can be a disturbance to residents living near a wind farm and therefore it is important to assess and ensure that exposure is limited. In this report, a location that may be sensitive to shadow flicker is referred to as a shadow receptor.

For shadow flicker to occur, the sky must be clear, and the turbine must be operating, otherwise no moving shadows are cast. For shadow flicker to occur at the location of a shadow receptor, the turbine rotor must be located in an unobstructed line of sight from the receptor to the sun. As the position of the sun changes throughout the day and throughout the year, the area that is affected by shadow flicker also changes. Furthermore, for shadow flicker to be visible, the change in light intensity must be above the level of perception of the human eye.

The distance between a wind turbine and a receptor affects the intensity of the flickering. Shadow flicker intensity decreases with greater separation from the receptor to the turbine, up to a point where the change in light intensity is below what the human eye can distinguish. Shadows cast close to a turbine are more intense, distinct and 'focused' because a greater proportion of the sun is intermittently blocked by the passing blades. As separation between the receptor and the turbine increases, the proportion of the sun that is blocked decreases and the shadows become less intense and less discernible. At a distance of about 10 times the diameter of the rotor, the intensity of shadow flicker is significantly reduced and becomes less perceptible to the human eye [1].

Shadow flicker intensity is also reduced if the plane of the rotor is at an angle other than perpendicular to the line of sight from the receptor to the sun, again because a smaller proportion of the sun is blocked by the passing blades. Ambient lighting conditions also affect the visibility of shadow flicker. Shadow flicker is more noticeable in a darkened room with a window facing the turbine than outdoors where ambient light levels are higher.

The frequency or speed of the flickering is related to the rotor speed and the number of blades on the turbine. Modern utility sized turbines are typically 3-bladed with rotor speeds below 20 RPM. This translates to blade passing frequencies less than 1 Hz or 1 cycle per second. At these low frequencies, shadow flicker is a concern for nuisance reasons, but does not pose a health threat. According to the British Epilepsy Association, frequencies below 3Hz do not cause seizures in people with photosensitive epilepsy, and the flicker rates of modern wind turbines are unlikely to trigger epileptic seizures [2].

In general, shadow flicker occurs during clear sky conditions when the sun is low on the horizon, either at sunrise or sunset. As the elevation of the sun in the sky changes throughout the year, the location of the shadow flicker also changes, so a specific shadow receptor is only affected at certain times of day and at certain times of year. By considering the spatial relationship between the turbines and the receptors (geographic locations and ground elevations) as well as the geometry of the turbines (hub height and rotor size), the occurrence of shadow flicker can be accurately modeled and predicted to within a few minutes at any location around the wind farm.

4. Shadow Receptors

The project area was assessed to identify all potential shadow receptors within 2000 m of the proposed turbine sites. A total 269 receptors were identified, consisting primarily of permanent residences, seasonal residences, and rental properties. Figure 1 shows the receptor database in relation to the proposed turbine sites. The receptor coordinates are summarized in Table 3. Receptors 44 and 189 are less than the regulatory 4 times total height setback from the nearest turbine.

Shadow Receptor Coordinates (UTM Zone 20 WGS84)									
Receptor ID	Easting (m)	Northing (m)	Elevation (m asl.)	Distance to Nearest Turbine (m)	Receptor ID	Easting (m)	Northing (m)	Elevation (m asl.)	Distance to Nearest Turbine (m)
1	410284	5196316	24.9	1457.3	136	415856	5202915	5.8	1731.6
2	409893	5196814	14	1525.4	137	415802	5202926	5.1	1767.3
3	409855	5196882	12.8	1539.8	138	415897	5202994	6	1783.4
4	409819	5196907	12.3	1567.3	139	415952	5202994	6.4	1760.2
5	409673	5197034	9.3	1681	140	416608	5202722	28	1335.6
6	409508	5196984	8	1852.4	141	416659	5202848	28	1460.1
7	410067	5197212	10	1266	142	416578	5202984	23.7	1598.8
8	410087	5197275	10	1241.5	143	416693	5202998	27.9	1610.1
9	410011	5197276	9.3	1317.4	144	416717	5203047	26.6	1659.6
10	410109	5197287	10	1219	145	416671	5203205	23.4	1817
11	410099	5197315	10	1228.2	146	416670	5203309	19.8	1921
12	410010	5197399	9.9	1318.7	147	416632	5203381	15.2	1993.4
13	410021	5197453	9.8	1311.5	148	416729	5203343	23.1	1955.8
14	410103	5197505	10	1236	149	416885	5203308	24	1931.7
15	410118	5197560	10	1230.1	150	416904	5203226	24	1852.5
16	410152	5197696	10.5	1229.7	151	417083	5203231	18.5	1888.2
17	410294	5197665	10.4	1084.9	152	416482	5203534	10	2154.4
18	410180	5197771	11.1	1227.6	153	417140	5203516	19.3	2178.7
19	410281	5197772	11.9	1134.2	154	417251	5203313	18.2	2010
20	410197	5197856	12	1231	155	417408	5203233	22.6	1986.2
21	409811	5197492	8	1524.3	156	417498	5203242	23.1	2029.5
22	409495	5197553	6	1845.2	157	417466	5203486	20	2243
23	409419	5197556	4.9	1921	158	417692	5203137	22.7	2024.4

24	409527	5197638	6.2	1825.6	159	417758	5202972	21.8	1920.3
25	409542	5197654	6.3	1813.6	160	418057	5202739	30	1934.4
26	409613	5197696	6.8	1752	161	417902	5202414	29.2	1601.4
27	409561	5197760	6.1	1816.8	162	417854	5202318	29.9	1503.6
28	409686	5197782	6.8	1701.2	163	417817	5202177	30.8	1390.1
29	409643	5197804	6.4	1748.5	164	417864	5202088	32.5	1381.9
30	410356	5197981	14	1044.1	165	417777	5202095	30.8	1311.4
31	410404	5198074	14	978.5	166	417838	5202018	33.9	1324.9
32	410349	5198138	14	1025.2	167	417805	5201318	33.4	1134.7
33	410469	5198152	14.6	904.5	168	417831	5201066	32	1202.4
34	410403	5198235	15.5	967.2	169	417880	5200927	32	1292.5
35	410514	5198268	16.7	857.1	170	418149	5201023	34.3	1520.9
36	410455	5198336	17.3	921.4	171	418213	5201058	32.8	1575.4
37	410271	5198349	16.3	1105.7	172	418288	5201166	32.8	1630.7
38	409865	5198658	11.1	1565.2	173	418390	5201431	32.2	1718
39	410621	5198625	20	847.5	174	418256	5201589	34.6	1596.2
40	410648	5198823	22	935.2	175	418292	5201808	32.6	1673.1
41	410760	5198829	20.9	838.3	176	418340	5201758	32.1	1708.1
42	410675	5198933	21.5	931.1	177	418536	5201538	30.3	1869.5
43	410518	5199158	18.4	1134.4	178	418635	5201493	30	1965.3
44	411030	5199177	20	675.6	179	418114	5200663	31.2	1613.6
45	410913	5199328	16.4	858.1	180	418050	5200622	31.6	1576.2
46	411015	5199435	15.1	853.8	181	417784	5200515	31.4	1413.4
47	411142	5199684	14	984.7	182	417889	5200412	30	1559.6
48	411292	5199765	13	939	183	417670	5200384	31.9	1415.3
49	411417	5199921	12	926.3	184	417720	5200298	32	1511.7
50	411437	5199940	12	924.2	185	417368	5200075	31.6	1343.4
51	411419	5199947	12	942.1	186	417244	5199946	34	1347.1
52	411429	5199955	12	940.3	187	417071	5199809	36	1354.5
53	411253	5199937	10.2	1064.5	188	416930	5199664	36.5	1417.2

54	411238	5199932	10.1	1073.8	189	416253	5200358	39.7	611.5
55	411226	5199927	10	1080.7	190	415677	5200056	42	830.8
56	411214	5199922	10	1087.8	191	415668	5199901	41.4	917.9
57	411259	5199975	10	1082.6	192	415382	5199691	40	911.9
58	411264	5199988	10	1086.7	193	415333	5199608	40	968.2
59	411269	5200001	9.9	1091	194	415444	5199585	40	1034.4
60	411271	5200017	9.6	1099.6	195	415383	5199523	40	1047.2
61	411255	5200031	9	1120.9	196	415176	5199300	38.7	952
62	411551	5199944	12	847.2	197	414882	5199159	33.3	831.2
63	411584	5199987	12	859.1	198	415009	5198893	37.8	1121.4
64	411574	5200073	12	934.1	199	414784	5199029	32.6	889.3
65	411729	5200093	12	871.8	200	414750	5199010	32.7	891.6
66	411739	5200150	12	919.2	201	414660	5198923	32.9	940.7
67	411694	5200224	10.8	1005.2	202	414546	5198731	34	1011.9
68	411750	5200335	9.9	1087	203	414470	5198657	33.2	968.8
69	411764	5200362	10	1108	204	414441	5198532	36	1002.4
70	412372	5200477	16	959.2	205	414278	5198555	34.9	854.4
71	412259	5200618	16	1139.2	206	414078	5198251	38.2	945.8
72	412158	5200631	15.2	1208.7	207	413998	5198194	38	958.3
73	412696	5200675	16	1021.9	208	413902	5198219	38	898
74	412778	5200678	16	1012.2	209	413847	5198052	39.4	942
75	413000	5200700	14.2	1032.9	210	413722	5198035	36.1	838.3
76	412993	5200783	14	1114.9	211	413516	5197813	35.2	821.8
77	412927	5201080	11.4	1407.9	212	413458	5197763	35.1	826.7
78	413581	5200719	5.8	1086.2	213	413410	5197720	34.9	837.5
79	414009	5200998	6.6	1087.8	214	413504	5197731	37.9	879.3
80	414450	5201476	6.3	1102.4	215	413515	5197650	39.1	952.3
81	414540	5201448	8	1036.5	216	413346	5197560	36.1	953.7
82	414607	5201392	8.6	958	217	413287	5197500	35.4	990.4
83	414645	5201427	8.9	976.6	218	412978	5197388	32	1057.2

84	414599	5201530	8.1	1089.2	219	412768	5197112	35.5	927.6
85	414653	5201532	8.4	1073.3	220	412540	5196900	33.8	844.3
86	414711	5201487	8.9	1013.6	221	416232	5198953	37.9	1997.2
87	414665	5201613	8	1147.4	222	416070	5198869	39	1940.4
88	414805	5201569	8.4	1073.5	223	415718	5198576	40.5	1828.2
89	414863	5201732	8.4	1227.6	224	415476	5198208	41.3	1950.4
90	414994	5201671	10	1161	225	415419	5198179	42	1943.4
91	415380	5201363	20.3	941.5	226	415216	5197911	40.4	1992
92	415108	5201756	10.2	1252.3	227	415154	5197871	40.7	1965.6
93	414971	5201810	9.7	1299.9	228	414924	5197627	42	1958.8
94	414962	5201843	9.4	1333	229	414885	5197580	42.1	1967.6
95	414945	5201865	9	1355.4	230	414683	5197401	42.1	1987.7
96	414926	5201890	8.5	1381	231	414612	5197317	42	1975
97	414910	5201907	8.2	1398.7	232	414519	5197225	41.8	1955.4
98	414896	5201933	8	1425.5	233	414504	5197147	41	1993.6
99	414877	5201968	7.6	1461.6	234	414426	5197118	41.4	1954.7
100	414643	5201974	3.8	1502.5	235	414439	5197197	42	1911.7
101	414653	5201991	4.2	1516.9	236	414407	5197189	42	1892.9
102	414805	5202049	6	1549	237	414315	5197175	42	1834.8
103	414730	5202006	4.1	1516.9	238	414241	5197254	42.9	1726.7
104	414831	5202049	6.2	1546.2	239	414170	5197068	42	1812.9
105	414858	5202089	6	1583.7	240	414026	5197104	42.7	1694.1
106	414881	5202062	6.7	1555.1	241	413597	5197006	44	1561.5
107	414904	5202047	7	1538.8	242	413054	5196764	45.1	1340.7
108	414943	5202063	7.1	1553.4	243	412914	5196818	42.8	1193.3
109	414934	5202112	6.5	1602.6	244	412875	5196805	42.6	1167.8
110	415117	5201886	10	1382.6	245	412844	5196709	43.6	1199.9
111	415179	5202046	10.2	1548.6	246	412201	5196633	30	877.4
112	415445	5202173	12.5	1457	247	411735	5196558	26	876.4
113	415616	5202124	14.1	1287.6	248	411690	5196449	30	956.2

114	415511	5202253	11.5	1448.2	249	411641	5196439	30.1	948.2
115	415669	5202189	13.2	1284	250	411608	5196418	29.8	957.8
116	415570	5202291	10.9	1425.1	251	411628	5196389	30.6	991.5
117	415726	5202325	11.4	1331.9	252	411507	5196390	28	960.7
118	416026	5202387	13.9	1189.9	253	411094	5196385	18	976.9
119	416212	5202155	28	894.6	254	411033	5196368	17.7	1009.5
120	416181	5202384	16	1110.7	255	411631	5196260	32.5	1115.9
121	416223	5202410	16.5	1116.5	256	412079	5196442	31.3	1032.3
122	416283	5202440	18	1121.8	257	412154	5196278	34	1207.4
123	416303	5202463	18	1136.7	258	411894	5196094	38	1363.2
124	416355	5202488	20.4	1144.9	259	411975	5196007	39	1454.6
125	416307	5202541	17.3	1209.5	260	411941	5195945	39.7	1515.5
126	416193	5202584	14	1288.5	261	412097	5195863	41.6	1608.2
127	416157	5202474	14	1202.1	262	412142	5195799	42	1677.5
128	416138	5202463	14	1200.5	263	417347	5199927	32.5	1430.7
129	416097	5202521	12.4	1270.8	264	412007	5195964	40	1499.4
130	416071	5202551	11.4	1309.3	265	411970	5195911	40	1550.3
131	416051	5202580	10.6	1344.3	266	416300	5199000	37	1961.3
132	416005	5202563	10.2	1351.4	267	416472	5199076	34	1888
133	416030	5202619	9.4	1388.6	268	416457	5199270	36	1693.4
134	415958	5202725	7.1	1515.9	269	416436	5199259	36	1703.3
135	415856	5202863	5.7	1685.9					

Table 3. Shadow Receptor Coordinates

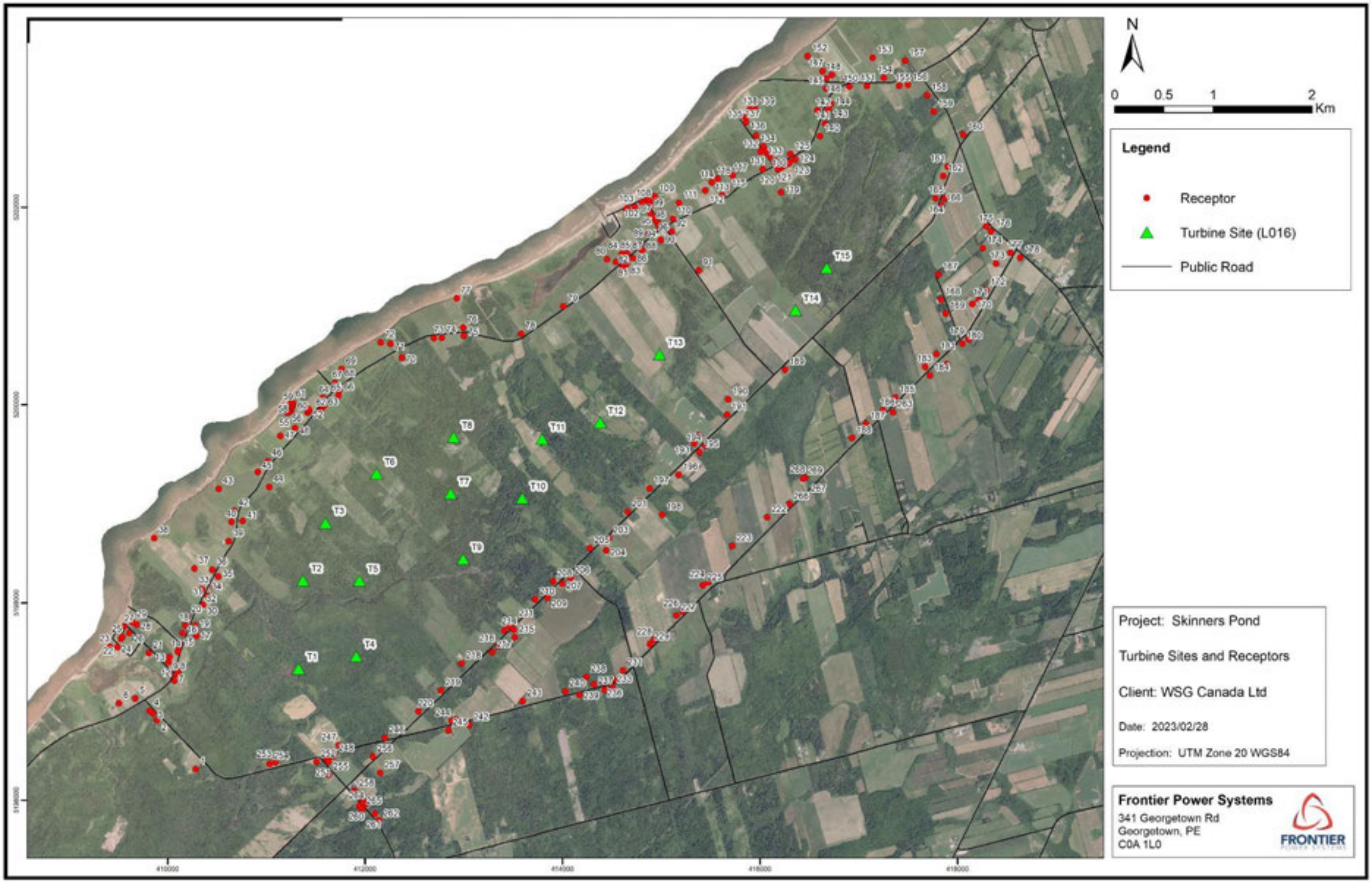

Figure 1. Turbine Sites and Shadow Receptors

5. Shadow Flicker Analysis

5.1. Methodology

Shadow flicker modeling was performed with the GH WindFarmer software package. The WindFarmer shadow flicker model determines the theoretical maximum amount of shadow flicker, in total hours of flicker per year, at any point up to the maximum specified calculation distance from the turbines. By defining specific shadow receptor locations, the model can also determine the time of day, day of year, and duration of every possible occurrence of shadow flicker at a receptor [3].

The shadow flicker model uses the following inputs:

- Geographic location of the wind plant
- Turbine locations
- Receptor locations
- Digital terrain map (ground elevation data)
- Turbine geometry (hub height and rotor diameter)

The amount of shadow flicker determined by the model is the theoretical maximum amount due to the following assumptions:

- Every day is sunny and cloudless
- The turbines are always operating
- The rotor plane is always perpendicular to the sun
- There are no obstacles such as trees or walls between the receptors and the turbines (it is assumed that all receptors have windows facing all directions with unobstructed views of the turbines)
- The limits of human perception of changing light intensity are not considered

The theoretical maximum amount of shadow flicker will never occur due to the impossibility of the above combination of assumptions. The theoretical maximum shadow flicker can be statistically de-rated to be more representative of actual, worst-case conditions using the following climatological data:

- Wind speed frequency distribution at hub height
- Sunshine hours from long term monthly reference data

The de-rated hours of shadow flicker per year are still a conservative, worst-case scenario, as there is no consideration given to the directional wind distribution, turbine availability, blocking obstacles, location of windows, or the intensity of the flicker.

5.2. Model Parameters

The following parameters were used in the shadow flicker model:

Latitude	46 deg 56 min North
Longitude	64 deg 7 min West
Calculation time interval	10 minutes
Maximum distance from turbine	2000 m
Minimum sun elevation	3 deg
Height about ground level	2 m
Year of calculation	2022

- Consider distance between rotor and tower No
- Turbine orientation Rotor plane facing sun azimuth plus 180°
- Model the sun as a disc No
- Terrain: consider turbine visibility Yes
- Terrain: consider sun visibility Yes

5.3. Worst-Case Shadow Flicker

The data summarized in Table 4 was used to statistically de-rate the theoretical maximum shadow flicker hours to obtain more conceivable, worst-case results. Monthly wind speed data were used to estimate the percentage of time that the turbine is operating each month. Long term climate records from the Environment Canada weather station in Charlottetown (Charlottetown CDA, Climate ID 8300400) provide data for the percentage of daylight hours with bright sunshine [4]. The monthly wind speed and sunshine statistics were combined to obtain monthly de-rating factors. The monthly factors were then averaged to get an overall de-rating factor to be applied to the theoretical maximum amount of shadow flicker at each receptor. It should be noted that the de-rated shadow flicker hours are still a very conservative, worst-case scenario as directional wind statistics (the time when the rotor is actually facing the receptor), turbine availability, blocking obstacles, window locations, and flicker intensity are not considered.

Shadow Flicker De-Rating Data													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Wind Speed above cut in (% time)	98.5	96.8	96.9	96.4	96.9	95.8	95.6	95.9	97.2	97.6	98.0	97.9	97.0
Bright sunshine (% of daylight hours)	37.5	39.7	38.7	37.1	42.5	47.8	52	50.9	46.6	36.3	27.1	27.7	40.3
Monthly De-rating Factors	0.37	0.38	0.37	0.36	0.41	0.46	0.50	0.49	0.45	0.35	0.27	0.27	0.39

Table 4. De-Rating Data

5.4. Results

Most of the 269 assessed receptors will be affected by shadow flicker to some degree. The amount of flicker is expected to exceed the commonly used assessment criterion of 30 hours per year at 65 of these receptors, with a theoretical maximum of 122 hours annually for receptor 41. This amount of flicker could be problematic for numerous receptors.

The more realistic, worst-case de-rated shadow flicker is greater than 30 hrs/yr at 16 receptor locations, with a maximum of 48 hrs per year for receptor 41.

There are 64 receptors that could receive more than 30 minutes of flicker per day, with a maximum of 60 minutes per day at 4 different receptor locations.

Shadow flicker modeling results for the SG6.6-170 turbine type are summarized in Table 5. Results for the V162-6.2 turbine type are summarized in Table 6.

Given the conservative assumptions used in the shadow flicker model, it is likely that site specific conditions will reduce the amount of shadow flicker that is actually observed throughout the year. Site specific conditions that may mitigate shadow flicker impact include trees or buildings that block the line of sight to the proposed turbine locations, seasonal or intermittent use, or the absence of windows facing the direction of the wind farm. However, flicker levels of this magnitude are likely to cause disturbance, annoyance, and complaints.

A shadow flicker contour map was produced to show the theoretical maximum hours of shadow flicker throughout the project area at 2 meters above ground level. The shadow flicker contour map for the SG6.6-170 turbines is shown in Figure 2. The shadow flicker contour map for the V162-6.2 turbines is shown in Figure 3.

A report containing the detailed shadow flicker data has also been produced to provide the time of day, day of year, and duration for every possible occurrence of shadow flicker at each receptor and from each turbine. This data is useful for determining shut down periods for certain turbines to reduce high levels of flicker at problematic receptor locations. This report is available upon request.

Shadow Flicker Results: SG6.6-170 (L016)									
Receptor ID	Theoretical Maximum Shadow Flicker (Hrs/yr)	Worst Case Shadow Flicker (Hrs/yr)	Maximum Minutes on Worst Day (minutes)	Number of Turbines Causing Flicker	Receptor ID	Theoretical Maximum Shadow Flicker (Hrs/yr)	Worst Case Shadow Flicker (Hrs/yr)	Maximum Minutes on Worst Day (minutes)	Number of Turbines Causing Flicker
1	0.0	0.0	0	0	136	0.0	0.0	0	0
2	11.7	4.6	30	1	137	0.0	0.0	0	0
3	11.2	4.4	30	1	138	0.0	0.0	0	0
4	9.2	3.6	20	1	139	0.0	0.0	0	0
5	6.5	2.5	20	1	140	0.0	0.0	0	0
6	5.7	2.2	20	1	141	0.0	0.0	0	0
7	14.2	5.5	30	2	142	0.0	0.0	0	0
8	15.7	6.1	40	2	143	0.0	0.0	0	0
9	13.5	5.3	40	2	144	0.0	0.0	0	0
10	16.8	6.6	40	2	145	0.0	0.0	0	0
11	15.7	6.1	40	2	146	0.0	0.0	0	0
12	23.0	9.0	40	3	147	0.0	0.0	0	0
13	28.7	11.2	40	3	148	0.0	0.0	0	0

14	40.7	15.9	40	4	149	0.0	0.0	0	0
15	48.3	18.9	40	4	150	0.0	0.0	0	0
16	55.7	21.7	30	4	151	0.0	0.0	0	0
17	65.8	25.7	40	4	152	0.0	0.0	0	0
18	51.2	20.0	40	4	153	0.0	0.0	0	0
19	71.0	27.7	40	4	154	0.0	0.0	0	0
20	46.3	18.1	40	4	155	0.0	0.0	0	0
21	24.5	9.6	30	2	156	0.0	0.0	0	0
22	10.2	4.0	20	2	157	0.0	0.0	0	0
23	4.3	1.7	20	1	158	0.0	0.0	0	0
24	11.0	4.3	20	2	159	0.0	0.0	0	0
25	10.8	4.2	20	2	160	0.0	0.0	0	0
26	12.3	4.8	30	2	161	20.0	7.8	30	1
27	11.8	4.6	20	2	162	23.2	9.0	30	1
28	13.8	5.4	30	2	163	30.5	11.9	30	2
29	12.2	4.7	20	2	164	27.7	10.8	30	2
30	65.2	25.4	40	5	165	33.8	13.2	40	2
31	80.7	31.5	40	5	166	24.8	9.7	30	2
32	83.5	32.6	40	5	167	25.8	10.1	30	2
33	89.3	34.8	50	5	168	27.8	10.9	30	2
34	92.8	36.2	50	5	169	28.7	11.2	30	2
35	84.8	33.1	50	6	170	14.7	5.7	30	2
36	80.3	31.3	50	6	171	13.7	5.3	30	2
37	60.0	23.4	40	5	172	11.3	4.4	20	2
38	25.0	9.8	30	3	173	5.7	2.2	20	1
39	107.5	41.9	50	5	174	10.5	4.1	30	2
40	99.2	38.7	50	4	175	6.0	2.3	20	1
41	122.5	47.8	50	4	176	6.0	2.3	20	1
42	91.8	35.8	50	4	177	3.5	1.4	20	1
43	49.7	19.4	40	4	178	4.2	1.6	20	1

44	113.7	44.3	60	5	179	24.0	9.4	30	2
45	80.2	31.3	50	4	180	28.8	11.2	30	2
46	84.7	33.0	50	4	181	12.3	4.8	30	1
47	28.8	11.2	40	3	182	9.8	3.8	20	1
48	46.7	18.2	60	3	183	20.3	7.9	30	1
49	78.0	30.4	50	3	184	20.0	7.8	30	1
50	78.2	30.5	50	3	185	0.0	0.0	0	0
51	74.8	29.2	50	3	186	0.0	0.0	0	0
52	76.3	29.8	50	3	187	0.0	0.0	0	0
53	48.0	18.7	50	3	188	0.0	0.0	0	0
54	44.8	17.5	50	3	189	16.0	6.2	30	2
55	40.3	15.7	50	3	190	30.2	11.8	30	3
56	38.2	14.9	50	3	191	11.3	4.4	30	2
57	54.3	21.2	50	3	192	29.0	11.3	40	3
58	55.8	21.8	50	3	193	34.7	13.5	40	3
59	58.2	22.7	40	3	194	27.0	10.5	40	3
60	57.8	22.6	40	3	195	34.0	13.3	40	3
61	56.7	22.1	40	3	196	30.2	11.8	30	3
62	80.5	31.4	50	3	197	40.2	15.7	30	2
63	61.8	24.1	50	3	198	20.7	8.1	30	2
64	40.2	15.7	30	3	199	36.3	14.2	30	5
65	40.2	15.7	30	2	200	30.2	11.8	30	5
66	38.0	14.8	30	2	201	25.3	9.9	30	4
67	30.7	12.0	30	2	202	51.2	20.0	40	4
68	15.3	6.0	30	1	203	74.2	28.9	50	4
69	16.7	6.5	30	1	204	34.5	13.5	30	3
70	9.5	3.7	30	1	205	22.2	8.6	30	3
71	6.8	2.7	20	1	206	17.3	6.8	40	1
72	6.3	2.5	20	1	207	22.5	8.8	40	1
73	25.7	10.0	30	2	208	31.2	12.2	40	2

74	22.7	8.8	30	2	209	62.0	24.2	50	2
75	14.2	5.5	30	2	210	50.0	19.5	50	3
76	10.7	4.2	20	1	211	12.5	4.9	20	2
77	14.3	5.6	20	1	212	13.0	5.1	20	2
78	32.3	12.6	40	2	213	15.0	5.9	20	2
79	23.0	9.0	40	1	214	11.2	4.4	20	2
80	4.8	1.9	20	1	215	11.2	4.4	20	2
81	5.3	2.1	20	1	216	19.2	7.5	30	2
82	6.0	2.3	20	1	217	30.8	12.0	30	3
83	6.0	2.3	20	1	218	31.0	12.1	40	3
84	6.7	2.6	20	1	219	59.0	23.0	50	2
85	6.8	2.7	20	1	220	14.2	5.5	30	1
86	11.5	4.5	20	2	221	0.0	0.0	0	0
87	7.5	2.9	20	1	222	10.2	4.0	20	1
88	14.0	5.5	20	2	223	0.0	0.0	0	0
89	15.3	6.0	20	2	224	0.0	0.0	0	0
90	18.2	7.1	20	2	225	0.0	0.0	0	0
91	37.8	14.8	40	2	226	0.0	0.0	0	0
92	22.8	8.9	30	2	227	0.0	0.0	0	0
93	16.2	6.3	20	2	228	0.0	0.0	0	0
94	17.7	6.9	30	2	229	0.0	0.0	0	0
95	17.3	6.8	30	2	230	6.5	2.5	10	1
96	16.8	6.6	30	2	231	0.0	0.0	0	0
97	16.3	6.4	20	2	232	0.0	0.0	0	0
98	16.0	6.2	20	2	233	0.0	0.0	0	0
99	16.2	6.3	20	2	234	0.0	0.0	0	0
100	7.0	2.7	20	1	235	0.0	0.0	0	0
101	7.7	3.0	20	1	236	0.0	0.0	0	0
102	14.7	5.7	20	2	237	0.0	0.0	0	0
103	6.8	2.7	20	1	238	0.0	0.0	0	0

104	15.3	6.0	30	2	239	0.0	0.0	0	0
105	18.2	7.1	20	2	240	0.0	0.0	0	0
106	18.3	7.2	30	2	241	4.8	1.9	20	1
107	18.8	7.3	30	2	242	18.5	7.2	20	2
108	23.0	9.0	30	2	243	18.8	7.3	20	2
109	22.7	8.8	20	2	244	11.5	4.5	20	2
110	24.8	9.7	30	2	245	7.0	2.7	20	1
111	32.7	12.7	30	2	246	0.0	0.0	0	0
112	15.5	6.0	30	1	247	0.0	0.0	0	0
113	22.3	8.7	30	1	248	0.0	0.0	0	0
114	19.7	7.7	30	1	249	0.0	0.0	0	0
115	33.5	13.1	40	1	250	0.0	0.0	0	0
116	28.8	11.2	30	1	251	0.0	0.0	0	0
117	29.0	11.3	40	1	252	0.0	0.0	0	0
118	0.0	0.0	0	0	253	0.0	0.0	0	0
119	0.0	0.0	0	0	254	0.0	0.0	0	0
120	0.0	0.0	0	0	255	0.0	0.0	0	0
121	0.0	0.0	0	0	256	0.0	0.0	0	0
122	0.0	0.0	0	0	257	0.0	0.0	0	0
123	0.0	0.0	0	0	258	0.0	0.0	0	0
124	0.0	0.0	0	0	259	0.0	0.0	0	0
125	0.0	0.0	0	0	260	0.0	0.0	0	0
126	0.0	0.0	0	0	261	0.0	0.0	0	0
127	0.0	0.0	0	0	262	0.0	0.0	0	0
128	0.0	0.0	0	0	263	0.0	0.0	0	0
129	0.0	0.0	0	0	264	0.0	0.0	0	0
130	0.0	0.0	0	0	265	0.0	0.0	0	0
131	0.0	0.0	0	0	266	0.0	0.0	0	0
132	0.0	0.0	0	0	267	0.0	0.0	0	0
133	0.0	0.0	0	0	268	0.0	0.0	0	0

134	0.0	0.0	0	0	269	0.0	0.0	0	0
135	0.0	0.0	0	0					

Table 5. Shadow Flicker Results: SG6.6-170 (L016)

Shadow Flicker Results: V162-6.2 (L016)									
Receptor ID	Theoretical Maximum Shadow Flicker (Hrs/yr)	Worst Case Shadow Flicker (Hrs/yr)	Maximum Minutes on Worst Day (minutes)	Number of Turbines Causing Flicker	Receptor ID	Theoretical Maximum Shadow Flicker (Hrs/yr)	Worst Case Shadow Flicker (Hrs/yr)	Maximum Minutes on Worst Day (minutes)	Number of Turbines Causing Flicker
1	0.0	0.0	0	0	136	0.0	0.0	0	0
2	11.5	4.5	20	1	137	0.0	0.0	0	0
3	10.8	4.2	30	1	138	0.0	0.0	0	0
4	9.5	3.7	20	1	139	0.0	0.0	0	0
5	6.7	2.6	20	1	140	0.0	0.0	0	0
6	5.3	2.1	20	1	141	0.0	0.0	0	0
7	14.2	5.5	30	2	142	0.0	0.0	0	0
8	15.3	6.0	40	2	143	0.0	0.0	0	0
9	13.7	5.3	40	2	144	0.0	0.0	0	0
10	16.5	6.4	40	2	145	0.0	0.0	0	0
11	15.8	6.2	40	2	146	0.0	0.0	0	0
12	22.7	8.8	40	3	147	0.0	0.0	0	0
13	28.5	11.1	40	3	148	0.0	0.0	0	0
14	39.7	15.5	40	4	149	0.0	0.0	0	0
15	48.2	18.8	40	4	150	0.0	0.0	0	0
16	54.2	21.1	30	4	151	0.0	0.0	0	0
17	63.2	24.6	40	4	152	0.0	0.0	0	0
18	50.2	19.6	30	4	153	0.0	0.0	0	0
19	69.2	27.0	30	4	154	0.0	0.0	0	0
20	46.7	18.2	40	4	155	0.0	0.0	0	0
21	25.0	9.8	30	2	156	0.0	0.0	0	0
22	11.0	4.3	20	2	157	0.0	0.0	0	0
23	4.8	1.9	20	1	158	0.0	0.0	0	0

24	10.8	4.2	20	2	159	0.0	0.0	0	0
25	10.3	4.0	20	2	160	0.0	0.0	0	0
26	12.2	4.7	20	2	161	20.2	7.9	30	1
27	11.5	4.5	20	2	162	23.2	9.0	30	1
28	13.8	5.4	30	2	163	30.3	11.8	30	2
29	12.0	4.7	20	2	164	27.5	10.7	30	2
30	62.2	24.2	40	4	165	32.8	12.8	30	2
31	78.8	30.7	40	5	166	24.8	9.7	30	2
32	81.8	31.9	40	5	167	25.8	10.1	30	2
33	86.3	33.7	50	5	168	28.0	10.9	30	2
34	89.2	34.8	40	5	169	28.7	11.2	30	2
35	83.7	32.6	50	6	170	14.8	5.8	30	2
36	82.8	32.3	50	6	171	13.7	5.3	30	2
37	60.2	23.5	40	5	172	11.7	4.6	20	2
38	25.5	9.9	20	3	173	5.5	2.1	20	1
39	103.5	40.4	60	5	174	10.7	4.2	30	2
40	98.8	38.5	50	4	175	6.0	2.3	20	1
41	117.3	45.8	50	4	176	6.0	2.3	20	1
42	91.8	35.8	50	4	177	4.0	1.6	20	1
43	49.2	19.2	40	4	178	3.8	1.5	20	1
44	109.2	42.6	60	5	179	24.2	9.4	30	2
45	72.0	28.1	40	4	180	28.5	11.1	30	2
46	81.8	31.9	50	4	181	12.0	4.7	30	1
47	28.3	11.1	40	3	182	10.3	4.0	20	1
48	45.3	17.7	60	3	183	20.0	7.8	30	1
49	74.2	28.9	50	3	184	20.7	8.1	20	1
50	75.2	29.3	50	3	185	0.0	0.0	0	0
51	71.8	28.0	50	3	186	0.0	0.0	0	0
52	74.7	29.1	50	3	187	0.0	0.0	0	0
53	44.3	17.3	50	3	188	0.0	0.0	0	0

54	43.2	16.8	60	3	189	16.0	6.2	30	2
55	38.5	15.0	50	3	190	26.7	10.4	30	3
56	37.2	14.5	50	3	191	11.7	4.6	30	2
57	48.7	19.0	50	3	192	28.0	10.9	30	3
58	53.7	20.9	50	3	193	34.5	13.5	40	3
59	53.2	20.7	40	3	194	27.7	10.8	40	3
60	57.2	22.3	40	3	195	33.7	13.1	40	3
61	56.0	21.8	40	3	196	29.0	11.3	30	3
62	78.7	30.7	50	3	197	41.3	16.1	30	2
63	63.5	24.8	50	3	198	20.7	8.1	30	2
64	41.8	16.3	40	3	199	36.3	14.2	30	5
65	39.0	15.2	30	2	200	29.2	11.4	40	5
66	38.0	14.8	30	2	201	25.8	10.1	30	4
67	31.5	12.3	30	2	202	50.5	19.7	40	4
68	15.8	6.2	30	2	203	71.7	28.0	50	4
69	16.3	6.4	30	1	204	33.7	13.1	30	3
70	9.3	3.6	30	1	205	20.0	7.8	30	2
71	7.2	2.8	20	1	206	16.3	6.4	30	1
72	6.8	2.7	20	1	207	22.5	8.8	40	1
73	26.3	10.3	30	2	208	31.2	12.2	40	2
74	23.0	9.0	30	2	209	57.0	22.2	40	2
75	14.5	5.7	30	2	210	49.3	19.2	50	3
76	10.2	4.0	20	1	211	12.5	4.9	20	2
77	14.5	5.7	20	1	212	13.3	5.2	20	2
78	32.2	12.5	40	2	213	15.2	5.9	20	2
79	21.0	8.2	30	1	214	11.7	4.6	20	2
80	4.7	1.8	20	1	215	11.2	4.4	20	2
81	5.3	2.1	20	1	216	19.7	7.7	20	2
82	5.7	2.2	20	1	217	29.0	11.3	30	3
83	5.5	2.1	20	1	218	31.5	12.3	30	3

84	6.2	2.4	20	1	219	59.3	23.1	50	2
85	6.7	2.6	20	1	220	13.8	5.4	30	1
86	11.7	4.6	20	2	221	0.0	0.0	0	0
87	7.5	2.9	20	1	222	10.5	4.1	20	1
88	13.7	5.3	20	2	223	0.0	0.0	0	0
89	15.0	5.9	20	2	224	0.0	0.0	0	0
90	17.8	7.0	20	2	225	0.0	0.0	0	0
91	35.7	13.9	40	2	226	0.0	0.0	0	0
92	21.8	8.5	30	2	227	0.0	0.0	0	0
93	15.7	6.1	20	2	228	0.0	0.0	0	0
94	17.8	7.0	30	2	229	0.0	0.0	0	0
95	16.7	6.5	30	2	230	6.5	2.5	10	1
96	16.3	6.4	20	2	231	0.0	0.0	0	0
97	16.0	6.2	20	2	232	0.0	0.0	0	0
98	15.7	6.1	20	2	233	0.0	0.0	0	0
99	16.0	6.2	20	2	234	0.0	0.0	0	0
100	7.3	2.9	20	1	235	0.0	0.0	0	0
101	7.8	3.1	20	1	236	0.0	0.0	0	0
102	14.5	5.7	30	2	237	0.0	0.0	0	0
103	5.8	2.3	20	1	238	0.0	0.0	0	0
104	14.5	5.7	20	2	239	0.0	0.0	0	0
105	18.0	7.0	20	2	240	0.0	0.0	0	0
106	18.0	7.0	20	2	241	5.0	2.0	20	1
107	18.0	7.0	20	2	242	18.8	7.3	20	2
108	22.8	8.9	30	2	243	18.8	7.3	20	2
109	22.0	8.6	20	2	244	11.5	4.5	20	2
110	22.5	8.8	20	2	245	7.7	3.0	20	1
111	31.2	12.2	30	2	246	0.0	0.0	0	0
112	14.8	5.8	30	1	247	0.0	0.0	0	0
113	21.3	8.3	30	1	248	0.0	0.0	0	0

114	17.7	6.9	30	1	249	0.0	0.0	0	0
115	28.3	11.1	30	1	250	0.0	0.0	0	0
116	28.2	11.0	30	1	251	0.0	0.0	0	0
117	28.3	11.1	30	1	252	0.0	0.0	0	0
118	0.0	0.0	0	0	253	0.0	0.0	0	0
119	1.7	0.7	10	1	254	0.0	0.0	0	0
120	0.0	0.0	0	0	255	0.0	0.0	0	0
121	0.0	0.0	0	0	256	0.0	0.0	0	0
122	0.0	0.0	0	0	257	0.0	0.0	0	0
123	0.0	0.0	0	0	258	0.0	0.0	0	0
124	0.0	0.0	0	0	259	0.0	0.0	0	0
125	0.0	0.0	0	0	260	0.0	0.0	0	0
126	0.0	0.0	0	0	261	0.0	0.0	0	0
127	0.0	0.0	0	0	262	0.0	0.0	0	0
128	0.0	0.0	0	0	263	0.0	0.0	0	0
129	0.0	0.0	0	0	264	0.0	0.0	0	0
130	0.0	0.0	0	0	265	0.0	0.0	0	0
131	0.0	0.0	0	0	266	0.0	0.0	0	0
132	0.0	0.0	0	0	267	0.0	0.0	0	0
133	0.0	0.0	0	0	268	0.0	0.0	0	0
134	0.0	0.0	0	0	269	0.0	0.0	0	0
135	0.0	0.0	0	0					

Table 6. Shadow Flicker Results: V162-6.2 (L016)

FRONTIER POWER SYSTEMS

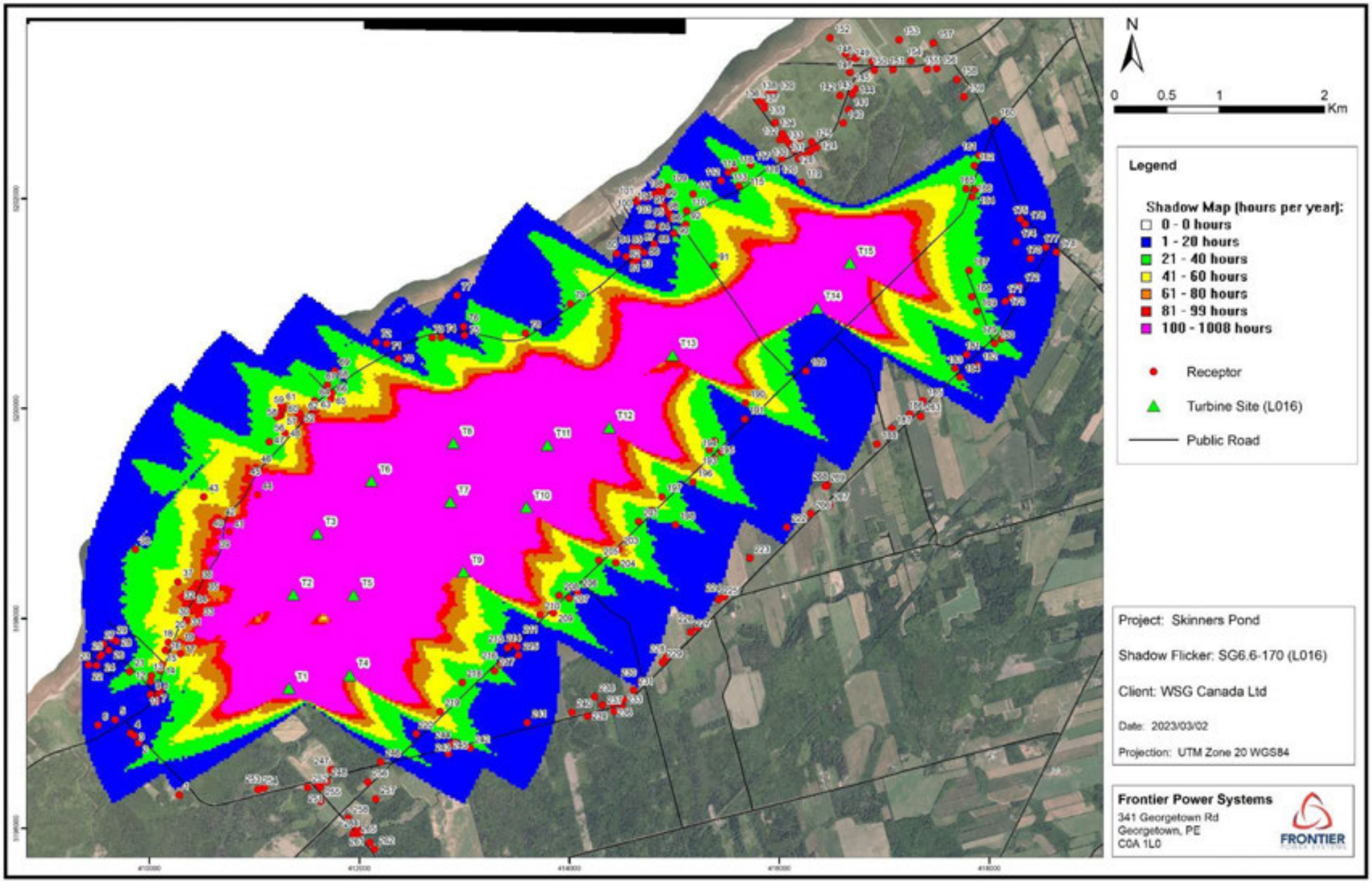

Figure 2. Shadow Flicker Map - Theoretical Maximum: SG6.6-170 (L016)

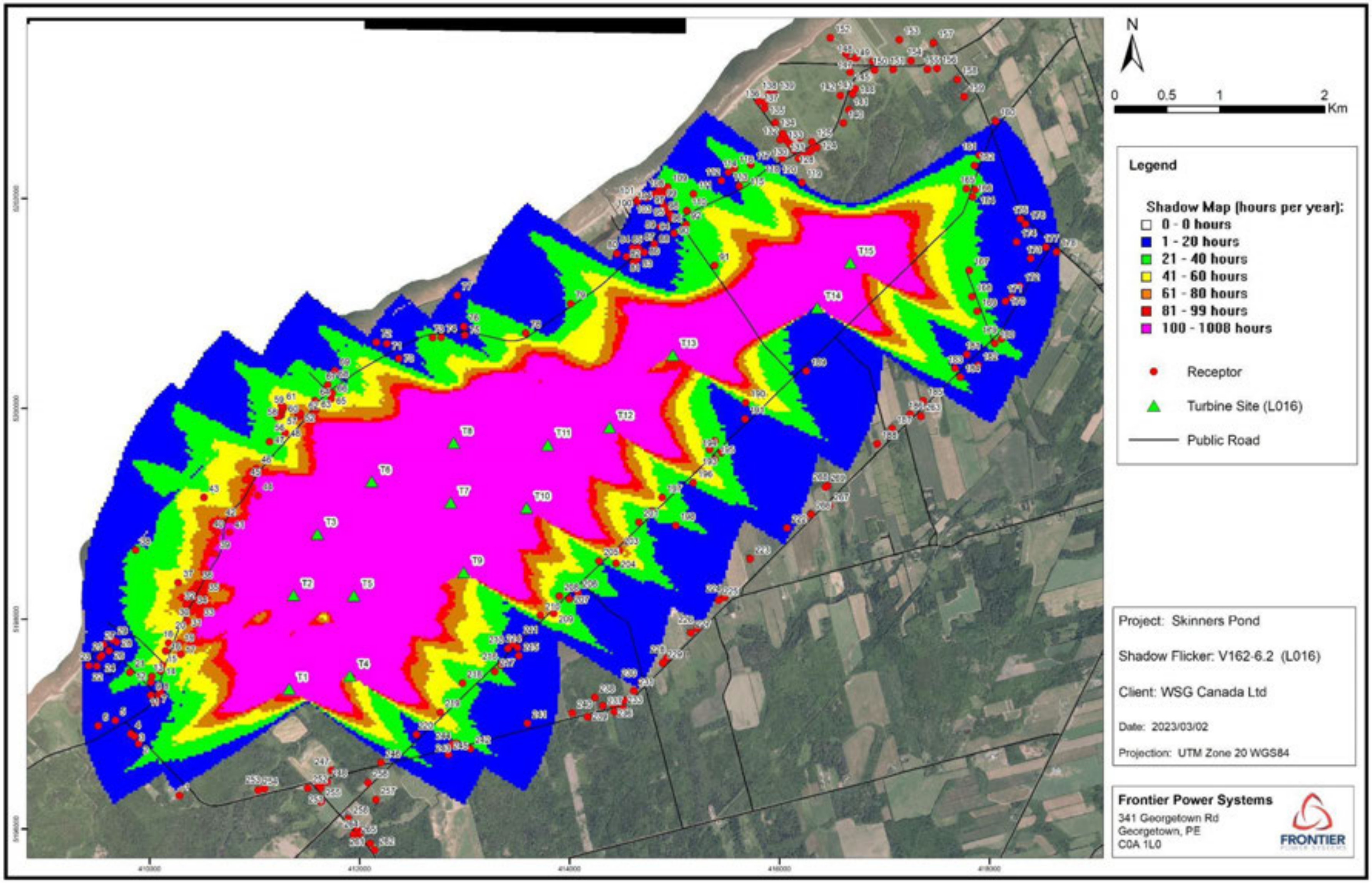

Figure 3. Shadow Flicker Map - Theoretical Maximum: V162-6.2 (L016)

5.5. Potential Mitigation Measures

If shadow flicker from the proposed turbine is a nuisance for nearby receptors, there are various mitigation measures which could be employed. Mitigation measures could include installation of window blinds or scheduled shut down of wind turbines which are known to cause problematic flicker during the times when it is known to occur.

6. Conclusion and Recommendations

Shadow flicker from the proposed Skinners Pond Wind Project has been assessed using a shadow flicker model to determine the theoretical maximum amount of flicker that is possible at each receptor location. Wind speed data and long-term sunshine data were also used to determine a more representative, worst-case value for shadow flicker hours at each receptor.

The results of this assessment indicate that shadow flicker from the proposed wind turbines does have the potential to cause annoyance for numerous receptors. If the proposed project progresses, a site-specific assessment of individual receptors with high levels of flicker should be carried out and mitigation measures should be implemented.

7. References

[1] *Onshore Wind: Shadow Flicker,* Department for Business Enterprise and Regulatory Reform (BERR), website: http://www.dti.gov.uk/energy/sources/renewables/planning/onshore-wind/shadow-flicker/page18736.html London, UK, November 2009.

[2] *Photosensitive Epilepsy,* Epilepsy Action (British Epilepsy Association), website: http://www.epilepsy.org.uk/info/photo.html Leeds, UK, November 2009.

[3] *GH WindFarmer Theory Manual,* Garrad Hassan and Partners Ltd., Bristol, UK, May 2009.

[4] *Canadian Climate Normals 1971-2000,* Environment Canada, website: http://climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html Canada, November 2009.