APPENDIX A
ENGAGEMENT

Fast Acting Natural Gas Power Generation Open House

Proposed for Marshdale, Pictou County

IESO Nova Scotia respectfully acknowledges that its work takes place in Mi'kma'ki, the ancestral and traditional territory of the Mi'kmaq People, covered by the Peace and Friendship Treaties. The ongoing relationship of the Mi'kmaq with these lands and waters is recognized and honoured.

Introduction to IESO Nova Scotia

IESO Nova Scotia is a new independent non-profit responsible for planning and operating Nova Scotia's bulk electricity system. Beginning in 2025, it will gradually take over these roles from Nova Scotia Power, including resource planning, energy procurement, system operations, and supporting a fair, transparent transition to clean energy.

IESO Nova Scotia is committed to delivering on the Clean Power Plan by achieving 80% renewable energy and retiring coal-fired electricity by 2030.

To ensure reliable, stable electricity when renewables are not available, IESO Nova Scotia will procure new generation focused on reliability and affordability for ratepayers. The first procurement will support up to 300 MW of fast-acting natural gas power, with future rounds to include batteries, hydrogen, and other emerging technologies.

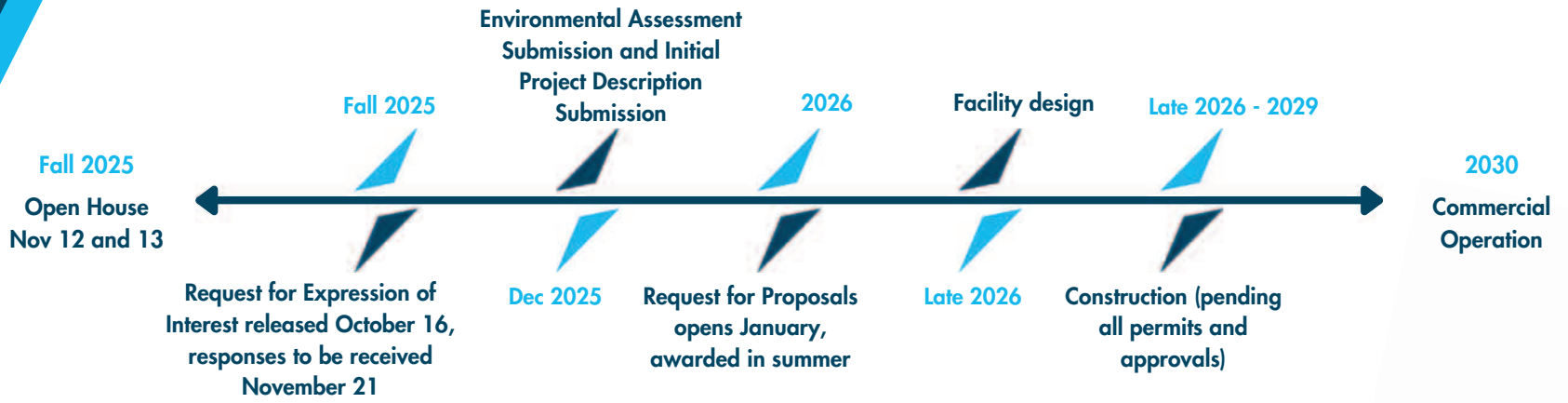
Need For The Project

Clean Energy Transition

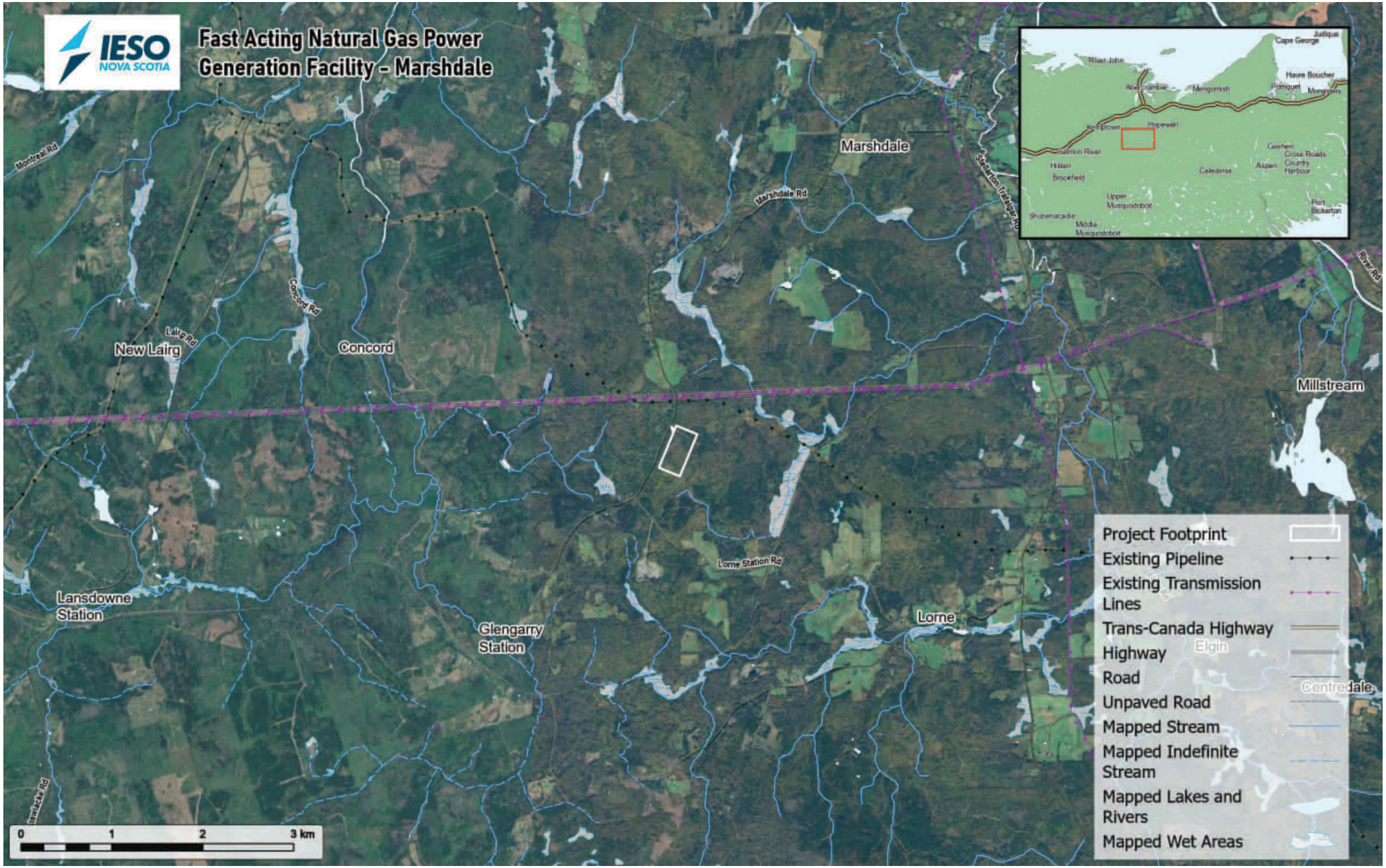
Nova Scotia's electricity system is undergoing a major transformation—driven by population growth, more homes and vehicles using electricity instead of gas or oil.

Nova Scotia's Clean Power Plan will phase out coal-fired electricity by 2030 and deliver 80% of power generated from renewables.

To maintain a reliable and affordable electricity system, Nova Scotia needs dependable fast acting energy sources available when renewables like wind and solar are unable to meet demand.



IESO NOVA SCOTIA


IESO
NOVA SCOTIA
Fast Acting Natural Gas Power Generation Facility - Marshdale
Marshdale
Marshdale Rd
Montreal Rd
Concord Rd
Concord
Lairg Rd
New Lairg
Millstream
River Rd
Lorne Station Rd
Lansdowne Station
Glengarry Station
Lorne
Elgin
Centredale
Project Footprint
Existing Pipeline
Existing Transmission Lines
Trans-Canada Highway
Highway
Road
Unpaved Road
Mapped Stream
Mapped Indefinite Stream
Mapped Lakes and Rivers
Mapped Wet Areas
0
1
2
3 km
Judique
Cape George
River John
Havre Boucher
Abercrombie
Merigomish
Pomquet
Monastery
Kenptown
Roperwell
Salmon River
Goshen
Cross Roads Country Harbour
Hilden
Brookfield
Caledonia
Aspen
Upper Musquodoboit
Port Bickerton
Shubenacadie
Middle Musquodoboit

Aerial photograph of a similar Facility

Project Description

The Project consists of an up to 300 megawatt (MW) power plant known as the Fast Acting Natural Gas Power Generation Facility – Marshdale, located near the community of Marshdale in the Municipality of Pictou County.

The proposed facility will operate only when the power grid requires additional supply. It will play a critical role in ensuring a reliable electricity supply, integrating more renewables in the future, and is designed to transition to low-carbon fuels like hydrogen and biofuels.

PRIMARY COMPONENTS

Fast Acting Power Generation Equipment

Facility will include multiple turbine generators up to 300 MW total capacity, each supported by an air inlet filtration unit, start-up system and exhaust stack.

Electrical Grid Interconnection

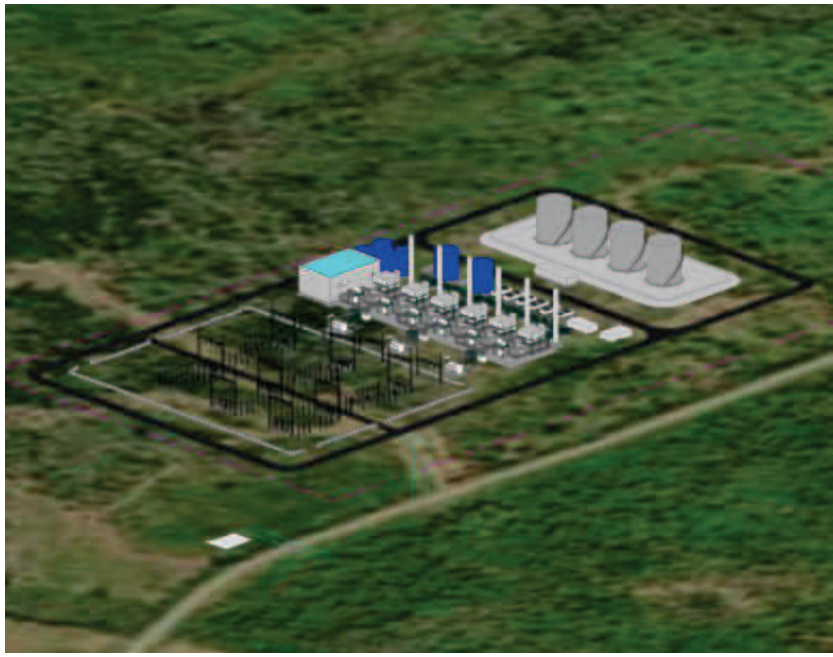
Powerline connections to existing transmission lines.

Fuel Supply

Natural gas supply from existing natural gas pipeline. Light fuel oil will be trucked to site and stored in tanks with fail safe secondary containment. Facility will be designed for conversion to hydrogen or biofuels in the future.

The Facility

The Project will have water storage and processing facilities. There will be winterized buildings for controls and instrumentation.



Rendering of the Proposed Facility

IESO NOVA SCOTIA

Community and Mi'kmaq Engagement

Feedback received from the public and the Mi'kmaq of Nova Scotia will be considered in Project design, construction, operations, and benefits.

We want to be good neighbours. We will continue to engage with landowners, residents, community groups, elected officials, and the Mi'kmaq of Nova Scotia to hear your feedback and address your questions and concerns.

BENEFITS

Jobs: 100–125 construction jobs and 10–15 operational jobs per 300 MW facility.

Local Hiring: Support local hiring through developing a "local business directory", hosting job fairs, and actively advertising jobs locally.

Training: Potential for operations training to develop skills related to energy operations, maintenance, and safety.

Local Sponsorship: Support for local events, community groups and infrastructure.

Economic Spin-offs: Increase spending at local businesses, contractors, gas stations, and restaurants.

Municipal Tax Revenue: Tax revenue based on facility size, road upgrades, commercial rate, and other comparable facilities.

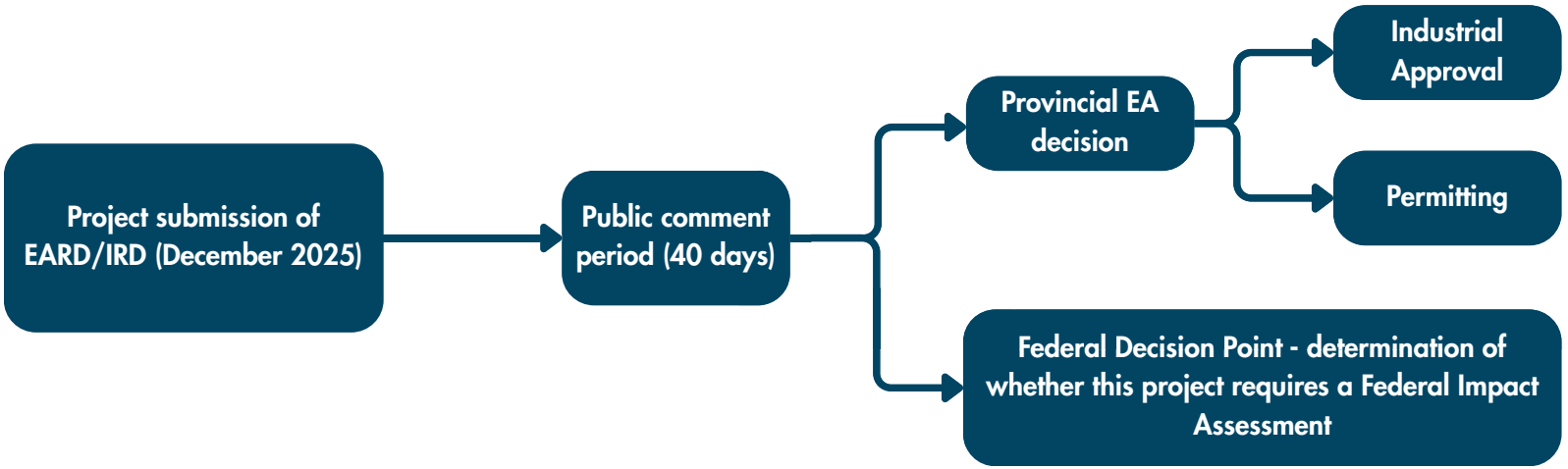
Interested in getting involved and staying fully informed? Join the Project's Community Liaison Committee! Sign up sheet on-hand.

Are you a local business or have skills to offer the Project? Talk to us or tell us more in the open house comment form.

Environmental Assessment

The project is subject to provincial and federal EA, with a coordinated provincial environmental assessment registration document (EARD) and a federal initial project description (IPD) planned for submission in December 2025. Once submitted, the regulators will confirm required regulatory pathway(s).

- Air Quality
- Greenhouse Gases
- Indigenous Peoples of Canada
- Groundwater
- Surface Water and Fish Habitat
- Wetlands
- Terrestrial Flora
- Terrestrial Fauna
- Avifauna
- Archaeological Resources
- Socioeconomic Environment
- Sound Environment



IESO NOVA SCOTIA

Surface Water, Fish Habitat and Wetlands

Eight wetlands and four watercourses were identified during field assessment.

Direct Impacts:

- Three wetlands will be altered, totaling 1.75 ha
- All watercourses have been avoided

Indirect Impacts:

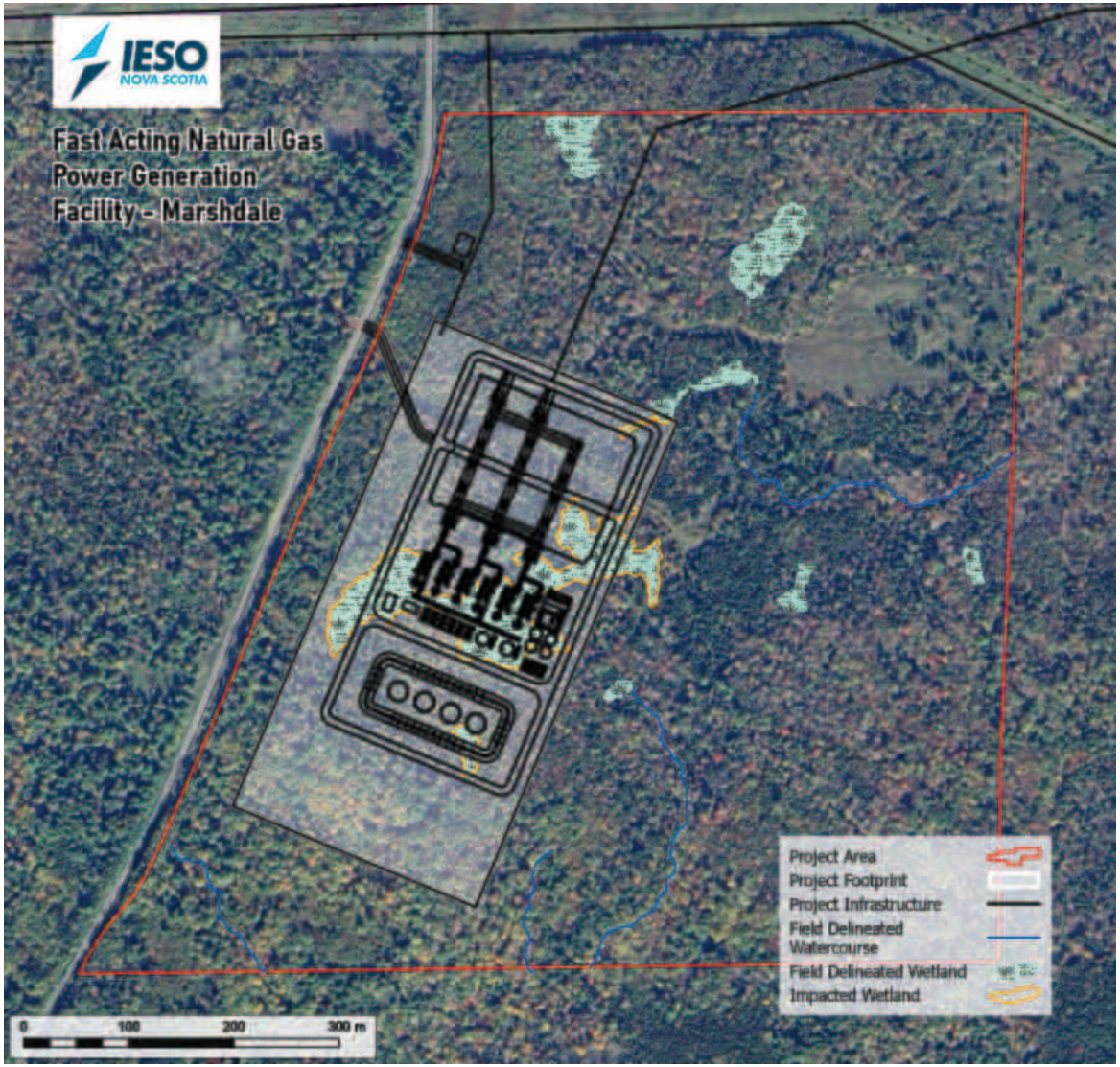
- Potential hydrological effects
- Potential changes in surface water quality
- Potential erosion and sedimentation
- Introduction of invasive species

MITIGATIONS

- During detailed design phase, further efforts will be made to microsite facility infrastructure away from wetlands.
- Provincial wetland permitting will be completed and necessary compensation for lost wetland habitat will be implemented.
- A 30 m buffer prohibiting activities like refueling and vegetation removal will be maintained on watercourses and wetlands where possible.

MONITORING

- Post-construction wetland monitoring with adaptive management will be conducted for potential indirect impacts.
- An Erosion and Sediment Control Plan will be implemented to mitigate potential impacts to wetlands and watercourses.
- A Surface Water Monitoring Plan will be implemented to ensure discharged water meets regulatory water quality requirements.



Terrestrial Flora, Fauna and Avifauna

Terrestrial Flora:

- The Project contained diverse vegetation communities, but most areas showed signs of previous disturbance from forest harvesting.
- Four black ash trees identified within the Project Area will be avoided.

Terrestrial Fauna:

- Trail camera photos and incidental observations identified white-tailed deer, coyote, bobcat, red squirrel and black bear. No evidence of mainland moose or wood turtle was observed.

Potential Project impact is approximately 12 ha.

Avifauna:

- Survey methods included spring and fall migration, breeding, and nightjar, with all surveys conducted within their respective seasons in 2025.
- Observations across all surveys observed 638 birds representing 57 species, including two species at risk:
  - Canada warbler
  - Eastern wood-pewee

Key Mitigations and Monitoring

- Avoid impacting observed species at risk locations.
- Minimize project traffic to reduce wildlife collisions and stress.
- Implement lighting and noise controls (e.g., mufflers) on all machinery during construction and operation.
- Conduct clearing outside of breeding bird season (April - August).
- Consult with Department of Natural Resources if unexpected SAR is encountered. If encountered, additional mitigations may be implemented.
- A site-specific post-construction wildlife management plan will be developed in consultation with regulators and other relevant parties.

Water Usage

The Project requires the extraction of groundwater to supply process water needs during operations. Water is used for:

- Emissions control, specifically NO_x
- Intermittent compressor washing
- Potable water usage for staff

Water will be sourced from new groundwater wells drilled near the site.

- Overall, a 300 MW facility uses about the same amount of water each year as 750 average rural homes.
- Most of this water becomes harmless water vapour, the remaining amount is safely treated before being gradually released in accordance with environmental standards.
- The final facility design will depend on sustainable groundwater yields for each site. Hydrogeological studies, including groundwater modeling, are ongoing.

IESO NOVA SCOTIA

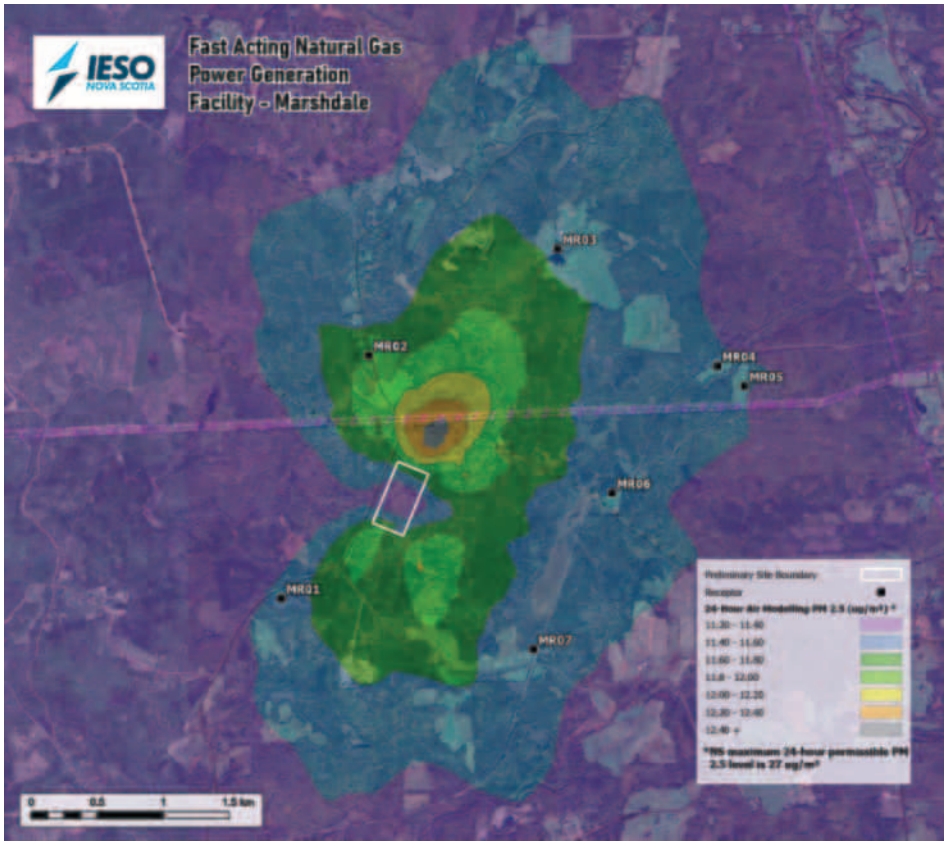
Greenhouse Gases

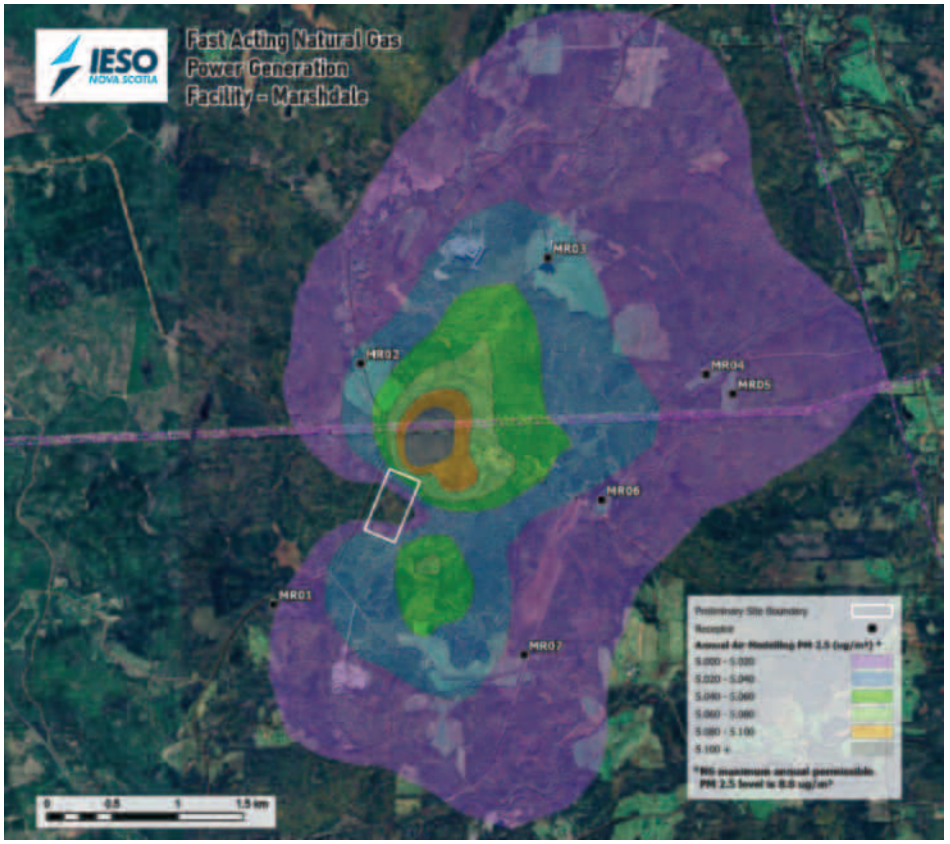
- Although there are some direct GHG emissions, this Project is expected to offset the current use of coal to meet grid requirements and facilitate the ongoing expansion and renewable power capacity leading to an overall decrease in the GHG emissions intensity of Nova Scotia's electrical grid.
- The Project is expected to emit approximately 326 kt/annually of CO_2 equivalent (CO_2e) of greenhouse gases (GHG), equal to 2.4% of Nova Scotia's emissions and 0.05% of Canada's emissions.
- Submission of annual GHG reports to the provincial and federal regulators will be required during operations, and are subject to provincial and federal emissions thresholds.
- This Project will have approximately 55% less GHG emissions than coal fired power plants.

IESO NOVA SCOTIA

Air Quality

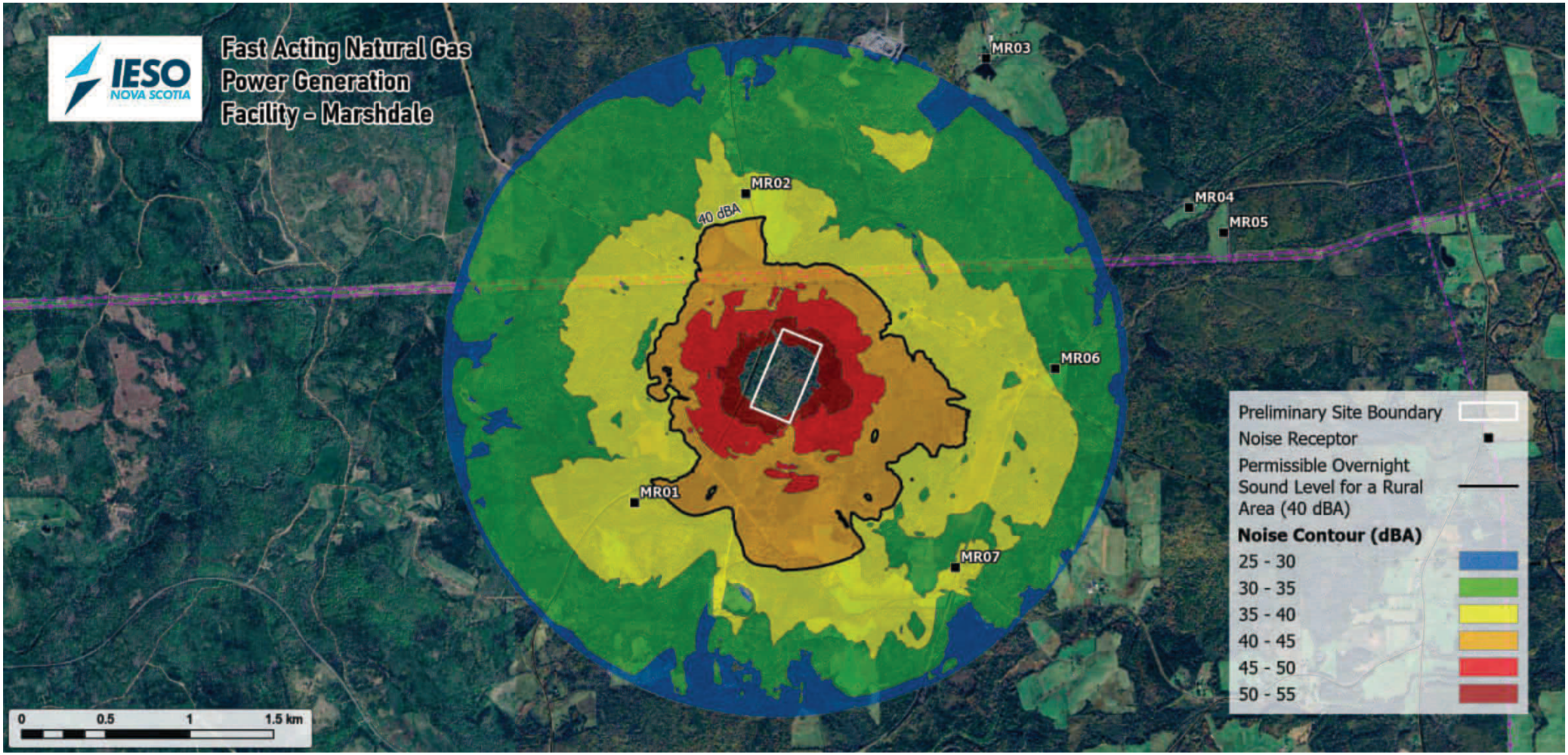
- No exceedances of regulated limits for NO_2, CO, or $PM_{2.5}$ are expected at ground level based on preliminary modeling.
- No exceedances of regulated limits are expected at nearby residences.
- The Project uses advanced emissions control (low NO_x Combustion, Continuous Emissions Monitoring System, Water/Steam Injection).
- Ongoing monitoring and regulatory reporting will be required during operations.





Sound Environment

- A study was conducted to model cumulative noise effects generated by the Project on nearby receptors, including residences. Noise levels will be below the permissible sound levels.
- The Project will implement a Complaint Response Plan to address concerns raised by the local residences as needed.



Cultural and Heritage Resources

An Archaeological Resource Impact Assessment was completed in September 2025 to identify any potential for archaeology or cultural findings.

The assessment identified low potential for archaeological resources across most of the Project Area. Three potential archaeological resources within one area of high potential were observed.

Mitigations and monitoring includes:

- Maintain a 30 m buffer for Project development and ground disturbance activity on the three sites of high archaeological potential.
- If future Project engineering or design requires development or ground disturbance within the 30 m buffer zone, conduct confirmatory shovel testing in areas of development/disturbance.
- Conduct additional archaeological assessment if, during the detailed design phase, it is determined that ground disturbance is required in areas not previously assessed.
- Develop a chance find procedure related to the potential unexpected discovery of archaeological items or sites, or human remains, during construction.

A Mi'kmaq Ecological Knowledge Study is underway and will be completed in 2026.

Example of a confirmatory shovel test

IESO NOVA SCOTIA

THANK YOU FOR ATTENDING

We welcome your feedback - please fill out a comment form on your way out.

LET'S STAY IN TOUCH

community@ieso-ns.ca

www.ieso-ns.ca

Marshdale – Fast Acting Natural Gas Power Generation Facility
Sign-In Sheet
Thursday November 13, 2025

Name	Town/Settlement	Phone Number	Email	I would like to receive emailed project updates
				☐ Yes
				☐ Yes
				☐ Yes
				☐ Yes
				☐ Yes
				☐ Yes
				☐ Yes
				☐ Yes
				☐ Yes
				☐ Yes

Marshdale – Fast Acting Natural Gas Power Generation Facility
Open House Comment Sheet
Thursday November 13, 2025

1) How did you hear about this open house? (i.e. heard from neighbour, municipal or county councillor, advertisement, website, social media, or hardcopy invitation):

_____

_____

_____

2) How helpful was the information you received? Please indicate by circling a number:

(Not at all helpful) 1 2 3 4 5 (Very helpful)

3) Did your opinion of the Project change as a result of attending the open house?

☐ My opinion became more favourable
☐ My opinion became less favourable
☐ My opinion did not change

4) How would you rank your current support for the proposed fast-acting natural gas power generation facility?

(I do not support) 1 2 3 4 5 (I fully support)

5) Are you interested in becoming a member of the Project's Community Liaison Committee? If yes, you would attend regular meetings with a small of group fellow community members to stay informed, share ideas and concerns, and contribute to Project engagement and benefits planning.

☐ Yes -> Name: _____ Email: _____
☐ No

Please return to a project team member

6) Are you a local skilled person or have a business that could contribute to facility construction and operation? If so, please share more details below. We are committed to using local resources and will use this information to populate a local business directory for the Project.

Name: _____

Email: _____

Phone Number: _____

Information about your skills and/or local business:

_____

_____

_____

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Please return to a project team member

7) Please provide your comments or feedback on the proposed Project:

_____

_____

_____

_____

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8) Please share your thoughts on what was done well tonight and how we can improve our engagement going forward:

_____

_____

_____

_____

_____

_____

_____

Please return to a project team member

Marshdale - Fast Acting Natural Gas Power Generation Facility
Community Liaison Committee Sign-Up Sheet

Name	Town/Settlement	Phone Number	Email

APPENDIX B
AIR EMISSION ASSESSMENT

Independent Energy System Operator Nova Scotia: Fast-Acting Natural Gas Power Generation Facility

Air Quality and GHG Assessment

					Meghari, Karim	
2025-11-25	0	Issued for Use	E. John	C. Lyons	K. Meghari	C. Rollings
Date	**Rev.**	**Status**	**Prepared By**	**Checked By**	**Approved By**	**Approved By**
			HATCH			**Client**

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Disclaimer

This report was prepared by Hatch Ltd. (“Hatch”) for the sole and exclusive benefit of the Independent Energy System Operator (IESO) Nova Scotia (the “Principal”) for the sole purpose of addition to an environmental assessment being prepared by Strum Consulting for the IESO Nova Scotia assisting the Principal to determine the feasibility of installation and operation of a fast-acting natural gas power generation facility with up to 300 MW capacity in Pictou, Nova Scotia (the “Project”), and must not be provided to, relied upon or used by any other party. The use of this report by the Principal is subject to the terms of the relevant [services agreement] between Hatch and Principal.

This report is meant to be read as a whole, and sections should not be read or relied upon out of context. The report includes information provided by the Principal and by certain other parties on behalf of the Principal. Unless specifically stated otherwise, Hatch has not verified such information and does not accept any responsibility or liability in connection with such information.

This report contains the expression of the opinion of Hatch using its professional judgment and reasonable care, based upon information available at the time of preparation. The quality of the information, conclusions and estimates contained in this report is consistent with the intended level of accuracy as set out in this report, as well as the circumstances and constraints under which this report was prepared.

As this report is an air quality and Greenhouse Gas (GHG) assessment report, all estimates and projections contained in this report are based on limited and preliminary data. Accordingly, while the work, results, estimates and projections in this report may be considered to be generally indicative of the nature and quality of the Project, they are not definitive. No representations or predictions are intended as to become the results of future work, and Hatch does not promise that the estimates and projections in this report will be sustained in future work.

1. Introduction

The Independent Energy System Operator (IESO) Nova Scotia are planning a fast-acting power generation facility in Pictou County. New fast-acting generators will replace existing coal-fired power generation to optimally manage power supply and reliability in conjunction with the significant quantities of variable-production renewable energy.

The proposed power plant is located near to Marshdale, Nova Scotia and will have a net power generation capacity of up to 300 MW. The proposed site location is shown in Figure 2-1.

At the request of the IESO Nova Scotia, Hatch Ltd. (Hatch) has completed the following:

- An air quality dispersion modelling assessment to determine if maximum operation of the proposed Facility will comply with the applicable Nova Scotia Maximum Permissible Ground Level Concentrations (GLC).
- An assessment of expected Greenhouse Gas (GHG) emissions from the facility based on anticipated annual operation.

2. Facility

The facility will be a simple cycle generating station that will include the following:

- Natural gas fired combustion turbines, equipped with low-NO_X burners, exhausting to individual 30 m stacks.
- Total capacity up to 300 MW.
- Synchronous condensing capabilities.
- Pipeline connection for natural gas supply.
- Dual fuel capabilities (natural gas and liquid fuels) with the capability of also converting to renewable fuels such as hydrogen and biofuels in the future.
- Liquid fuel storage system.
- Electrical system.
- Administration building.

The site layout showing the stack locations, property boundary, and buildings is provided in Figure 2-2.

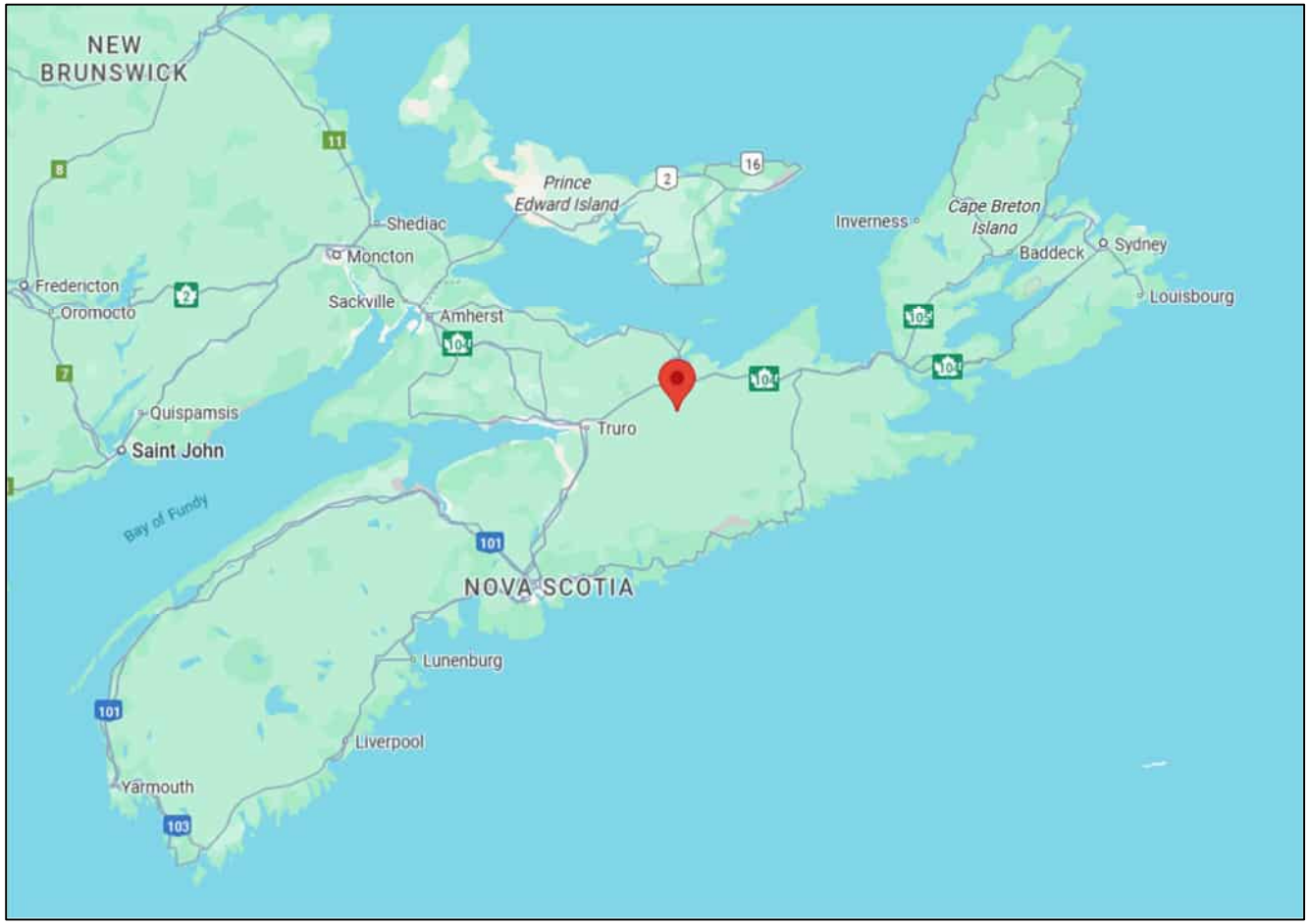

Figure 2-1: Proposed Location

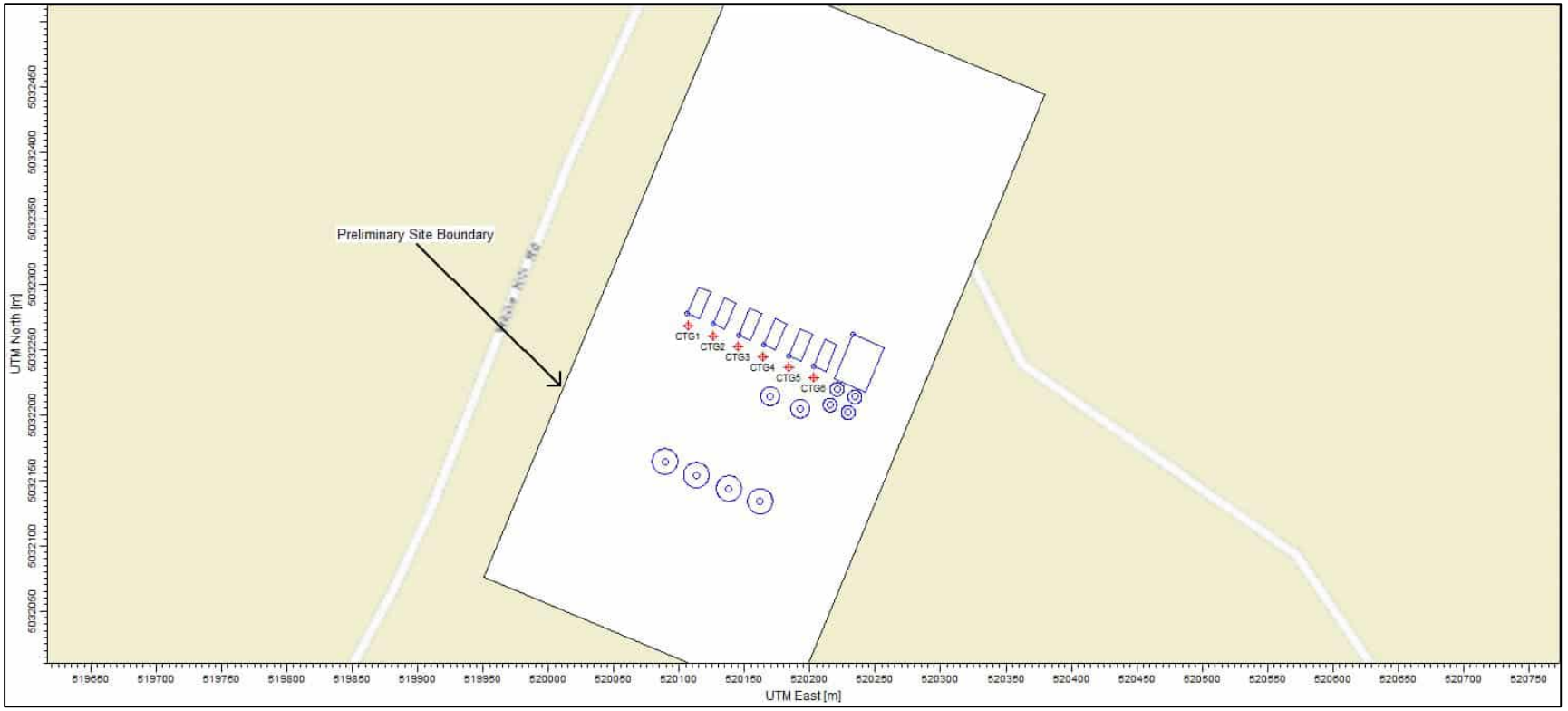

Figure 2-2: Site Layout

2.1 Operations

The proposed facility is expected to consist of combustion turbines with up to 300 MW total net generation capacity. The combustion turbines will be capable of dual fuel operation, where natural gas or light fuel oil (diesel) can be used. Both operating conditions were considered in the assessment to determine potential worst case air contaminant emissions during normal operation. Given the expected grid requirements, the Facility will operate intermittently as required to support renewable energy sources on the grid.

For the purpose of the modelling study, to establish worst case ground level concentrations, air contaminant emissions resulting from maximum operation of the Facility are assumed to be released continuously over the entire period of the model. The gas turbine generating units likely to be installed are expected to be capable of short start up times (<10 minutes), limiting duration of increased emissions during startup periods. Peak emissions are only expected to occur during a portion of the total startup time. Therefore, the hourly emissions during start-up are expected to be similar to those during normal operation.

GHG emissions are estimated based on the expected annual natural gas and diesel consumption based on a 25% capacity factor for the Facility, with a fuel split of 80% natural gas and 20% diesel fuel.

3. Air Quality

3.1 Air Quality Dispersion Modelling Assessment

The air quality dispersion model was performed using AERMOD in compliance with the Nova Scotia Department of Environment and Climate Change, Air Quality Unit *Air Assessment Guidance Document* (NS AAGD) (NSECC 2020), Section 4. The modelling was conducted to determine if operation of the proposed facility will comply with the applicable Nova Scotia Maximum Permissible Ground Level Concentrations (GLC) for key contaminants.

3.1.1 Model Selection

The United States Environmental Protection Agency (US EPA) AERMOD v.24142 model was selected to perform the air quality assessment because of the following:

- The AERMOD model is the preferred regulatory model and accepted for assessing regulatory compliance in NS.
- Plume modelling of long-range transport is not required for this study, i.e., releases from these sources are expected to travel for a short distance (i.e., less than 50 km), prior to impingement.
- The terrain in the area is simple.
- The site is located away from the coast, i.e., not in an area where potential for shoreline fumigation exists.

3.1.2 Modelling Domain

A modelling domain consisting of a 10 km by 10 km area centered near the proposed site was selected for the assessment.

3.1.3 Terrain Data

Terrain data covering the study area were obtained from Natural Resources Canada Canadian Digital Elevation Data (CDED) database in United States Geological Survey (USGS) Digital Elevation Model (DEM) file type (WebGIS 2025). DEM data were processed using the US EPA AERMAP model and this terrain data is incorporated into the AERMOD modelling. Terrian elevation data surrounding the site is shown graphically in Figure 3-1.

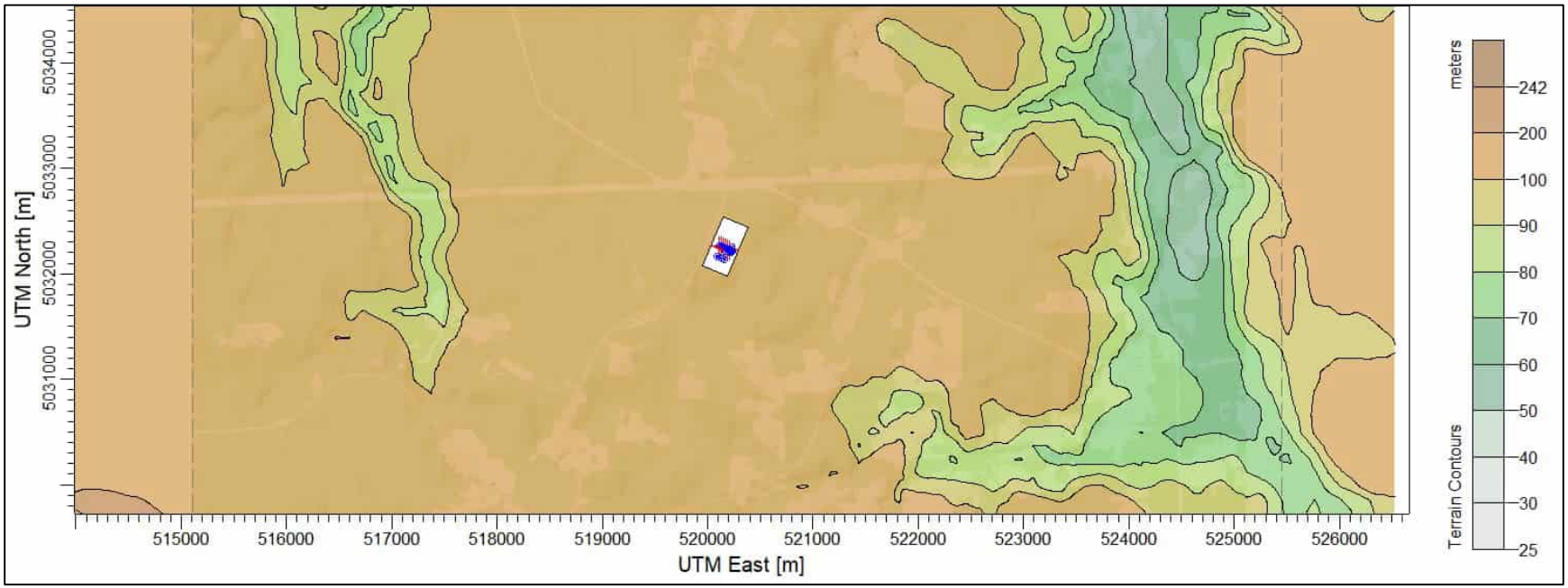

Figure 3-1: Terrain in the Vicinity of Marshdale Site

3.1.4 Receptor Grid

The following receptor grid used in the model was developed as required by the NS AAGD:

- 50 m receptor spacing within 500 m from the sources of interest.
- 100 m receptor spacing within 1000 m from the sources of interest.
- 250 m spacing within 2000 m from the sources of interest.
- 500 m spacing within 5000 m from the sources of interest.
- 1000 m spacing beyond 5000 m from the sources of interest.
- 20 m receptor along the Facility fence line.

Sensitive receptor locations were also identified within the study area. The sensitive receptors are listed in Table 3-1.

Table 3-1: Sensitive Receptors

ID	Description
M_SR1	Marshdale Cemetery
M_SR2	Nearest Residence
M_SR3	Raven Forest Festival Grounds
M_SR4	Lorne Community Hall
M_SR5	St Columbia United Church

The receptor grid, fence line and sensitive receptors are shown in Figure 3-2.

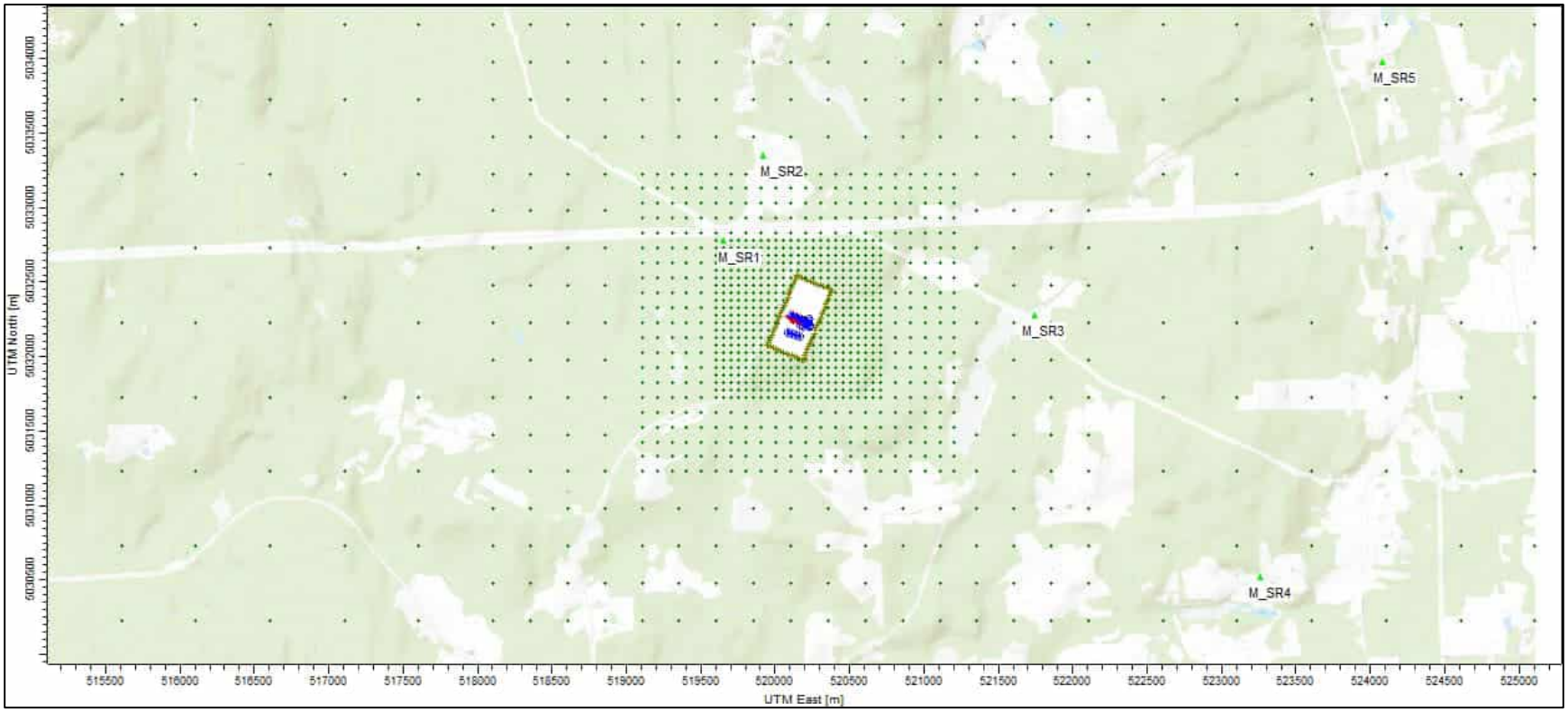

Figure 3-2: Receptor Grid

3.1.5 Meteorological Data

Meteorological data for the dispersion modelling study were obtained from Lakes Environmental's Meteorological Data Service (Lakes Environmental 2025). The data for the study area is ready for use with AERMET and AERMOD and was generated from the Weather Research and Forecast Model (WRF) and the Mesoscale Model Interface Program (MMIF). The data provided was centered at UTM Coorinates 515,311 E and 5,038,860 N in UTM Zone 20, and were extracted from the WRF model with a grid resolution of four (4) km. The data were extracted and processed by Lakes Environment using the MMIF in accordance with the recommendations of the US EPA in its Guidance on the use of MMIF for AERMOD Applications (US EPA 2024) and the MMIF User Guide (Version 4.1) (RAMBOLL US Consulting, Inc. 2024). Surface features extracted from the WRF model data using the MMIF were used and are presented in Table 3-2.

Table 3-2: MMIF Surface Characteristics

Month	Albedo	Bowen Ratio	Surface Roughness (m)
January	0.370	1.390	0.200
February	0.450	1.350	0.200
March	0.290	1.240	0.200
April	0.170	1.680	0.364
May	0.140	1.280	0.500
June	0.160	0.570	0.500
July	0.160	0.290	0.500
August	0.150	0.280	0.500
September	0.150	0.480	0.500
October	0.130	0.980	0.331
November	0.130	1.150	0.200
December	0.210	1.450	0.200

A windrose showing the annual wind speed and direction in the vicinity (based on WRF data obtained for the project) of the proposed site is provided in Figure 3-3. As indicated in this figure, prevailing winds are from the southwest, with highest and lowest wind speeds occurring most frequently from the southwest and west-southwest directions, respectively.

3.1.6 Building Downwash

The building downwash analysis was conducted to incorporate building downwash effects on exhaust plumes. This analysis was performed using the US EPA Building Profile Input Program (BPIP) for the Plume Rise Model Enhancements (BPIP-PRIME) and incorporated into the AERMOD model. The site layout is shown in Figure 2-2, while 3-Dimensional images showing building and stack locations are provided in Figure 3-4.

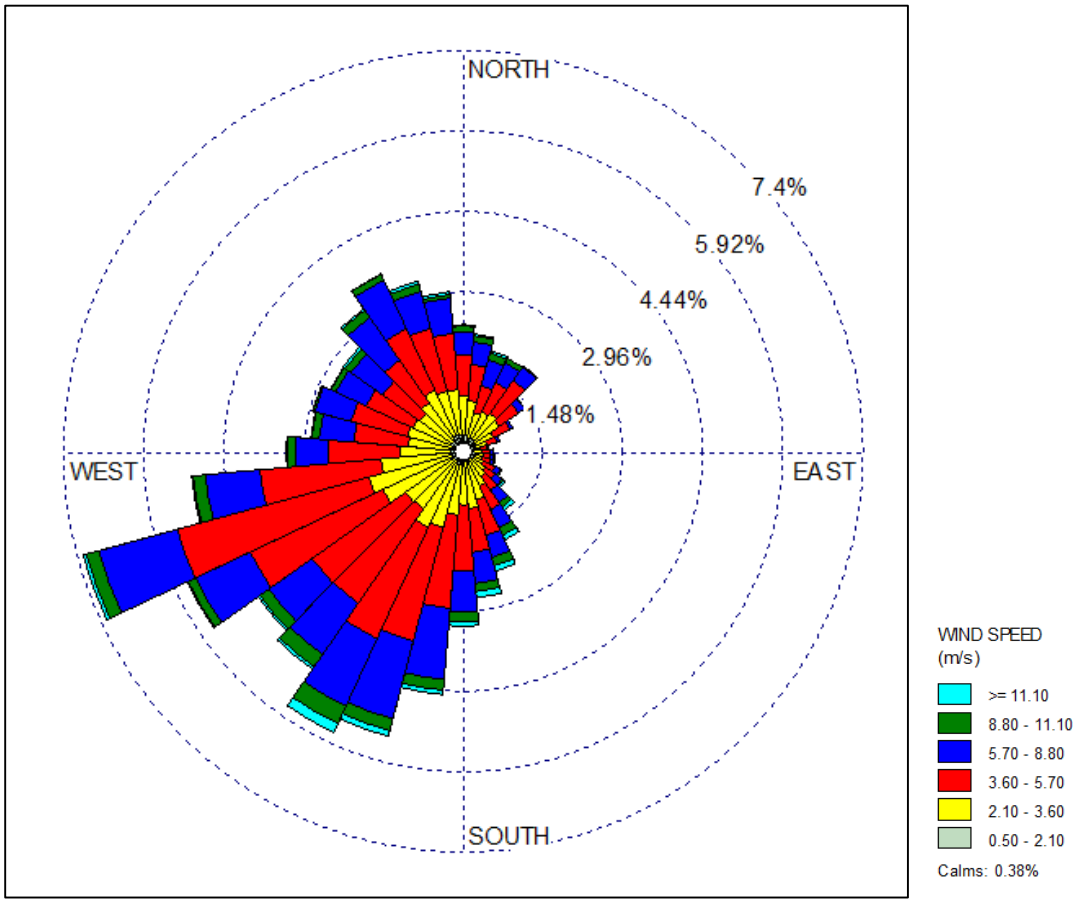

Figure 3-3: Windrose Plot 2020-2024 WRF Data

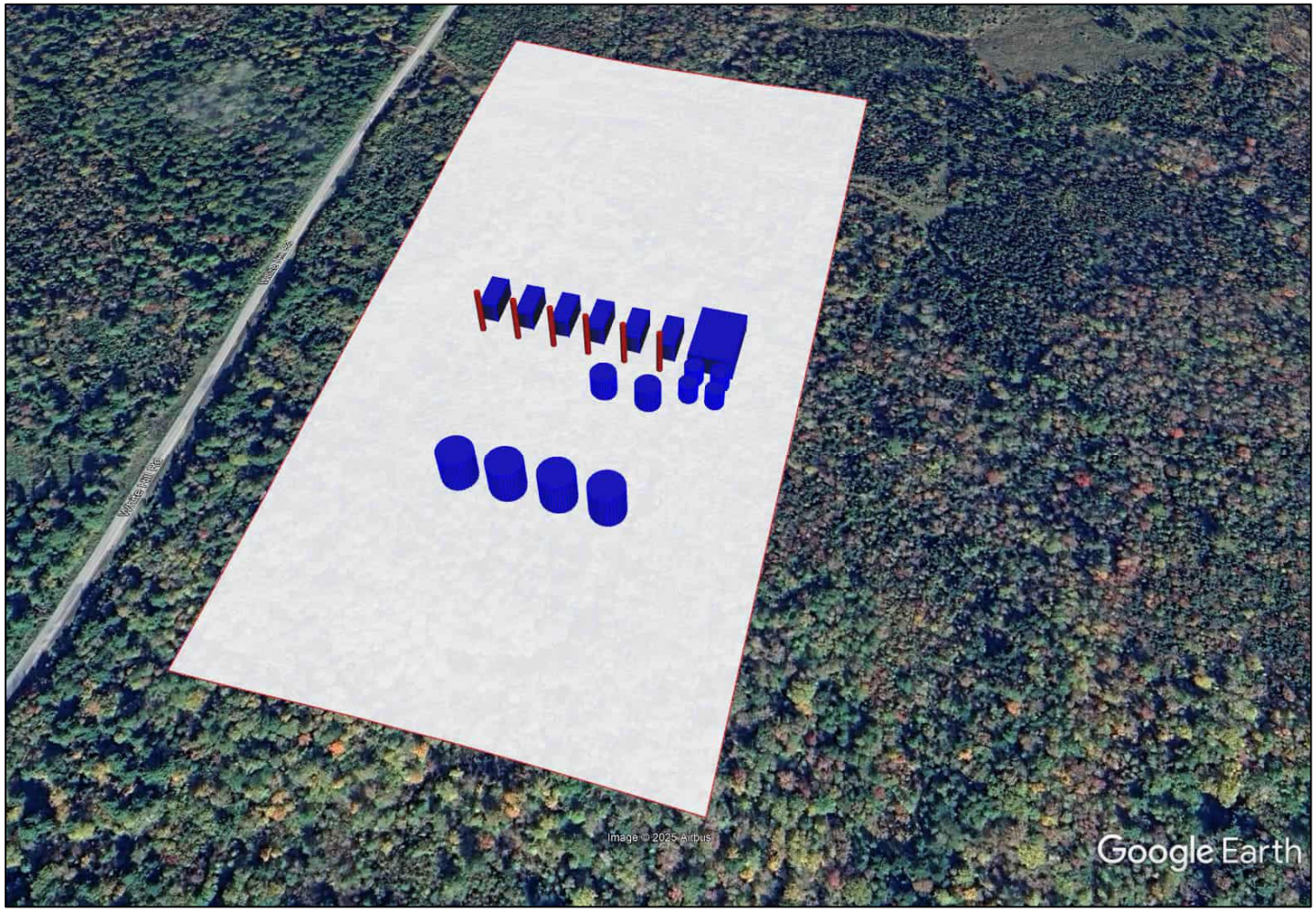

Figure 3-4: 3-D Site Layout

3.1.7 *Air Quality Regulations*

In Nova Scotia, air quality is regulated under the *Environment Act* through ambient air quality objectives which are established as Maximum Permissible GLC for key air contaminants. These Maximum Permissible GLC are listed in Schedule A of the Nova Scotia *Air Quality Regulation* (GNS 2020). Impacts to local air quality as a result of air contaminant releases from a source or group of sources are compared with the Maximum Permissible GLC to assess compliance.

In addition to the provincial air quality regulations, Canadian Council of Ministers of the Environment (CCME) Canadian Ambient Air Quality Standards (CAAQS) may also apply for particulate matter with aerodynamic diameters less than 2.5 µm ($PM_{2.5}$), Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2) and Ozone (O_3) (CCME 2015). However, it is important to note that CAAQS are intended for regional airshed management and are therefore, not necessarily directly comparable with maximum point of impingement concentrations as a result of air contaminant releases from specific sources.

The complete list of Nova Scotia Maximum Permissible GLC and CCME CAAQS are shown in Table 3-3. For combustion turbines that operate using natural gas and light fuel oil (diesel), it is anticipated that Nitrogen Oxides (NO_x), CO and $PM_{2.5}$ would be the air contaminants of most concern. The model results presented in this study were compared with the applicable limits shown in Table 3-3, noting that the CAAQS for NO_2 are not applied in the assessment, since these are not intended for comparison with Maximum Point Of Impingement (MPOI) concentrations but for airshed management. The CAAQS for $PM_{2.5}$ is applied since no other limits exist in Nova Scotia.

Table 3-3: NS Maximum Permissible GLC and CCME CAAQS

Air Contaminant	Averaging Period	NS Maximum Permissible GLC (µg/m³)	CAAQS	
			2020/2030 (µg/m³)	2020/2025 (ppb)
CO	1-Hour	34,600	-	-
	8-hour	12,700	-	-
H_2S	1-Hour	42	-	-
	24-Hour	8	-	-
NO_2	1-Hour	400	-	60/42 (a)
	Annual	100	-	17/12 (b)
O_3	1-hour	160	-	-
	8-hour	-	-	62/60
$PM_{2.5}$	24-Hour	-	27/23 (c)	-
	Annual	-	8.8/8.0 (d)	-
SO_2	1-Hour	900	-	70/65 (e)
	24-Hour	300	-	-
	Annual	60	-	5/4 (b)

Air Contaminant	Averaging Period	NS Maximum Permissible GLC (µg/m³)	CAAQS	
			2020/2030 (µg/m³)	2020/2025 (ppb)
TSP	24-Hour	120	-	-
	Annual	70 (f)	-	-

Notes: µg/m³ micrograms per cubic meter
ppb parts per billion
(a) The three-year average of the annual 98th percentile of the daily maximum one-hour average concentrations
(b) The average over a single calendar year of all one-hour average concentrations
(c) The three-year average of the annual 98th percentile of the daily 24-hour average concentrations
(d) The three-year average of the annual average of the daily 24-hour average concentrations
(e) The three-year average of the annual 99th percentile of the SO_2 daily maximum one-hour average concentrations
(f) Geometric mean

3.1.8 Emission Sources

The six combustion turbine exhaust stacks are expected be the only substantive sources of air contaminant emissions associated with the proposed project. Air contaminants expected to be released in substantive quantities during operation of the project include the following:

- NO_X as NO_2
- CO
- $PM_{2.5}$

Particulate matter emissions from natural gas and fuel oil combustion in the gas turbines are expected to consist completely of size fractions ≤ 2.5 microns, therefore Total Suspended Particulate (TSP) is considered equivalent to $PM_{2.5}$. Since the CAAQS for $PM_{2.5}$ is more stringent than the Nova Scotia Maximum Permissible GLC for TSP, only $PM_{2.5}$ was modelled.

3.1.8.1 Negligible Sources

There may be other sources at the Facility such as combustion air and space heaters, gas preheaters and/or other various vents. However, these are expected to be minor compared to the emissions from the combustion turbines and are therefore, considered to be negligible and are not modelled.

3.1.8.2 Emissions Estimation

The estimated emissions of air contaminants expected to be released in substantive quantities are summarized in Table 3-4 for operation on each fuel type. The emissions shown are based on releases from a single turbine stack. The total emissions from the project are equal to the rates in the table multiplied by six (6) combustion turbines. The emissions were estimated using stack concentration limits that are expected to apply to the facility, published emission factors and expected exhaust gas characteristics based on vendor data for similar combustion turbines. Additional details on the estimation methodology applied as well as sample calculations are provided in the following sections and in Appendix A.

Table 3-4: Air Contaminant Emissions

Air Contaminant	Fuel	Emission Limit (ppmv at 15% O_2)	Emission Factor (lb/MMBTU)	Emission Rate (g/s)
CO	Natural Gas	50[(a)]	-	6.5
	Fuel Oil	50[(a)]	-	6.6
NO_x	Natural Gas	25[(b)]	-	5.4
	Fuel Oil	38[(b)]	-	8.3
$PM_{2.5}$	Natural Gas	-	0.0066[(c)]	0.35
	Fuel Oil	-	0.012[(c)]	0.64

Notes:
[(a)] Obtained from Ontario MECP Guideline A-5 (2021)
[(b)] Obtained from ECCC Reducing Nitrogen Oxide Emissions from Natural Gas-Fuelled Stationary Combustion Turbines: Guidelines (2017)
[(c)] Obtained from US EPA AP-42 Compilation of Emission Factors, Chapter 3.1: Stationary Gas Turbines

3.1.8.2.1 NO_x and CO

The NO_x emissions from the combustion turbines were estimated using the emission limit for peaking units with a capacity ≥4 MW and ≤70 MW, as per the Environment and Climate Change Canada (ECCC) *Reducing Nitrogen Oxide Emissions from Natural Gas-Fuelled Stationary Combustion Turbines: Guidelines* (2017). The CO emissions were estimated using emission limits provided in the Ontario Ministry of the Environment, Conservation and Parks (MECP) *Guideline A-5 Atmospheric Emissions from Stationary Combustion Turbines* Section 5.3. NO_x and CO emissions were calculated using Eqn. **1**. A summary of the emission limits and estimated emission rates are provided in Table 3-4.

Eqn. 1:
$$ER_x = EL_x \times \frac{(20.9 - O2_S)}{(20.9 - 15\%)} \times \frac{P_S \times MW_x}{R \times T_S} \times Q_S$$

Where:
- ER_x = Emission Rate of Compound x (g/s)
- EL_x = Emission Limit of Compound x (ppmv)
- $O2_S$ = Stack Oxygen Concentration (%)
- P_S = Stack Exit Pressure (kPa) (assumed to be barometric pressure)
- MW_x = Molecular Mass of Compound x (g/mol)
- R = Ideal Gas Constant =8.314 L-kPa/gmol-K
- T_S = Stack Exit Temperature (K)
- Q_S = Stack Exhaust Gas Flow (Dm^3/s)

3.1.8.2.2 $PM_{2.5}$

$PM_{2.5}$ emissions from the combustion turbines were estimated using published emission factors provided in the US EPA *AP-42: Compilation of Emission Factors, Chapter 3.1 Stationary Gas Turbines*. These emission factors are also provided in Table 3-4 and the $PM_{2.5}$ emissions were estimated using Eqn. 2.

Eqn. 2:
$$\boldsymbol{ER_{PM2.5} = EF_{2.5} \times E_{Fuel} \times \frac{1\ h}{3600\ s} \times \frac{2200\ g}{lb}}$$

Where:
- $ER_{PM2.5}$ = Emission Rate of $PM_{2.5}$ (g/s)
- $EF_{PM2.5}$ = $PM_{2.5}$ Emission Factor (lb/MMBTU)
- E_{Fuel} = Energy Input from Fuel (421 MMBTU/h for natural gas and 420 MMBTU/h for fuel oil)

3.1.8.2.3 Sample Calculations

The sample calculation to estimate NO_x (as NO_2) emissions from Combustion Turbine No. 1 when burning fuel oil is as follows using Eqn. 1, noting again that each turbine used in this assessment is an identical unit:

$$\boldsymbol{ER_{NO_X} = 38\ ppmv \times \frac{(20.9 - 14.4\%)}{(20.9 - 15\%)} \times \frac{101.3\ kPa \times 28\ g/mol}{8.314\ L.kPa/mol.K \times 725.15\ K} \times 256 \frac{Dm^3}{s} = 8.3\ g/s}$$

A sample calculation to estimate the $PM_{2.5}$ emissions from each turbine when burning fuel oil is as follows using Eqn. 2, noting again that each turbine proposed for the Facility are identical in this assessment:

$$\boldsymbol{ER_{PM2.5} = 0.012 \frac{lb}{MMBTU} \times \frac{421\ MMBTU}{h} \times \frac{1\ h}{3600\ s} \times \frac{2200\ g}{lb} = 0.64\ g/s}$$

3.1.9 Modelling Source Parameters

The source characteristics and emission rates used in the modelling are summarized in Table 3-5. The stack dimensions and exhaust gas characteristics are based on preliminary design information and vendor data for similar combustion turbines. Since operation on light fuel oil results in higher magnitude emissions, this operating scenario was considered and modelled in this assessment. Operation on natural gas was not modelled as the resulting GLC will be less than those from fuel oil.

Table 3-5: Model Inputs –Source Characteristics

Source ID	Location (m)		Base Elevation (m)	Stack Height (m)	Exhaust Gas Temperature (K)	Exhaust Gas Velocity (m/s)	Stack Diameter (m)	Emission Rate (g/s)		
	UTM E	UTM N						NO_x	CO	$PM_{2.5}$
CTG1	520106	5032268	152	30	725.15	28.99	3.5	8.28	6.63	0.6378
CTG2	520126	5032260	152	30	725.15	28.99	3.5	8.28	6.63	0.6378
CTG3	520145	5032252	152	30	725.15	28.99	3.5	8.28	6.63	0.6378
CTG4	520164	5032244	152	30	725.15	28.99	3.5	8.28	6.63	0.6378
CTG5	520184	5032236	152	30	725.15	28.99	3.5	8.28	6.63	0.6378
CTG6	520203	5032228	152	30	725.15	28.99	3.5	8.28	6.63	0.6378
Total (300MW)								**49.7**	**39.8**	**3.8**

3.1.10 Background Concentrations

Background concentrations of air contaminants considered in the study were estimated using ambient air quality data measured at the nearest ECCC National Air Pollution Surveillance (NAPS) program stations. The background data is added to the maximum model predictions to account for existing air contaminant concentrations within the study area (ECCC 2025a).

Hourly data measured at the Pictou Station from 2021 to 2023 were used to estimate NO_x, O_3, and $PM_{2.5}$ background concentrations. This station is located approximately 27 km to the north of the Marshdale Site. Hourly data to estimate CO background concentrations were obtained from 2021 to 2023 data measured at the Halifax Station, which is the nearest station with CO measurement data available. This station is located in approximately 100 km southeast of the Marshdale site.

The background values were estimated generally in accordance with the Nova Scotia AAGD, Section 4 using the NAPS AAQM data, which refers to the approach defined in the Alberta Environment and Parks (AEP) Air Quality Model Guideline (AEP 2021). Background $PM_{2.5}$ concentrations were estimated using the statistical basis of the CAAQS, since the $PM_{2.5}$ results will be compared to the CAAQS. The background concentrations applied in the study are summarized in Table 3-6.

Table 3-6: Estimated Background Concentrations

Air Contaminant	Average Period	Background Concentration (µg/m³)	NS Max Permissible GLC/CCME CAAQS (µg/m³)	Percent (%) of Limit	Notes
$PM_{2.5}$	24-hour	11.1	27	41	3- year average of annual 24-h 98th percentiles (2021 to 2023)
	Annual	5.0	8.8	56	3-year average of annual averages (2021 to 2023)
NO_2	1-hour	3.8	400	<1	3-year maximum of annual hourly 90th percentiles (2021 to 2023)
	Annual	1.8	100	2	3-year maximum of annual averages (2021 to 2023)
CO	1-hour	252	34,600	<1	3-year maximum of annual hourly 90th percentiles (2021 to 2023)
	8-hour	240	12,700	2	3-year maximum of 8-h rolling average with hourly values >90th percentile excluded (2021 to 2023)

3.1.11 Conversion of NO_x to NO_2

NO_x is composed of Nitric Oxide (NO) and Nitrogen Dioxide (NO_2), and of the species that make up NO_x, only NO_2 is regulated. The ratio of NO_2 to NO_x in exhaust gases from combustion sources is dependent on the combustion process. For example, applications with higher temperatures and pressures in the combustion zone result in higher NO_2 to NOx ratios at the point of release. Subsequently, the conversion of NO to NO_2 continues in the plume as it travels downwind because of reactions with atmospheric O_3.

The conversion of NO to NO_2 must be accounted for when predicting concentrations of NO_2 and this was achieved using the Ozone Limited Method (OLM). In order to model OLM in AERMOD, ambient ozone concentrations are required as well as in-stack ratios of NOx to NO_2 as inputs to model. Since actual NO_x to NO_2 ratios were not available for the modelled sources, the in-stack ratio of 0.6 for compressors and gas turbines from the Newfoundland and Labrador department of Environment and Climate Change (NLDECC) Guideline for Plume Dispersion Modelling was applied (NLDECC 2012).

OLM compares the ambient concentration of O_3 to the maximum predicted concentration of NO_x to determine the limiting factor in the generation of NO_2. If the O_3 concentration is greater than 90% of the predicted NO_x concentration, then total conversion is assumed. When this condition is not met, the NO_2 formation is limited by the ambient O_3 concentration. The resulting NO_2 concentrations are then estimated from the sum of NO_2 produced by in-stack thermal processes and the conversion of NO to NO_2 by oxidation with ambient O_3.

Onsite O_3 data was not available, as such, the hourly O_3 concentrations measured at the Pictou Station were used in this assessment. The hourly O_3 concentrations measured in 2023 were used to represent hourly O_3 concentrations over the 5-year period of the model (2020 to 2024).

3.2 Modelling Results

The modelling results are provided and compared with applicable ambient air quality limits in Table 3-7.

In accordance with the NS AAGD, meteorological anomalies have been removed from the results presented in the tables below. The 8-highest hourly predictions per year and the 1st highest 8-hour periods are removed.

The maximum predicted GLCs associated with worst-case operation of the power plant (with up to 300 MW capacity) complies with the applicable Nova Scotia Maximum Permissible GLCs. Also, as indicated in results, the maximum $PM_{2.5}$ GLCs are within the applicable CAAQS of 27 and 8.8 µg/m^3 for the 24-hour and annual averaging periods. As such, since TSP emissions from combustion turbines are expected to be equivalent to $PM_{2.5}$, the maximum predicted TSP GLCs will also comply with the less stringent 24-hour and annual average limits of 120 and 70 µg/m^3, respectively.

The maximum predicted GLCs at the sensitive receptors within the study area were also well below the applicable NS Maximum Permissible GLCs and CCME CAAQS.

Isopleths showing the predicted concentrations graphically are provided in Appendix B (as indicated in Table 3-7).

Table 3-7: Air Quality Modelling Results

Air Contaminant	Averaging Period	Background Concentration (µg/m^3)	Maximum Predicted GLC (µg/m3)	Total GLC (µg/m3)	Applicable Limit (µg/m^3)	Percentage of Limit (%)	Isopleth Figure No.
CO	1-Hour	252	80.8	333	34,600	<1%	NA
	8-hour	240	57.2	298	12,700	2%	NA
NO_2	1-Hour	3.76	88.0	91.7	400	23%	Figure B-1
	Annual	1.83	2.01	3.84	100	4%	NA
$PM_{2.5}$	24-Hour	11.1	1.41	12.6	27/23[(a)]	46%	Figure B-2
	Annual	4.97	0.163	5.13	8.8/8[(a)]	58%	Figure B-3

Notes:
(a) 3-year rolling average of annual 24-h 98th percentiles
(b) 3-year rolling average of annual averages

4. GHG Emissions Assessment

GHG emissions were estimated from the combustion of natural gas and light fuel oil (No. 2 diesel) in the six (6) combustion turbines. The annual fuel consumption was estimated based on a 25% capacity factor and an assumed annual fuel split of 80% natural gas and 20% diesel fuel. The emissions were calculated using the anticipated annual fuel consumption (of natural gas and fuel oil) and published emission factors from the ECCC *GHG Offset Credit System - Emission Factors and Reference Values* (ECCC 2024a, 2024b). The project related GHG emissions were also compared with Nova Scotia provincial and Canadian national total GHG releases, taken from the ECCC *National Inventory Report 1990-2023: GHG Sources and Sinks in Canada* (ECCC 2025b).

The expected annual operating data are shown in Table 4-1.

The emission factors used for the estimates are provided in Table 4-2 and the estimated annual GHG Emissions from the project are summarized in Table 4-3.

The NS provincial and Canadian National GHG total emissions for 2023 are shown and compared with project emissions in Table 4-4.

Table 4-1: Annual Operational Data

Parameter	Unit	Value
Power Generation	MWh/a	657,000
Operating Hours	hrs/a	2,190
Natural Gas Consumption (80%)	Nm^3/a	120,265,628
Fuel Oil Consumption (20%)	L/a	33,209,295

Table 4-2: GHG Emission Factors Applied

Fuel Type	Emission Factor (kg GHG/m^3 fuel consumption)		
	CO_2	CH_4	N_2O
Light Fuel Oil - Electric Utilities (2025)	2753	0.18	0.031
Marketable NG (NS 2025)	1.919	-	-
Natural Gas - Electric Utilities (2025)	-	0.00049	0.000049

Table 4-3: Project Annual GHG Emissions Estimates

GHG	Annual Emissions (t/a)		GWP	Annual Emissions (t/a CO_2e)
	Natural Gas	Fuel Oil		
CO_2	230,790	91,425	1	322,215
CH_4	58.9	5.98	28	1,817
N_2O	5.89	0.00163	265	1,562
Total				325,594

Table 4-4: Provincial and National GHG Emissions

Parameter	2023 Annual Emissions (kt/a CO_2e)	Project percent of Annual Emissions
Project Emissions (kt/a CO_2e)	-	326
NS Provincial Total	13,500	2.4%
National Total	694,000	0.05%

Based on the estimated GHG emissions expected from the project once operational (assuming 2,190 hours of operation per year, 20% on diesel fuel and 80% on natural gas), the associated releases would account for 2.4% of provincial and 0.05% of national total GHG emissions (based on 2023 reporting data, ECCC 2025b). Although the project will result in direct GHG emissions, it is expected that it will offset coal fired generation which is currently used to meet the power grid requirements, with a lower GHG emissions intensity. The new power plant will also facilitate the ongoing expansion and use of renewable power capacity leading to an overall decrease in the GHG emissions intensity of the Nova Scotia electrical grid.

5. Conclusions

The IESO Nova Scotia are planning a fast-acting power generation facility in Pictou County. New fast-acting generators will replace existing coal-fired power generation to optimally manage power supply and reliability in conjunction with the significant quantities of variable-production renewable energy. The proposed power plant site is located near to Marshdale, Nova Scotia and will have a net power generation capacity of up to 300 MW.

At the request of the IESO Nova Scotia, Hatch has completed air quality dispersion modelling to assess the project impacts to air quality. Emissions modelling was performed to assess NO_2, CO and $PM_{2.5}$ emissions resulting from combustion turbine generator operation on light fuel oil and natural gas. Light fuel oil emission rates are used as the basis of the assessment as the emission rates on this fuel are higher than the emission rates applicable to natural gas operation. The modelling results were compared with applicable NS Maximum Permissible GLCs (NO_2 and CO) and CCME CAAQS ($PM_{2.5}$) to assess compliance. Hatch has also completed an assessment of the expected Greenhouse Gas (GHG) emissions.

The results of the emissions dispersion model indicate the maximum predicted GLCs associated with the maximum operation of the power plant on light fuel oil generating up to 300 MW of capacity, comply with the applicable Nova Scotia Maximum Permissible GLCs and CCME CAAQS. Furthermore, the maximum predicted GLCs at the sensitive receptors within the study area were found to be well below the applicable limits.

Based on 2023 GHG reporting data (ECCC 2025b), the estimated GHG emissions from the project would account for 2.4% of provincial and 0.05% of national total GHG emissions. Although the project will result in direct GHG emissions, it is expected that it will offset coal fired generation which is currently used to meet the power grid requirements, with a lower GHG emissions intensity. The new power plant will also facilitate the ongoing expansion and use of renewable power capacity leading to an overall decrease in the GHG emissions intensity of the Nova Scotia electrical grid.

6. References

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Appendix A:
Emissions Inventory

Model Inputs

Natural Gas

Source	Location (m)		Base Elevation (m)	Stack Height (m)	Exhaust Gas Temperature (K)	Exhaust Gas Velocity (m/s)	Stack Diameter (m)	Emission Rates (g/s)		
	UTM - X	UTM - Y						NOX	CO	PM2.5
CTG1	520106	5032268	152	30	721.65	29.19	3.5	5.35	6.52	0.351
CTG2	520126	5032260	152	30	721.65	29.19	3.5	5.35	6.52	0.351
CTG3	520145	5032252	152	30	721.65	29.19	3.5	5.35	6.52	0.351
CTG4	520164	5032244	152	30	721.65	29.19	3.5	5.35	6.52	0.351
CTG5	520184	5032236	152	30	721.65	29.19	3.5	5.35	6.52	0.351
CTG6	520203	5032228	152	30	721.65	29.19	3.5	5.35	6.52	0.351
Total (300MW)								**32.1**	**39.1**	**2.11**

Fuel Oil MarshdaleU MarshdaleU MarshdaleBase Elev

Source	Location (m)		Base Elevation (m)	Stack Height (m)	Exhaust Gas Temperature (K)	Exhaust Gas Velocity (m/s)	Stack Diameter (m)	Emission Rates (g/s)		
	UTM - X	UTM - Y						NOX	CO	PM2.5
CTG1	520106	5032268	152	30	725.15	28.99	3.5	8.28	6.63	0.638
CTG2	520126	5032260	152	30	725.15	28.99	3.5	8.28	6.63	0.638
CTG3	520145	5032252	152	30	725.15	28.99	3.5	8.28	6.63	0.638
CTG4	520164	5032244	152	30	725.15	28.99	3.5	8.28	6.63	0.638
CTG5	520184	5032236	152	30	725.15	28.99	3.5	8.28	6.63	0.638
CTG6	520203	5032228	152	30	725.15	28.99	3.5	8.28	6.63	0.638
Total (300MW)								**49.7**	**39.8**	**3.83**

Operational Information - LM6000 (or equivalent)

Primary Fuel	Natural Gas	80%
Secondary Fuel	Light Fuel Oil (diesel)	20%
Annual Capacity Factor	25%	
Net Generating Capacity	300 MW Nominal @ Guaranteed Reference Conditions	
Operating Hours per year	2190	

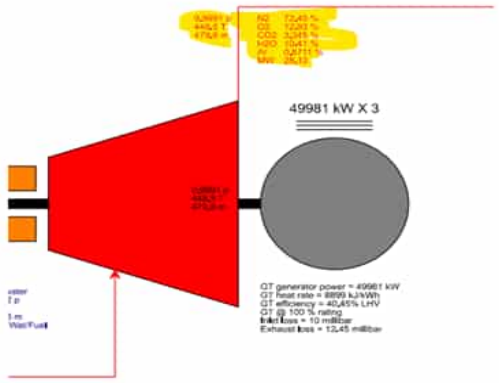
Power Generation and Fuel Estimates			
Thermal Efficiency	0.4045	NG	Assumed (based on similar operation - LHV)
	0.3988	FO	
Power Generation			
Power Gen - Shaft Power	50.0	MW	NG
	49.2	MW	FO
Estimated Heat from fuel	123.56	MW	NG
	444.82	GJ/hr	
	123.38	MW	FO
	444.15	GJ/hr	
NG LHV	983	BTU/scf	Lower and Higher Heating Values of Gas, Liquid and Solid Fuels
FO LHV (low-sulfur diesel)	129488	BTU/gal	

Exhaust Gas Properties			
O2 Stack concentration - NG	12.93	%	Assumed (based on similar operation), wet basis
O2 Stack concentration - FO	13.21	%	Assumed (based on similar operation), wet basis
NG Stack moisture content	10.41	%	Assumed (based on similar operation)
FO Stack moisture content	8.252	%	Assumed (based on similar operation)
Exhaust Gas Temp	721.65	K	NG - Assumed based on Similar Operation
	725.15	K	FO - Assumed based on Similar Operation
Exhaust Gas Pressure	0.9991	atm(a)	NG/FO - Assumed based on Similar Operation

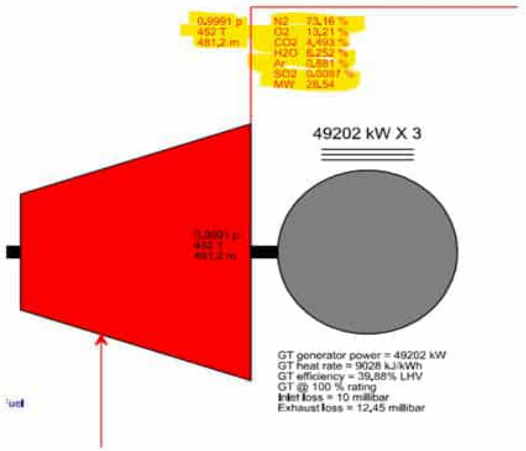
Exhaust Gas Flow rates		
Ideal Gas Constant, R	0.08206	L*atm/gmol*K
Molecular Weights		
NG	28.13	g/gmol
FO	28.54	g/gmol
Exhaust gas Mass Flow		
Natural Gas	479.8	t/h
Fuel Oil	481.2	t/h
Volume Flow		
Natural Gas	280.82	Am3/s
Fuel Oil	278.94	Am3/s
Assumed Stack Diameter	3.5	m
Exit Velocity		
NG	29.19	m/s
FO	28.99	m/s

Note the units are as follows:
P: atm(a)
T: C
M: t/h
Composition: Vol%

Gas:



Diesel:



Stack Flow and Emission Estimates

Stack Gas Properties

Natural Gas			
O2 stack concentration	14.4324143	%	wet basis
Stack exhaust gas flow	252	Dm3/s	@ Stack temp and pressure
Fuel Oil			
O2 stack concentration	14.398134	%	wet basis
Stack exhaust gas flow calc	256	Dm3/s	@ Stack temp and pressure

Emissions Estimates

Standard Conditions			
Tstk	721.65	K	NG
	725.15	K	FO
Pstk	101.3	kPa	
Ideal Gas Const, R	8.314	L kPa/mol K	

Emissions Estimates

Air Contaminant	**MW g/gmol**	**Stack Gas Concentrations**			**Emission Rate (kg/hr)**
		15% O2 (ppmd)	**at stack O2 (ppmd)**	**mg/Dm3 @ Ts, Ps**	
Natural Gas					
NOX	46	25	27.4	21.3	19.3
CO	28	50	54.8	25.9	23.5
#2 Fuel Oil					
NOX	46	38	41.9	32.4	29.8
CO	28	50	55.1	25.9	23.9

Stack concentrations based on ECCC (Reducing nitrogen oxide emissions from natural gas-fueled stationary combustion turbines: Guidelines (2017)) and Ontario MECP (Guideline A-5 Atmospheric Emissions from Stationary Combustion Turbines) stack limits

PM emissions Calcs - EF basis

Heat input from fuel	421.61	MMBTU/hr	NG
	420.97	MMBTU/hr	FO
PM NG EF	6.60E-03	lb/MMBTU	
PM FO EF	1.20E-02	lb/MMBTU	
NG PM Er	1.26	kg/hr	
FO PM Er	2.30	kg/hr	

US EPA AP-42 Chapter 3.1 Stationary Gas Turbines - https://www.epa.gov/sites/default/files/2020-10/documents/c03s01.pdf

Table 3.1-2a. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM STATIONARY GAS TURBINES

Pollutant	Emission Factors[a] - Uncontrolled			
	Natural Gas-Fired Turbines[b]		Distillate Oil-Fired Turbines[d]	
	(lb/MMBtu)[c] (Fuel Input)	Emission Factor Rating	(lb/MMBtu)[e] (Fuel Input)	Emission Factor Rating
CO_2[f]	110	A	157	A
N_2O	0.003[g]	E	ND	NA
Lead	ND	NA	1.4 E-05	C
SO_2	0.94S[h]	B	1.01S[h]	B
Methane	8.6 E-03	C	ND	NA
VOC	2.1 E-03	D	4.1 E-04[j]	E
TOC[k]	1.1 E-02	B	4.0 E-03[l]	C
PM (condensible)	4.7 E-03[l]	C	7.2 E-03[l]	C
PM (filterable)	1.9 E-03[l]	C	4.3 E-03[l]	C
PM (total)	6.6 E-03[l]	C	1.2 E-02[l]	C

[a] Factors are derived from units operating at high loads (>80 percent load) only. For information on units operating at other loads, consult the background report for this chapter (Reference 16), available at "www.epa.gov/ttn/chief". ND = No Data, NA = Not Applicable.

[b] SCCs for natural gas-fired turbines include 2-01-002-01, 2-02-002-01 & 03, and 2-03-002-02 & 03.

[c] Emission factors based on an average natural gas heating value (HHV) of 1020 Btu/scf at 60°F. To convert from (lb/MMBtu) to (lb/10^6 scf), multiply by 1020. Similarly, these emission factors can be converted to other natural gas heating values.

[d] SCCs for distillate oil-fired turbines are 2-01-001-01, 2-02-001-01, 2-02-001-03, and 2-03-001-02.

[e] Emission factors based on an average distillate oil heating value of 139 MMBtu/10^3 gallons. To convert from (lb/MMBtu) to (lb/10^3 gallons), multiply by 139.

[f] Based on 99.5% conversion of fuel carbon to CO_2 for natural gas and 99% conversion of fuel carbon to CO_2 for distillate oil. CO_2 (Natural Gas) [lb/MMBtu] = (0.0036 scf/Btu)(%CON)(C)(D), where %CON = weight percent conversion of fuel carbon to CO_2, C = carbon content of fuel by weight, and D = density of fuel. For natural gas, C is assumed at 75%, and D is assumed at 4.1 E+04 lb/10^6scf. For distillate oil, CO_2 (Distillate Oil) [lb/MMBtu] = (26.4 gal/MMBtu) (%CON)(C)(D), where C is assumed at 87%, and the D is assumed at 6.9 lb/gallon.

[g] Emission factor is carried over from the previous revision to AP-42 (Supplement B, October 1996) and is based on limited source tests on a single turbine with water-steam injection (Reference 5).

[h] All sulfur in the fuel is assumed to be converted to SO_2. S = percent sulfur in fuel. Example, if sulfur content in the fuel is 3.4 percent, then S = 3.4. If S is not available, use 3.4 E-03 lb/MMBtu for natural gas turbines, and 3.3 E-02 lb/MMBtu for distillate oil turbines (the equations are more accurate).

[j] VOC emissions are assumed equal to the sum of organic emissions.

[k] Pollutant referenced as THC in the gathered emission tests. It is assumed as TOC, because it is based on EPA Test Method 25A.

[l] Emission factors are based on combustion turbines using water-steam injection.

Greenhouse Gas Emissions Estimates

Parameter	Unit	Value
Power Generation	MWh/a	657,000
Operating Hours	hrs/a	2,190
Natural Gas Consumption (80%)	Nm3/a	120,265,628
Fuel Oil Consumption (20%)	L/a	33,209,295

Emission Factors - https://publications.gc.ca/collections/collection_2024/eccc/En84-294-2024-eng.pdf

Fuel Type	Emission Factor (kg/m3)		
	CO2	CH4	N2O
Light Fuel Oil (Electric Utilities 2025)	2753	0.18	0.031
Marketable NG (NS 2025)	1.919	-	-
Natural Gas - Electric Utilities (2025)	-	0.00049	0.000049

From Table 2.1/2.2 NG and 4.2 FO

Emissions Estimates

GHG	Annual Emissions (T/a)		GWP	Annual Emissions CO2e (T/a)
	Natural Gas	Fuel Oil		
CO2	230,790	91,425	1	322,215
CH4	58.9	5.98	28	1,817
N2O	5.89	0.00163	265	1,562
Total				325,594

GWP from ECCC (IPCC 5th Assessment Report):
https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/quantification-guidance/global-warming-potentials.html

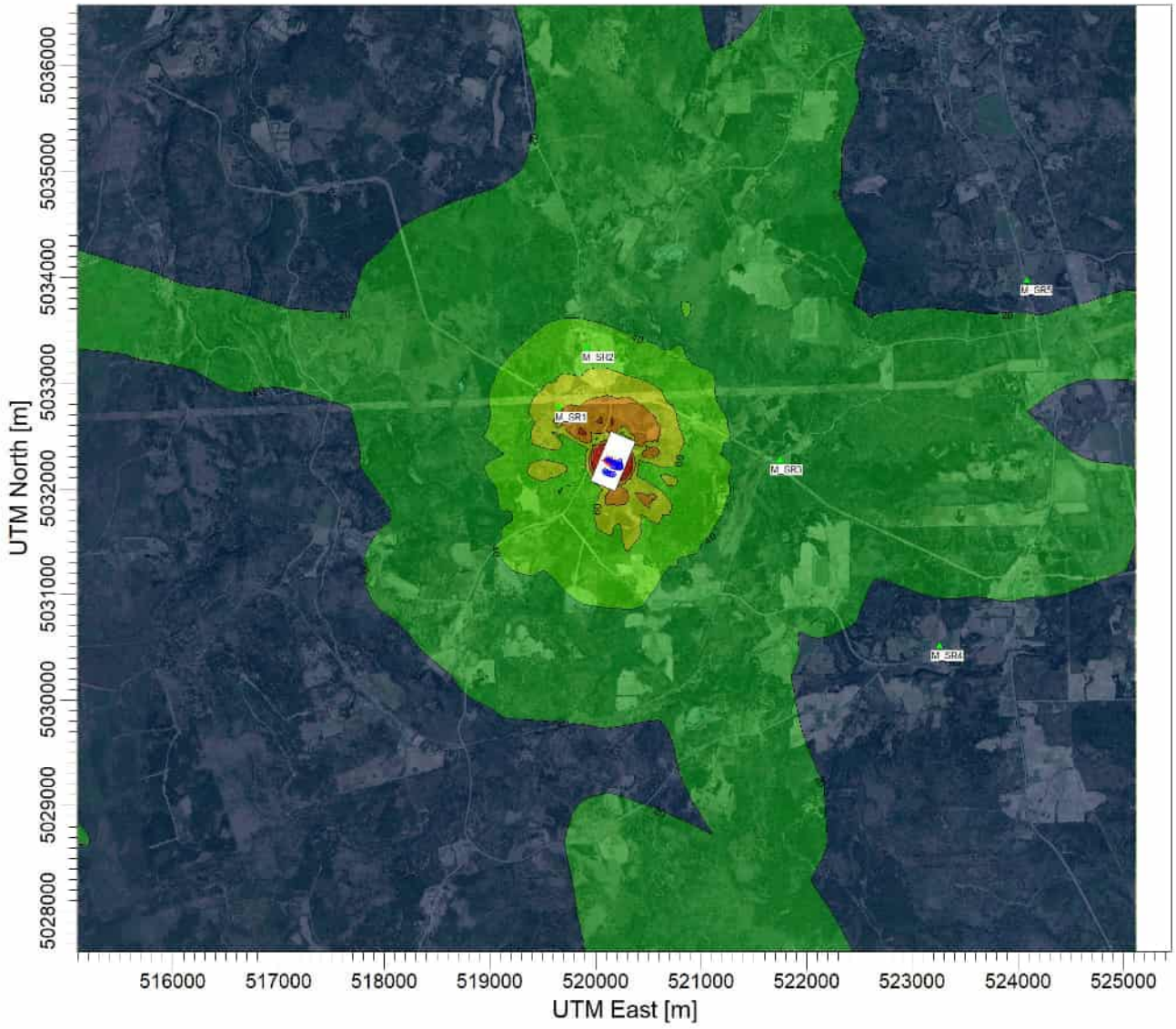
	CO2e (kt/a)		
	2023 Emissions	Source	Project Percent of total
NS Provincial Total	13500	Table A11-6	2.4%
National Total	694000	Table A9-2	0.05%

https://publications.gc.ca/collections/collection_2025/eccc/En81-4-2023-3-eng.pdf

Appendix B: Isopleths

PROJECT TITLE:

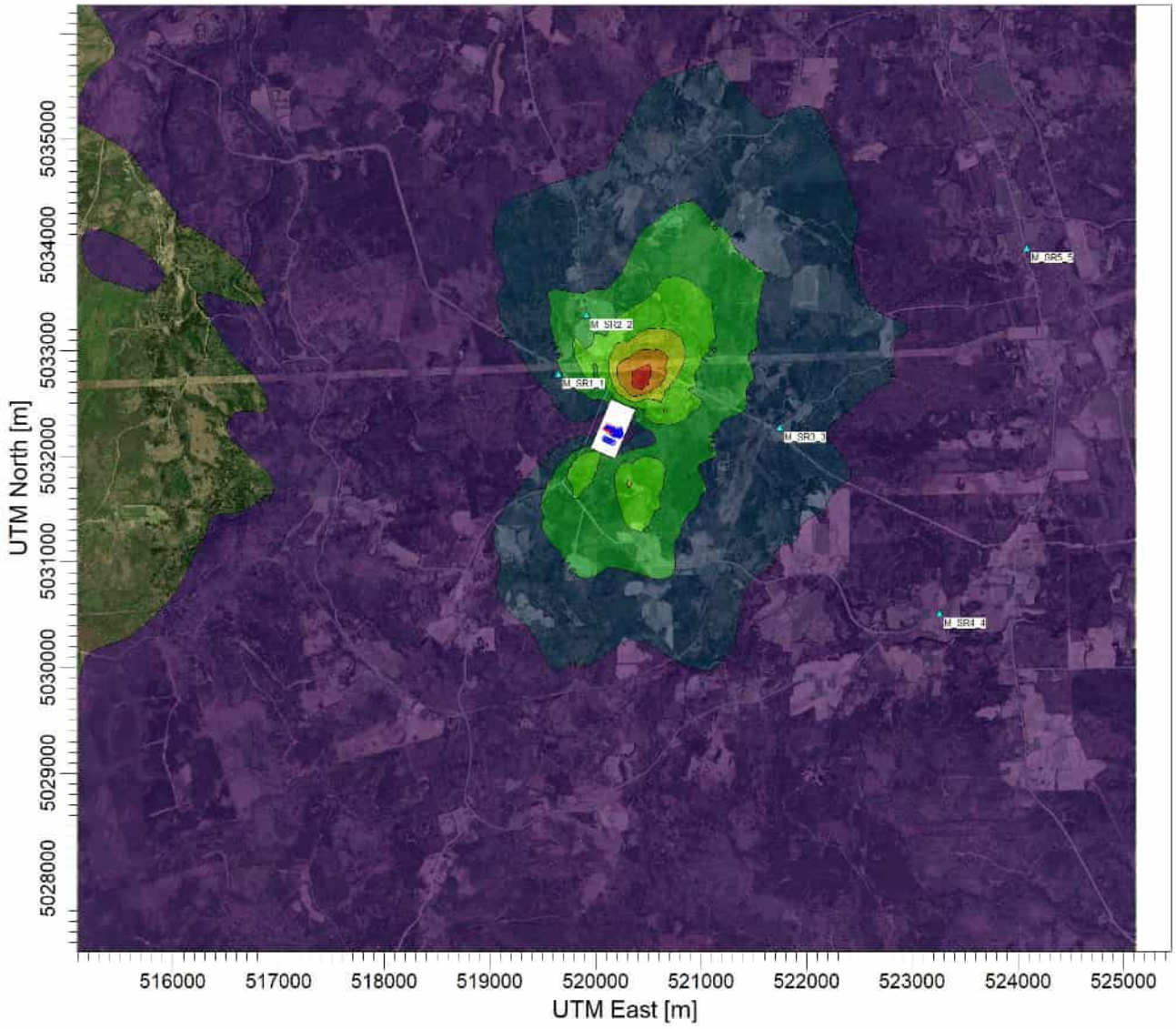
Figure B-1: Max Predicted 1-hour NO2 Concentrations (incl Background)
Marshdale Site - 300 MW Case



COMMENTS: Background: 3.76 ug/m3 NSECC Max Permissible GLC: 400 ug/m3	SOURCES: **6**	COMPANY NAME: **IESO Nova Scotia: Fast Acting Natural Gas Power Generation Facility**	
	RECEPTORS: **1439**	MODELER: **CL**	HATCH
	OUTPUT TYPE: **Concentration**	SCALE: 1:65,159 0 2 km	
	MAX: **211 ug/m^3**	DATE: **11/13/2025**	PROJECT NO.: **H376817**

PROJECT TITLE:

Figure B-2: Predicted 24-hour PM2.5 Concentrations (incl Background)
Marshdale Site - 300 MW Case



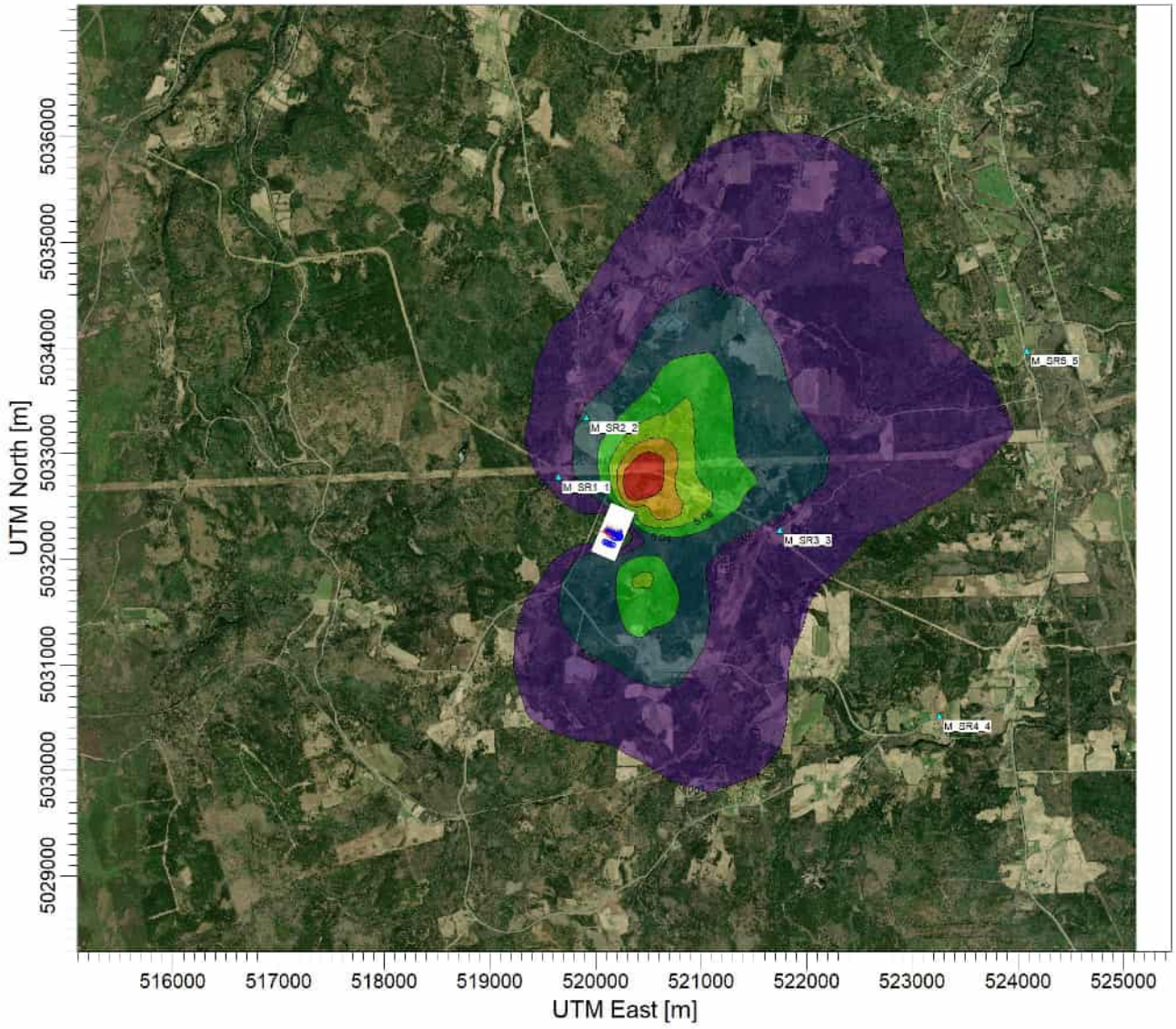
PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL ug/m^3

Max: 12.6 [ug/m^3] at (520456.00, 5032728.00)

COMMENTS: Background: 11.2 ug/m3 CCME CAAQS: 27 ug/m3 (Max 3-year rolling Avg Annual 24-hour 98th Percentiles)	SOURCES: **6**	COMPANY NAME: **IESO Nova Scotia: Fast Acting Natural Gas Power Generation Facility**	
	RECEPTORS: **1444**	MODELER: **CL**	HATCH
	OUTPUT TYPE: **Concentration**	SCALE: 1:65,159 0 2 km	
	MAX: **12.6 ug/m^3**	DATE: **11/13/2025**	PROJECT NO.: **H376817**

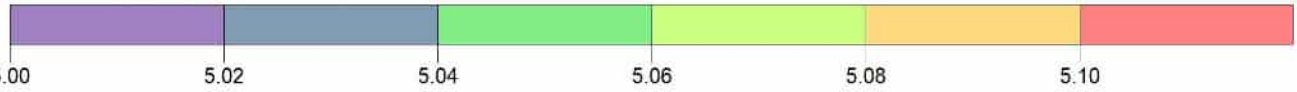
PROJECT TITLE:

Figure B-3: Predicted Annual PM2.5 Concentrations (incl Background)
Marshdale Site - 300 MW Case



POST/PLOT FILE OF ANNUAL VALUES FOR YEAR 1 FOR SOURCE GROUP: ALL ug/m^3

Max: 5.13 [ug/m^3] at (520456.00, 5032778.00)



COMMENTS: Background: 5.0 ug/m3 CCME CAAQS: 8.8 ug/m3 (Max 3-year rolling Annual Avg)	SOURCES: **6**	COMPANY NAME: **IESO Nova Scotia: Fast Acting Natural Gas Power Generation Facility**	
	RECEPTORS: **1444**	MODELER: **CL**	HATCH
	OUTPUT TYPE: **Concentration**	SCALE: 1:65,159 0 2 km	
	MAX: **5.13 ug/m^3**	DATE: **11/13/2025**	PROJECT NO.: **H376817**

Table 1: Mobile Construction Equipment GHG Quantification – Fast Acting Natural Gas Power Generation Facility – Marshdale *Project # 25-12222*

Major Equipment Type/ Model	Estimated Number of Operating Equipment Required	Number of Years	Operating Days Per Year	Operating Days	Runtime/Day (hrs)	Average Fuel Consumption (L/hr)	Total Fuel consumption (L)	Fuel Type	Emission coefficient ($kgCO_2e/L$)	Total CO_2e Emissions (kg)	Total CO_2e (tonnes)
Dozers	3	2	250	500	14	33	701,400	Diesel	2.68	1,879,752	1,880
Excavators	3	2	250	500	14	31	656,250	Diesel	2.68	1,758,750	1,759
Dump Trucks	3	2	250	500	14	25	525,000	Diesel	2.68	1,407,000	1,407
Loaders	3	2	250	500	14	20	420,000	Diesel	2.68	1,125,600	1,126
Trucks (Heavy Diesel)	3	2	250	500	14	30	637,000	Diesel	2.68	1,707,160	1,707
Trucks (Light Gasoline)	8	2	250	500	14	15	840,000	Gasoline	2.31	1,940,400	1,940
Cranes and Manlifts	3	2	250	500	14	49	1,023,750	Diesel	2.68	2,743,650	2,744
Tree Clearing and Harvesting Equipment	3	2	250	500	14	30	630,000	Diesel	2.68	1,688,400	1,688
Pile Boring/Driving Machines	3	2	250	500	14	18	378,000	Diesel	2.68	1,013,040	1,013
Vacuum Trucks	3	2	250	500	14	30	630,000	Diesel	2.68	1,688,400	1,688
Generators	3	2	250	500	14	18	378,000	Diesel	2.68	1,013,040	1,013
Rollers	3	2	250	500	14	10	210,000	Diesel	2.68	562,800	563
Graders	3	2	250	500	14	25	525,000	Diesel	2.68	1,407,000	1,407
									Total Emissions (tCO2e/year)		**19,934.99**

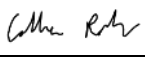
Source: Canada's Greenhouse Gas Quantification Requirements Version 7.0

Steel Production			
Parameter/Variable	Value	Unit	Comments
Steel Fabrications	1,092	m^3	Assumed based upon Proponent provided Site Plan
Steel Density	8,000	kg/m^3	The Engineering Toolbox, n.d.
Steel Mass in kg	8,735,351	kg	(B5*B6)
Steel Mass in tonne	8,735	tonne	1 kg = 0.001 Tonnes
Facility Foundation			
Parameter/Variable	Value	Unit	Comments
Concrete Production Quantity	31,528	m^3	Assumed based upon Proponent provided Site Plan
Concrete Density	2,400	kg/m^3	The Engineering Toolbox, n.d.
Concrete Mass in kg	75,666,000	kg	B17*B18
Concrete Mass in tonne	75,666	tonne	1 kg = 0.001 Tonnes
Concrete Truck	22	tonne/truck	Source: Ready Mixed Concrete Association of Ontario, n.d
	3,504	trucks	(B20/B22) Number of concrete deliveries
Heavy Duty Truck (Steel Delivery)	8,735	tonnes	Based on weights provided by the Proponent
	38	tonne/truck	No more than 49,500 Gross Vehicle Weight (Assumed unladen weight of 11.5 tonnes)
	230	trucks	(B25/B26) Required trucks deliveries
Concrete Transportation Distances			
Distance Travelled (freight)	21	km	Based on one-way trip from Concrete Supplier to Project Area
Distance Travelled (no freight)	21	km	Based on one-way trip from Concrete Supplier to Project Area
Steel Transportation Distances			
Distance Travelled (freight)	83	km	Based on one-way trip from Steel Supplier to Project Area
Distance Travelled (no freight)	83	km	Based on one-way trip from Steel Supplier to Project Area
Emission Factors			
Parameter/Variable	Value	Unit	Comments
Concrete Production	300	g CO_2e/kg	0.3 kg CO_2e/kg [Source: GHGenius v5.0d].
Concrete Truck (freight)	135	g $CO_2e/tonne{\cdot}km$	Freight emissions for calculating GHGs from freight (materials delivery, shipment of product to market, etc.) [Source: GHGenius v5.0d].
Concrete Truck (no freight)	1,106	g CO_2e/km	Emissions for calculating GHGs where the volume of fuel consumed is unknown but the distance travelled is known [Source: GHGenius v5.0d]
General Steel Production	1.5	t CO2e/tonne	Estimated from the UK's general steel type, excluding stainless steel (Inventory of Carbon & Energy (ICE), Version 2.0)
Heavy Duty Truck (freight)	135	g $CO_2e/tonne{\cdot}km$	Freight emissions for calculating GHGs from freight (materials delivery, shipment of product to market, etc.) [Source: GHGenius v5.0d].
Heavy Duty Truck (no freight)	1,106	g CO_2e/km	Emissions for calculating GHGs where the volume of fuel consumed is unknown but the distance travelled is known [Source: GHGenius v5.0d]
Conversion Factor	0.000001	t CO_2e/g	1 g = 0.000001 Tonnes
Concrete Production Emissions	22,699.80	t CO_2e/year	B19*B37*B44
Concrete Truck (freight) Emissions	214.57	t CO_2e/year	B22*B23*B30*B38*B44
Concrete Truck (no freight) Emissions	81.38	t CO_2e/year	B23*B31*B39*B44
Steel Production Emissions	13,103.03	t CO_2e/year	B8*B41
Heavy Duty Truck (freight) Emissions	97.93	t CO_2e/year	B26*B27*B33*B42*B44
Heavy Duty Truck (no freight) Emissions	21.11	t CO_2e/year	B27*B34*B43*B44
Total Emissions (Construction Phase)	**36,217.83**	**t CO_2e/year**	**SUM(B40:B46)**

APPENDIX C
NOISE IMPACT ASSESSMENT

Nova Scotia Independent Energy System Operator: Combustion Turbine Power Plant Owners Engineer

Marshdale Community Noise Impact Assessment

					Meghari, Karim	
2025-11-27	0	Issued for Use	M. Andargie	M. Choy	K. Meghari	C. Rollings
Date	**Rev.**	**Status**	**Prepared By**	**Checked By**	**Approved By**	**Approved By**
			HATCH			**Client**

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1. Introduction

Independent Energy System Operator of Nova Scotia (IESO Nova Scotia) is planning a fast-acting power generation facility in Pictou County. New fast-acting generators will replace the existing fleet of coal-fired generators to optimally manage grid supply and reliability in conjunction with significant amounts of variable-production renewable energy.

The proposed site is located near Marshdale, Nova Scotia. The facility will have a power generation capacity of up to 300 MW.

2. Facility Description

The power generating station is planned be a multi-unit simple cycle power plant employing aeroderivative combustion turbine technology operation. The plant will use natural gas as the primary fuel and light fuel oil as the secondary fuel. The plant has been modelled to have six (6) 50MW combustion turbine generators with a net generating capacity of up to 300 MW and a 360 MVA substation. This configuration represents a conservative assumption for noise compared to a single large combustion turbine.

The proposed site location is in Marshdale, Nova Scotia. The site will be approximately 125,000 m^2. The site layout is shown in Appendix B.

3. Noise Criteria

The Nova Scotia Department of Environment and Climate Change (NSECC) outlines community noise requirements in their published Guidelines for Environmental Noise Measurement and Assessment [1]. Table 3-1 summarizes the Guidelines' permissible sound levels based on geographic classification. The NSECC defines permissible sound levels as the maximum comprehensive sound levels that are permitted to be experienced at receptor locations. The comprehensive sound level is the maximum noise level comprised of the 'baseline' plus the 'project (target)' noise levels. The comprehensive noise level must be equal to or less than the permissible sound levels presented in
Table 3-1.

Table 3-1: Permissible Sound Levels

Geographic Classification	$L_{Aeq, 1hr}$ (dBA)		
	Day (7:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 7:00)
Rural	53	48	40
Urban Residential	58	53	45
Industrial	65	60	55

4. Receptor Locations

Table 4-1 presents the representative worst case receptor locations. Refer to Appendix B for illustrations identifying the locations of representative receptors in relation to the proposed site.

A desktop review identifies that all receptors surrounding the proposed site are best described as 'rural residential'. NSECC defines rural residential areas as areas with a population of less than 1,000 with a population density of less than 400 persons/km^2. Rural residential areas are commonly described as agricultural, wilderness, recreational or other areas dominated by natural sounds. A zoning map is included in Appendix A.

Table 4-1: Representative Receptor Locations

Receptor ID	Municipal Address	Geographic Classification	UTM Co-ordinates (m) (NAD 83 UTM Zone 20)	
			Easting	Northing
MR01	2262 White Hill Rd	Rural	519268	5031504
MR02	2731 White Hill Rd	Rural	519929	5033344
MR03	416 Marshdale Rd	Rural	521360	5034150
MR04	1651 Culloden Rd	Rural	522569	5033262
MR05	42 Grant 2 Rd	Rural	522774	5033112
MR06	342 Grant 2 Rd	Rural	521771	5032301
MR07	359 Lorne Station Rd	Rural	521177	5031118

5. Noise Source Summary

5.1 Stationary Equipment

Table 5-1 lists the major stationary noise sources within the site boundary and their sound power levels (L_W). Equipment sound power levels are estimated based on a repository of vendor and measured data. Sound powers are prorated, as needed, to the design capacity of a plant up to 300 MW.

Table 5-1: Equipment Sound Power Level

Equipment	QTY.	L_W (dB)^0									OVL (dBA)
		31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Turbine air intake	6		115	105	105	101	96	95	92	93	104
Exhaust stack	6		104	94	94	90	85	85	82	82	93
Fin fan cooler	6		112	109	107	102	99	91	88	84	104
Transformer (125 MVA)	3	101	107	109	104	104	98	93	88	81	104
Station Service Transformer (3MVA)	4	78	84	86	81	81	75	70	65	58	81
Sound power spectra are for a single piece of equipment or noise source.											

5.2 Site Traffic

A conservative model of 52 trucks per day was used for the infrequent times that the facility will be operating on light fuel oil for an extended period. Sound emissions from site trucking were based on the expected annual operating parameters based on a 25% capacity factor for the plant, with a fuel split of 80% natural gas and 20% light fuel oil.

It is assumed that the truck speed limit on the access road approaching the plant is 30 km/h and the speed limit on site is 20 km/h.

6. Assessment Methodology

A noise model of the turbine was created using Computer Aided Atmospheric Noise Propagation Modeling Software (CadnaA) which administers the ISO 9613-2 algorithm [2] for stationary sources. Road traffic noise was also incorporated into the noise model. CadnaA administers the Federal Highway Administration (FHWA) Traffic Noise Model (TNM) version 2.5 [3]. The noise model included attenuation effects due to geometric and atmospheric divergence, barriers, ground absorption. Noise calculations pursuant to ISO 9613-2 consider favorable meteorological conditions for sound propagation resulting in conservative noise levels at the receiver.

The NSECC Guidelines for Environmental Noise Measurement and Assessment [1] outlines the use of Eq 1 to calculate the comprehensive sound levels ($L_{comprehensive}$) based on the modelled project (target) noise level. The $L_{comprehensive}$ is then compared with the permissible sound levels presented in Section 3, Table 3-1.

$$L_{Comprehensive} = 10 \log_{10} 10^{\frac{L_{Baseline}}{10}} + 10^{\frac{L_{Project}}{10}} \quad \text{Eq 1.}$$

Where:

$L_{Comprehensive}$ = Comprehensive noise level (dBA)

$L_{Baseline}$ = Baseline noise level (dBA)

$L_{Project}$ = Project noise level (dBA)

6.1 Assumptions and Limitations

The following assumptions were made in completing the noise modelling:

- Measured or modelled baseline noise levels are not available at the time of authoring this report. In cases where baseline data is not available, Health Canada Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise [4] recommends using a day-night noise level (L_{dn}) of 35 dBA for rural areas. To achieve an L_{dn} of 35 dBA, it is assumed that the daytime noise level is 35 dBA, evening noise level is 30 dBA and nighttime noise level is 25 dBA. This assumption is supported by Health Canada [4] and ISO 1996-1 [5] suggestions that evening and nighttime noise levels drop by approximately 5 dB and 10 dB, respectively, compared to daytime noise levels in quiet rural areas.
- All stationary equipment operates simultaneously with maximum hourly traffic volume.
- A ground attenuation coefficient, G, of 0.7 was used to represent mixed ground in a rural area dominated by porous ground. Site topography was considered with bare ground cover.
- For two storey buildings, day and evening noise levels are modelled at 1.5 m above ground at an outdoor point of reception, and night levels are modelled at 4.5 m above ground at the building façade to represent a second storey window. For single storey buildings, day, evening and night levels are modelled at 1.5 m above the ground.
- A desktop review was completed to identify the typical number of storeys of surrounding buildings. For buildings where the number of storeys are not identified, night levels are modeled at 4.5 m above ground.
- A building permit review for vacant lots surrounding the site has not been completed. No vacant lot receptors are identified at the time of writing this report. It is recommended to complete building permit review of vacant lots surrounding the site in the future.
- It is assumed that the site speed limit is 20 km/h.
- It is assumed that the speed limit on access roads is 30 km/h.

7. Results

The comprehensive day, evening and night noise levels were calculated for each receptor and compared to the permissible noise levels. Table 7-1 presents the noise assessment results. Appendix B shows the noise contour around the site. Receptor partial noise levels are presented in Appendix C.

The comprehensive noise levels at all receptors are below the permissible noise levels for day, evening, and night. Noise mitigation is not required for this site.

Table 7-1: Noise Assessment Results

Receptor ID	Permissible $L_{Aeq, 1hr}$ (dBA)			Baseline $L_{Aeq, 1hr}$ (dBA)			Modelled Target $L_{Aeq, 1hr}$ (dBA)			Comprehensive $L_{Aeq, 1hr}$ (dBA)			Meets Criteria?
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	
MR01	53	48	40	35	30	25	38	38	39	39	38	39	Yes
MR02	53	48	40	35	30	25	38	38	39	40	39	40	Yes
MR03	53	48	40	35	30	25	-80	-80	-80	35	30	25	Yes
MR04	53	48	40	35	30	25	-80	-80	-80	35	30	25	Yes
MR05	53	48	40	35	30	25	-80	-80	-80	35	30	25	Yes
MR06	53	48	40	35	30	25	36	36	37	38	37	37	Yes
MR07	53	48	40	35	30	25	34	34	34	38	36	35	Yes

Note: Day – 7:00 to 19:00; Evening – 19:00 to 23:00, Night – 23:00 to 7:00.

8. Conclusion

A preliminary community noise impact assessment was completed for the siting of a combustion turbine power plant up to 300 MW at a proposed site located in Marshdale, Nova Scotia. The project comprehensive noise levels were evaluated at surrounding worst case noise sensitive receptors and compared to Nova Scotia's permissible noise level limits for rural areas.

The predicted noise impact at the receptors surrounding the proposed site is below the NS permissible noise levels. No noise controls are anticipated to be required for the site.

9. References

[1] Nova Scotia Department of Environment and Climate Change, "Guidelines for Environmental Noise Measurement and Assessment," October 1, 2023.

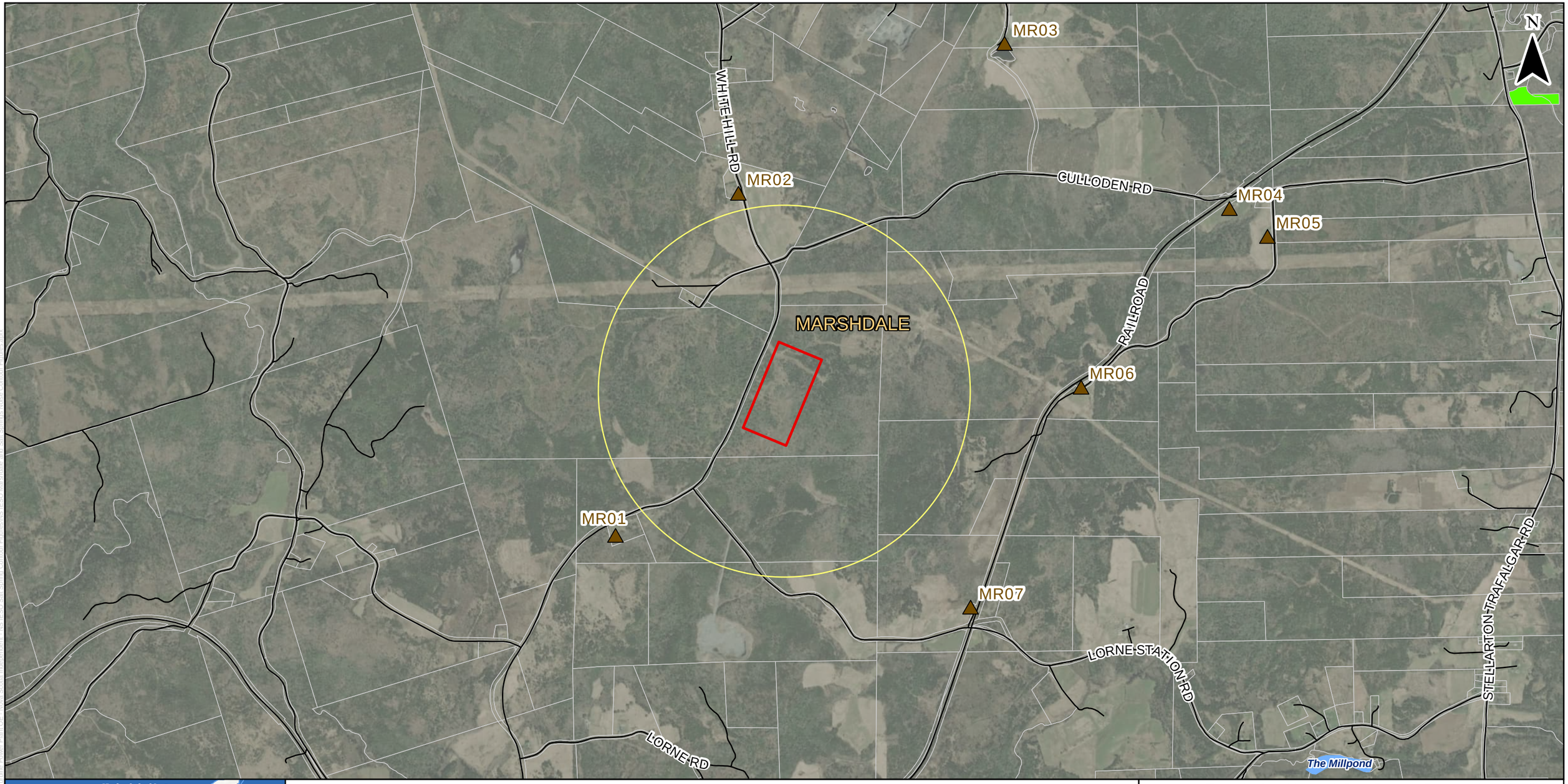
[2] ISO 9613-2, "Acoustics — Attenuation of sound during propagation outdoors - Part 2: Engineering method for the prediction of sound pressure levels outdoors," International Organization for Standardization, 1996.

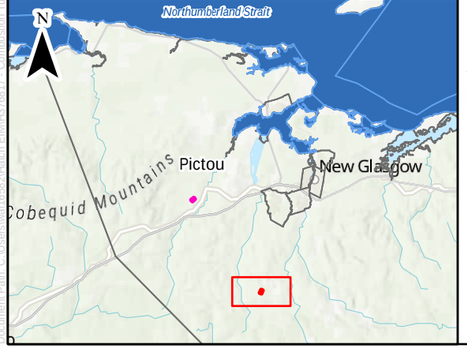
[3] FHWA, "Traffic Noise Model, Version 2.5," Federal Highway Administration.

[4] Health Canada, "Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise," Ottawa, 2017.

[5] ISO 1996-1, "Acoustics — Description, measurement and assessment of environmental noise - Part 1: Basic quantities and assessment procedures," International Organization for Standardization, 2016.

Appendix A:
Zoning Maps





LEGEND

- Noise Receptors
- Municipal Road
- Site Boundary
- Property Boundary
- 1 km Buffer
- Waterbody

Zoning

- Parks and Open Space
- Rural General

NOTES:

1. Produced by Hatch, contains information licensed under the Open Government Licence – Nova Scotia
2. Spatial referencing: NAD 1983 CSRS UTM Zone 20N
3. Zoning and Property Boundary information were retrieved from the municipality's ArcGIS online and follows under the ESRI Master License Agreement and Online Terms of Use

0 300 600 1,200 Meters

1:20,000

PROJECT: Fast Acting Natural Gas Power Generation Facility - Marshdale

FIGURE TITLE: Municipality Zoning Information - Community Noise Impact Assessment

CLIENT: IESO Nova Scotia

DWG BY:	CHK BY:	FIG NO.:	REV NO.:
W. WAI	M. ANDARGIE	2	1
DATE: 24/11/25	**PAGE:** 1		

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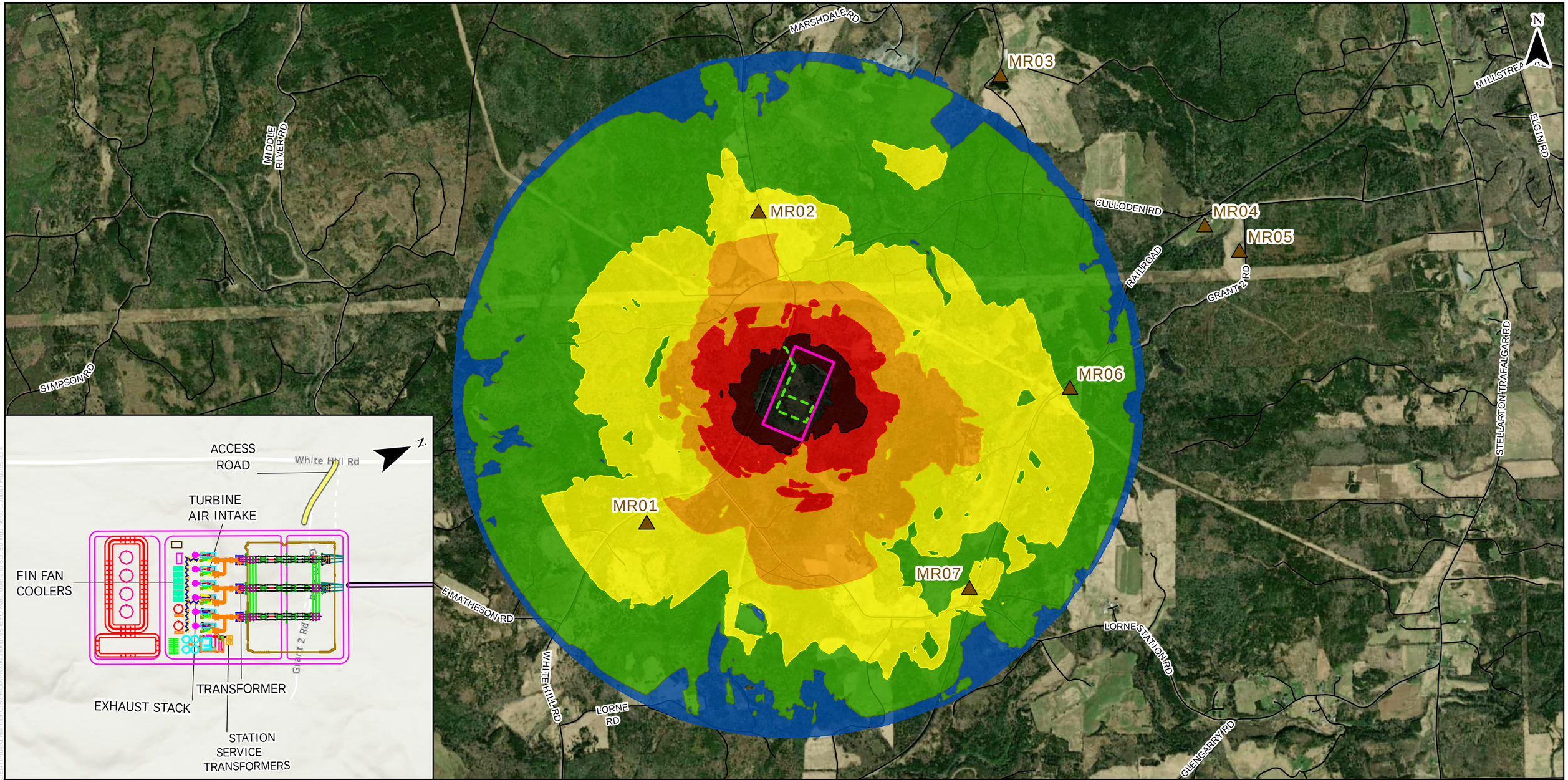
Appendix B:
Noise Contour Plots



LEGEND

Noise Contours (dBA)

- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- > 55

- Noise Receptors
- Site Road
- Municipal Road
- Site Boundary

NOTES:

1. Produced by Hatch, contains information licensed under the Open Government Licence – Nova Scotia
2. Spatial referencing: NAD 1983 CSRS UTM Zone 20N
3. Noise contour was generated based on a 10 x 10 m grid at 4.5 m elevation above ground.
4. Layout was retrieved from CAD drawing H376817-0000-221-20M-0002 on Nov 19, 2025 and does not reflect any changes beyond that

0 325 650 1,300 Meters

1:22,000

PROJECT: Fast Acting Natural Gas Power Generation Facility - Marshdale

FIGURE TITLE: 300 MW Combustion Turbine Power Plant - Community Noise Impact Assessment

CLIENT: IESO Nova Scotia

DWG BY:	CHK BY:	FIG NO.:	REV NO.:
W.WAI	M. ANDARGIE	1	1
DATE: 20/11/25	**PAGE:** 1		

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Appendix C:
Receptor Partial Noise Levels at 4.5m above Ground

Table C-1: Receptor Partial Noise Levels

Noise Source Description	Partial Noise Level at 4.5 m above Ground (dBA)						
	MR01	MR02	MR03	MR04	MR05	MR06	MR07
Access Road	8	8	-	-	-	4	2
Exhaust Stack #1	17	18	-	-	-	15	13
Exhaust Stack #2	18	18	-	-	-	15	13
Exhaust Stack #3	18	18	-	-	-	15	13
Exhaust Stack #4	18	18	-	-	-	15	13
Exhaust Stack #5	18	19	-	-	-	14	13
Exhaust Stack #6	18	19	-	-	-	14	13
Fin Fan Cooler #1	25	25	-	-	-	25	21
Fin Fan Cooler #2	25	24	-	-	-	24	21
Fin Fan Cooler #3	25	25	-	-	-	24	21
Fin Fan Cooler #4	25	23	-	-	-	23	21
Fin Fan Cooler #5	25	25	-	-	-	24	21
Fin Fan Cooler #6	25	24	-	-	-	23	21
Site Road	16	16	-	-	-	18	16
Station Service Transformer #1	1	3	-	-	-	4	-2
Station Service Transformer #2	1	3	-	-	-	4	-2
Station Service Transformer #3	1	3	-	-	-	4	-2
Station Service Transformer #4	-2	3	-	-	-	4	-2
Transformer #1	27	27	-	-	-	26	24
Transformer #2	23	26	-	-	-	26	21
Transformer #3	24	26	-	-	-	27	21
Turbine Air Intake #1	28	29	-	-	-	26	24
Turbine Air Intake #2	29	29	-	-	-	26	22
Turbine Air Intake #3	29	30	-	-	-	26	23
Turbine Air Intake #4	29	30	-	-	-	26	23
Turbine Air Intake #5	29	30	-	-	-	25	23
Turbine Air Intake #6	29	30	-	-	-	25	23

APPENDIX D
WATER RESOURCE ASSESSMENT

Report

Water Resources Assessment for Marshdale Site

H376817-0000-2A4-066-0002

			Mohamed Khafagy		Meghari, Karim	
2025-11-27	0	Approved for Use	M. Khafagy	W. Hoyle	K. Meghari	C. Rollings
DATE	REV.	STATUS	PREPARED BY	CHECKED BY	APPROVED BY	APPROVED BY
			Hydrogeologist	Discipline Lead	Project Manager	Client

Disclaimer

This report was prepared by Hatch Ltd. (“Hatch”) or the sole and exclusive benefit of the Independent Energy System Operator (IESO) Nova Scotia (the “Principal”) for the sole purpose of addition to an environmental assessment being prepared by Strum Consulting for the IESO Nova Scotia assisting the Principal to determine the feasibility of installation and operation of a fast-acting natural gas power generation facility with up to 300 MW capacity in Pictou, Nova Scotia (the “Project”), and must not be provided to, relied upon or used by any other party. The use of this report by the Principal is subject to the terms of the relevant services agreement between Hatch and Principal.

This report is meant to be read as a whole, and sections should not be read or relied upon out of context. The report includes information provided by the Principal and by certain other parties on behalf of the Principal. Unless specifically stated otherwise, Hatch has not verified such information and does not accept any responsibility or liability in connection with such information.

This report contains the expression of the opinion of Hatch using its professional judgment and reasonable care, based upon information available at the time of preparation. The quality of the information, conclusions and estimates contained in this report is consistent with the intended level of accuracy as set out in this report, as well as the circumstances and constraints under which this report was prepared.

As this report is a water resources assessment report, all estimates and projections contained in this report are based on limited and preliminary data. Accordingly, while the work, results, estimates and projections in this report may be considered to be generally indicative of the nature and quality of the Project, they are not definitive. No representations or predictions are intended as to become the results of future work, and Hatch does not promise that the estimates and projections in this report will be sustained in future work.

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1. Introduction

Nova Scotia's Independent Energy System Operator (IESO Nova Scotia) is planning a fast-acting power generation facility in Pictou County (Project). New fast-acting generators must replace the existing fleet of coal-fired generators to optimally manage grid supply and reliability in conjunction with our significant amounts of variable-production renewable energy. Hatch Ltd. (Hatch) has been retained by the IESO Nova Scotia to provide water resources assessment services to support the development of the Project. The proposed site is located near to Marshdale, Nova Scotia (Figure 1-1). The facility will have a power generation capacity of up to 300 MW. The purpose of this high-level desktop study is to assess the groundwater potential at the project site to support the power plant operation.

The combustion turbine power plant will be a multi-unit simple cycle power plant based on aeroderivative combustion turbine technology, operating on natural gas as a primary fuel and light fuel oil as a secondary fuel.

Figure 1-1: Proposed Location for the Project

1.1 Study Area and Facility Description

This Marshdale project site is located within the Parcel Identification Number (the "PID") 00910307 and consists of approximately 55.95 ha of land that abuts White Hill Road in Pictou County, Nova Scotia. The site comprises a portion of this PID (approximately 12 ha) along White Hill Road. Figure 1-2 presents the proposed location for the Marshdale site. The site is bounded by White Hill Road to the west, approximately 300 m from Culloden Road to the north, and bounded by natural forest to the east and south. The Project site has an area of approximately 125,000 m^2 and falls under the coordinate system NAD83 (CSRS)/UTM Zone 20N.

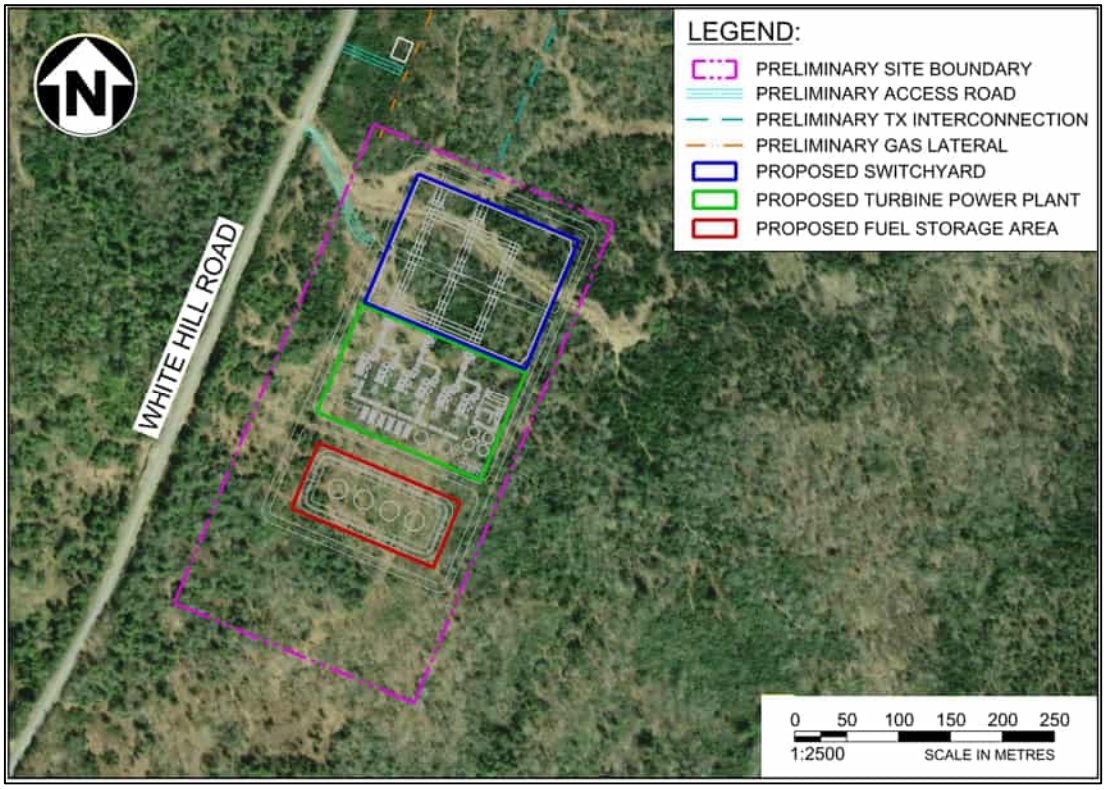


Figure 1-2: Marshdale Project Site Location

1.2 Scope of Work

The objective of this water resources assessment study is to complete the following desktop review and evaluation:

- Desktop Review
  - Assess and utilize existing information and data within the study area to provide an effective water resources assessment.
- Evaluate Hydrogeological Conditions of the Study Area.

- The key objectives of this desktop study are to:
  - Evaluate groundwater availability at the project site to meet the planned water consumption for site services, as well as demineralized water consumption for emissions control, power augmentation, and compressor washing.

1.3 Water Resources Assessment Guidelines

The following guidelines and standards were utilized to prepare the water resources assessment for the Project site:

- Nova Scotia Environment and Climate Change Canada (NSECC). (2015). Groundwater observation well network;
- Nova Scotia Environment and Climate Change Canada (NSECC). (2020). Nova Scotia well logs database; and
- Nova Scotia Environment and Climate Change Canada (NSECC). (1977). Water Resource Reports and Maps.

1.4 Basis of Plant Water Demand

Depending on the power plant design and configuration, the peak water consumption for a simple-cycle combustion turbine facility when generating may include water usage to produce demineralized water for the following applications:

- Power augmentation;
- NOx control; and
- Intermittent compressor washing.

Demineralized water used for NOx control and power augmentation reports to the turbine exhaust as water vapour. Consumption is dependent on the ambient temperature and relative humidity, as well as the fuel type and composition for the 300-MW plant size scenario.

Section 1.4.1 presents the estimated water consumption rates for a power plant configuration with a conservatively higher range of water consumption based on the combustion turbine model selection and demineralized water production technology options available. Other power plant configurations and combustion turbine model selections, as well as demineralized water production technologies, are available which may greatly reduce power plant water consumption depending on the configuration selected to best suit the needs of the project. Water consumption may be reduced in other configurations by avoiding water use for power augmentation, using other emissions control strategies, and pursuing demineralized water production technologies with higher recovery rates and reduced process water rejection during regeneration.

1.4.1 300-MW Simple-Cycle Combustion Turbine Facility

The estimated water consumption rates are shown in Table 1-1 for a 300-MW scenario facility. The peak consumption value reflects raw water supply to demineralized water production and site services. Estimated process water discharge rates are also shown for regeneration of the demineralizer trains and removal of captured minerals.

Table 1-1: Estimated Water Consumption – 300-MW Scenario

Flow Description	Flow Rate (m^3/hr)
Peak Raw Water Consumption	175
Full Load Demineralized Water Consumption (Natural Gas Operation)	90 to 122
Full Load Demineralized Water Consumption (Light Fuel Oil Operation)	100 to 130
Peak Process Water Discharge	50
Average Annual Raw Water Consumption (@25% Capacity Factor)	23 to 31
Average Annual Process Water Discharge (@25% Capacity Factor)	9 to 12

Continuous full-load water consumption values are shown for both natural gas and light fuel oil operation, based on dual-fuel combustion turbine units without dry low-NOx capabilities utilizing demineralized water for NOx control and power augmentation when operating on both fuel types. Demineralized water consumed by the combustion turbine units is discharged as water vapour to the exhaust stacks with the combustion turbine exhaust flow.

The average annual raw water consumption rates are also provided with the corresponding average process water discharge rates based on the expected limited operation of the facility as a backup and peaking plant at a 25% capacity factor, with 80% of operating hours on natural gas, and 20% of operating hours on light fuel oil.

2. Existing Conditions

The Project site is located within the East/Middle/West (Pictou) River watershed. The Marshdale site lies within the Central Uplands Ecodistrict, which occupies 129,118 ha and covers most of eastern Colchester County and western Pictou County, Nova Scotia.

2.1 Geological Review

The Province of Nova Scotia has undertaken a preliminary inventory and characterization of surficial aquifers, with emphasis on sand and gravel deposits that possess sufficient saturated thickness and aerial extent. This inventory consolidates existing stratigraphic information, including water-well and government test-hole logs and relevant historical groundwater assessment reporting. Figure 2-1 shows the potential surficial aquifers regional map. Within the proposed project location, the mapping does not delineate potential areas for

surficial-aquifer groundwater supply. This figure shows that there are no drilled water wells identified as suitable for surficial-aquifer groundwater supply; however, there is one water well around the Marshdale site within approximately 3.5 km north of the site and associated with the residential properties along Marshdale Road. The water wells are shown as gray dots and represent drilled water wells not intercepting sand and/or gravel materials suitable for surficial-aquifer groundwater supply development according to the well stratigraphic record.

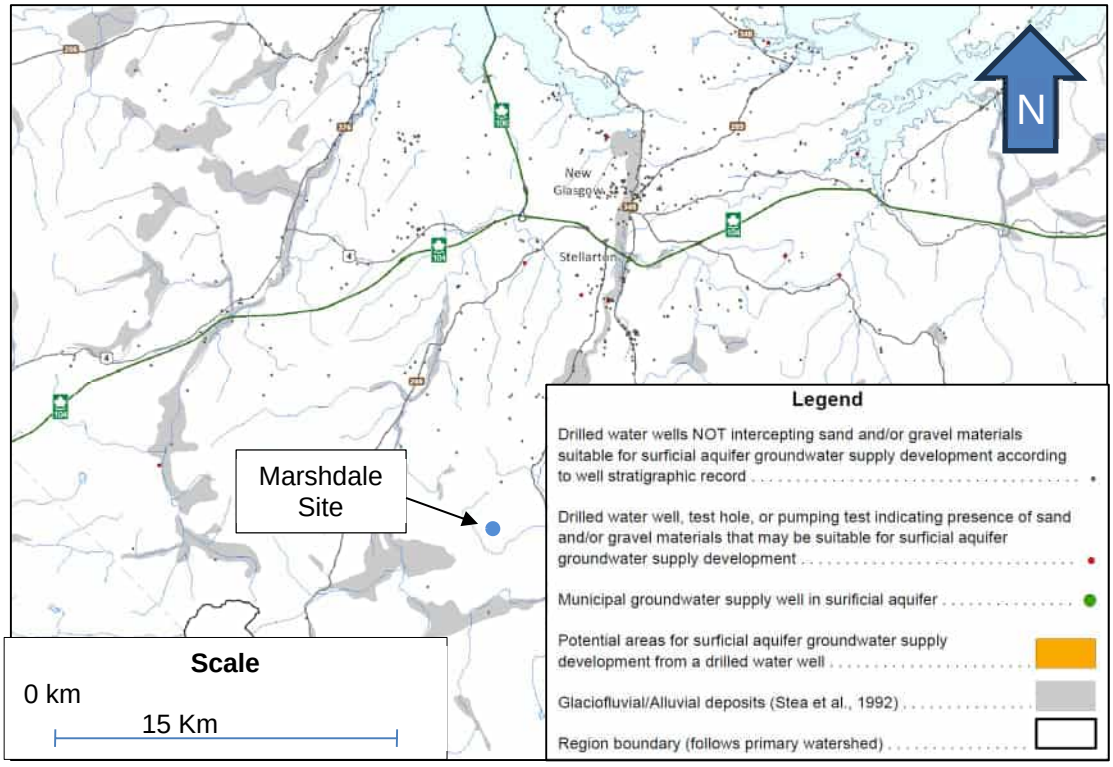


Figure 2-1: Surficial Aquifers Regional Map

With respect to surficial geology, the Pictou County Water Resources Evaluation map indicated that a gravelly sandy till overlies the Marshdale site (Appendix A).

The bedrock geology is presented in Appendix B. The Marshdale site is underlain by the Mabou Group, which comprises undivided red and gray mudrock, green sandstone.

Structural features mapped in the vicinity include a fault within the Mabou Group crossing approximately 1.5 km northwest of the Marshdale site. Mineralization noted in the regional datasets includes hematite and coal within approximately 1 km of the Marshdale site.

2.2 Subsurface Stratigraphy

No comparable borehole or observation-well stratigraphy was identified for the Marshdale site; therefore, a formation-matched subsurface log is not available for that location.

3. Hydrogeological Assessment

Nova Scotia's Groundwater Observation Well Network, established in 1965, includes 40 active observation wells equipped with hourly level loggers and telemetry to track groundwater levels and chemistry, assess the effects of human activities, and evaluate long-term trends. Based on the Network listings reviewed, none of the 40 active observation wells are completed in the formation that underlies the Marshdale site; therefore, there are no formation-matched network hydrographs or aquifer-test parameters available for the Marshdale site.

3.1 Wells Within the Marshdale Site

3.1.1 Groundwater Wells Within 5 km

A total of 26 drilled wells installed between 2000 and 2015 were identified within 5 km of the Marshdale (Hopewell) site from the Nova Scotia Well Logs Database. Reported depths range from 22 m to 104 m, with a median depth of 52 m and a mean of 55.5 m (Table 3-1). Among wells with reported yields, values span from 0.12 to 6.84 m^3/hr, with a median of 1.08 m^3/hr and an interquartile range of 0.60 to 1.62 m^3/hr. The upper tail includes higher-yield wells (90th percentile ≈ 3.67 m^3/hr; maximum 6.84 m^3/hr), while the lower tail includes several single-digit L/min wells (0.12 to 0.66 m^3/hr).

Table 3-1: Summary of Wells Located Within 5 km of the Marshdale Site

No. of Wells	Well Depth (m)					
	Minimum	**25th Percentile**	**Median**	**Mean**	**75th Percentile**	**Maximum**
26	22.0	38.5	52.0	55.5	73.0	104.0
Estimated Yield Per Well (m^3/hr)						
Minimum	**10th Percentile**	**25th Percentile**	**Median**	**75th Percentile**	**90th Percentile**	**Maximum**
0.12	0.22	0.60	1.08	1.62	3.67	6.84

All entries are domestic wells, and these yields are short-duration driller estimates at well completion and should be considered indicative rather than sustained production rates; long-term "safe yield" requires site-specific pumping and recovery testing.

Continuous high pumping from fractured bedrock can lower water levels and affect nearby wells. Using groundwater with storage and well spacing to meet average demand presents a lower risk, whereas the continuous or peak operations from groundwater alone increases the zone of influence and third-party impacts. The Marshdale site has a high interference risk due to the lower nearby reported yields. A field program including, test drilling, step-drawdown and 72-hour constant-rate pumping with observation wells, should be completed with an operating plan for groundwater depletion protection.

4. Recommendations on Potential Options

This section translates the desktop findings into practical options to meet the plant's water needs defined in Section 1.4. All groundwater capacity estimates below are based on the driller estimated yields from nearby wells. Note that driller estimates are short-duration completion values; however, sustained "safe yield" is typically lower and must be confirmed by controlled pumping and recovery tests. Counts derived from driller yields therefore represent planning-level ranges only.

4.1 300-MW Simple Cycle Combustion Turbine Power Plant

Based on 26 wells within 5 km (2000 to 2015), reported driller-estimated yields (where provided) range 0.12 to 6.84 m³/hr (median 1.08 m³/hr, interquartile range 0.60 to 1.62 m³/hr, and 90th percentile 3.67 m³/hr). Table 4-1 shows the estimated production wells needed by a 300-MW demand scenario based on driller-estimated yield percentiles.

Table 4-1: Estimated Production Wells Needed by Demand Scenario for the Marshdale Site (300 MW)

Demand Scenario	Estimated Yield per Well (m³/hr)	Median	75th Percentile	90th Percentile	Maximum
		1.08	1.62	3.67	6.84
Average demand (23 to 31 m³/hr)	No. of Required Production Wells	21 to 29	14 to 19	6 to 9	4 to 5
Continuous full-load demand (Natural Gas 90 to 122 m³/hr)		83 to 113	56 to 75	25 to 34	13 to 18
Continuous full-load demand (light fuel oil 100 to 130 m³/hr)		93 to 120	62 to 80	27 to 35	15 to 19
Peak demand (175 m³/hr)		162	108	48	26

To address practical limitations, a storage buffer can be implemented to meet peak water requirements. Table 4-2 provides an example of the number of wells combined with storage volumes assuming wells perform in the 75th percentile range.

Table 4-2: Estimated Production Wells Combined with Storage Volumes Needed Demand Scenario for the Marshdale Site (300 MW)

Demand Scenario	No. of Required Production Wells	Storage Volume (m³)
Average demand (23 to 31 m³/hr)	14 to 19	-
Continuous full-load demand (Natural Gas 90 to 122 m³/hr)	14 to 19	650 to 880
Continuous full-load demand (light fuel oil 100 to 130 m³/hr)	14 to 19	740 to 950
Peak demand (175 m³/hr)	14 to 19	1,390 to 1,460

The reduction in the required quantity of wells is facilitated by water storage supplying the additional flow required during full-load/peak demand, while the wellfield is sized to supply the plant average demand continuously (23 to 31 m³/hr). For example, with wells at the 75th percentile yield (1.62 m³/hr), 14 to 19 wells produce 23 to 31 m³/hr, and the 175 m³/hr peak deficit is then approximately 144 to 152 m³/hr, which requires about 1,152 to 1,216 m³ for an 8-hour event, and approximately 1,390 to 1,460 m³ when a 20% factor of safety is applied. Final well count and storage must be refined after pump testing.

Note that the number of wells is calculated using well estimated yields, which represent short duration estimates and may not be sustainable. Achieving peak water requirements using groundwater alone without significant on-site storage is unlikely. Practical development would require extensive testing, well spacing, and monitoring. A groundwater extraction plan with a storage sized around the average demand range may be feasible if several production wells perform near the 75th percentile, with storage buffering full-load and peak periods. Sustainable yields would need to be confirmed through site pump testing, after which the facility's water-use configuration and storage requirements can be adjusted to match the verified groundwater supply. This assessment represents a reasonable worst-case planning scenario.

4.2 Next Steps

The next steps include advancing a hydrogeological field assessment to convert driller-estimated yields into site-specific sustainable rates, assess well interference, and verify aquifer properties (transmissivity, storativity). The program would include:

- Pump testing of candidate wells to confirm sustainable yields and drawdown characteristics;
- Well interference monitoring to evaluate potential interactions between wells in a proposed field; and
- Groundwater modelling may be required to assess the effects of withdrawals on local groundwater levels and nearby receptors.

Given that expected groundwater withdrawals will exceed 23,000 L/day, an application should be prepared and submitted to the Nova Scotia Ministry of Environment and Climate Change (NSECC) for approval, including:

- Sustainable yield calculations based on field data;
- Wellfield design and spacing considerations; and
- Integration with on-site stormwater management and water storage strategies.

Additionally, an operational water management plan should be developed to optimize wellfield controls, storage operations (both raw and demineralized), maintenance scheduling (e.g., compressor washing), and peak-shaving strategies aligned with plant operating fuel type.

5. Conclusion

The following are the key conclusions that can be drawn from the water resources assessment study:

- Comparing the distribution of local driller-estimated yields with the plant water demand for the 300-MW scenario (average 23 to 31 m^3/hr, continuous full-load 90 to 122 m^3/hr on natural gas and 100 to 130 m^3/hr on light fuel oil, and a peak of 175 m^3/hr), groundwater development alone would require a large number of production wells even under optimistic yield assumptions. This indicates that relying on groundwater as the primary water source for plant operation would require extensive wellfield development, significant storage, and demonstration of acceptable interference and environmental effects through site-specific testing.
- Avoiding the use of demineralized water for power augmentation and using dry low NOx technologies offers the opportunity to eliminate continuous water consumption during natural gas operation, and reduce continuous water consumption on light fuel operation to an estimated 135 m^3/hr, and an estimated annual average 5 m^3/hr consumption based on the expected limited power plant operation on light fuel oil.
- Given local yield distributions, feasibility is dependent on field testing to confirm sustainable yields and acceptable well interference at deeper depths than the available residential well information currently available.
- The yield values summarized herein are short duration estimates recorded at well completion and are indicative only. Verification would require a staged field program (test drilling, step-drawdown and 72-hour constant-rate pumping with recovery, and interference monitoring) before any groundwater supply decision.

This report has evaluated a conservative power plant configuration with a high range of water consumption based on the combustion turbine model selection and demineralized water production technology options available. With the proposed storage tanks, the average plant demand could be reliably met, performing at the 75th percentile, with storage buffering short-term peaks and full-load operation. While groundwater alone is insufficient for continuous peak demand, this combination of wells and storage represents a practical scenario within the site footprint, allowing normal operation without exceeding sustainable well yields.

Other power plant configuration and combustion turbine model selection options are available which may greatly reduce power plant water consumption. However, these lower water configurations were not modelled as part of this desktop assessment. Water consumption can be reduced in other configurations by avoiding water use for power augmentation and using other emissions control strategies such as dry low NOx combustion for natural gas operation. Demineralized water production technologies with higher demineralized water recovery rates can also be pursued which reduce raw water consumption based on reduced process water discharge during regeneration.

6. References

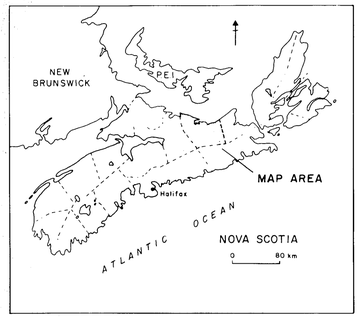
- Nova Scotia Environment and Climate Change Canada (NSECCC). (August 2015). Groundwater observation well network. Available online at: https://novascotia.ca/nse/groundwater/docs/GroundwaterObservationWellNetwork2015Report.pdf
- Nova Scotia Environment and Climate Change Canada (NSECCC). (2020). Nova Scotia well logs database. Available online at: https://novascotia.ca/nse/groundwater/welldatabase.asp
- Nova Scotia Environment and Climate Change Canada (NSECCC). Interactive Groundwater Maps of Nova Scotia. Available online at: Nova Scotia Groundwater Atlas
- Nova Scotia Environment and Climate Change Canada (NSECCC). (1977). Water Resource Reports and Maps. Available online at: Water Resource Reports and Maps | Groundwater
- Strum Consulting (May 2025). Water Resources Assessment.

Appendix A
Surficial Aquifers of Nova Scotia

Sources of Information

Surficial geology compiled by Project staff from field work and the following reports:

1. Cann, D.B. and Wicklund, R.E.: Soil Survey of Pictou County, N.S.; Report No.4 – Nova Scotia Soil Survey, Canada Dept. of Agriculture, Truro, 1950.
2. Fowler, John H. and Dickie, Gordon B.: Sand and Gravel Resources of Pictou County, Nova Scotia Department of Mines, Paper 77-6, Halifax, 1977.



REFERENCE

- Sandy till
- Gravelly sandy till
- Silty till
- Clay till
- Glaciofluvial deposits
- ▲1 Surficial sample
- ◆ Stream gauge
- ★ Rain gauge
- ⊛ Rain gauge and thermograph

HIGHWAYS

- Trans Canada Highway, provincial arterials
- Trunk highways, collector highways (hard surface)
- Local roads (loose surface)

PICTOU COUNTY WATER RESOURCES EVALUATION PROJECT

Map 2

SURFICIAL GEOLOGY and HYDROMETEOROLOGICAL STATIONS

PROVINCE OF NOVA SCOTIA

A Joint Project with the

DEPARTMENT OF REGIONAL ECONOMIC EXPANSION

KILOMETRES 0 5 10 15

MILES 0 5 10

Scale 1:125,000

Appendix B
Bedrock Geology Map (NSECC)

Nova Scotia Department of Natural Resources
Mineral Resources Branch

Open File Map ME 2005-119

Geological Map of the Hopewell Area (NTS 11E/07), Nova Scotia

R. D. Naylor, P. S. Giles and D. C. Brisco

Scale 1:50 000

Halifax, Nova Scotia

Introduction

The outcrop data on this map have been obtained from a variety of sources. The most recent data were collected during the 2003 and 2004 field seasons as part of a federal-provincial Targeted Geoscience Initiative (Phase 2) project that concentrated on geological mapping and mineral resource evaluation for NTS areas 11E/06 and 11E/07. Data were compiled from Stevenson (1956 and 1958 a and b), Benson (1967 a and b), Bingley (1968-71 a and b), Donohoe and Wallace (1982), Pe-Piper and Piper (2005 a and b), Chandler et al. (1997), Giles (1992) and Giles et al. (2005). Map interpretation was aided by review and analysis of a number of geophysical surveys. These include unpublished industry seismic data acquired by Contact Resources, and regional magnetic and radiometric surveys (see King, 2005 a and c).

Sources of the individual outcrop data are not indicated on the map. The digital database from which this map was derived (Brisco et al., 2005) contains source information for all the outcrop data illustrated.

The map illustrates a number of important advancements not shown on previous maps. These include more detailed stratigraphic subdivision of Carboniferous strata, more accurate delineation of major faults, updated mineral occurrence data, and the location of localized mafic and felsic units that appear to intrude Carboniferous strata.

References

Bingley, J. M. 2005a: Unpublished geological field maps and notebooks (1968-1971) for the St. Marys River Basin Project, Colchester, Guysborough and Pictou Counties, Nova Scotia, parts of NTS 11E/07 and 11E/08, scale 1:15 840 (available as Nova Scotia Department of Natural Resources, Digital Product ME 119).

Bingley, J. M. 2005b: Unpublished geological field maps (1968-1971), St. Marys River Basin Project, Guysborough County, Nova Scotia, parts of NTS 11E/07, 11E/08 and 11F/05, scale 1:15 840 (available as Nova Scotia Department of Natural Resources, Digital Product ME 073).

Benson, D. G. 1967a: Geology of the Hopewell map area, Nova Scotia; Geological Survey of Canada, Memoir 343, 58 p.

Benson, D. G. 1967b: Geological map, Hopewell, Nova Scotia; Geological Survey of Canada, Map 1215A, NTS 11E/07, scale 1:63 360 (also available as Nova Scotia Department of Natural Resources, Digital Product ME 109).

Brisco, D. C., Naylor, R. D., Giles, P. S., Fisher, B. E., Poole, J. C. and McKinnon J. S. 2005: Digital Geological Data Generated as Part of the Targeted Geoscience Initiative Project (Phase 2), Geological Mapping and Resource Evaluation in Central Nova Scotia, 2003-2005, NTS 11E/06 and 11E/07 and parts of 11E/05, 11E/10, 11E/11 and 11E/12; Nova Scotia Department of Natural Resources, Digital Product ME 185, Version 1.

Chandler, F. W., Waldron, J. W. F., Giles, P. S. and Gall, Q. 1997: Geology of the Stellarton Gap, Nova Scotia; Geological Survey of Canada, Open File Map 3535, scale 1:50 000 (also available as Nova Scotia Department of Natural Resources, Digital Product ME 150).

Donohoe, H. V., Jr. and Wallace, P. I. 1982: Geological map of the Cobequid Highlands, Nova Scotia; Nova Scotia Department of Mines and Energy, Maps 82-8 and 82-9, scale 1:50 000 (also available as Nova Scotia Department of Natural Resources, Digital Product ME 184).

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King, M. S. 2005b: Airborne magnetic calculated first vertical derivative map for NTS 11E/07, Hopewell area, Nova Scotia; Nova Scotia Department of Natural Resources, Open File Map ME 2005-23, scale 1:50 000.

King, M. S. 2005c: Airborne magnetic calculated second vertical derivative map for part of NTS 11E/07, Hopewell area, Nova Scotia; Nova Scotia Department of Natural Resources, Open File Map ME 2005-43, scale 1:50 000.

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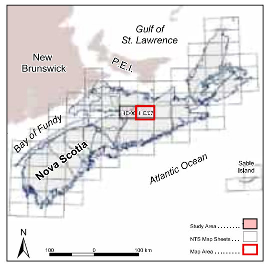
Regional Key Map



Map Notes

Universal Transverse Mercator Projection (UTM), Zone 20, Central Meridian 63°00' West.

North American Datum (NAD) 1927.

Base and digital data derived from the Nova Scotia Topographic Database (NSTDB). The NSTDB is available from Service Nova Scotia and Municipal Relations (SNSMR), Land Information Services Division (LIS), Nova Scotia Geomatics Centre (NSGC), Amherst, Nova Scotia.

Funded by Natural Resources Canada and Nova Scotia Department of Natural Resources under the Targeted Geoscience Initiative (Phase 2) Project: Geological Mapping and Resource Evaluation in Central Nova Scotia, 2003-2005.

Cartography and reproduction by Nova Scotia Department of Natural Resources, Geoscience Information Services Section, 2005.

Disclaimer

Recommended Citation

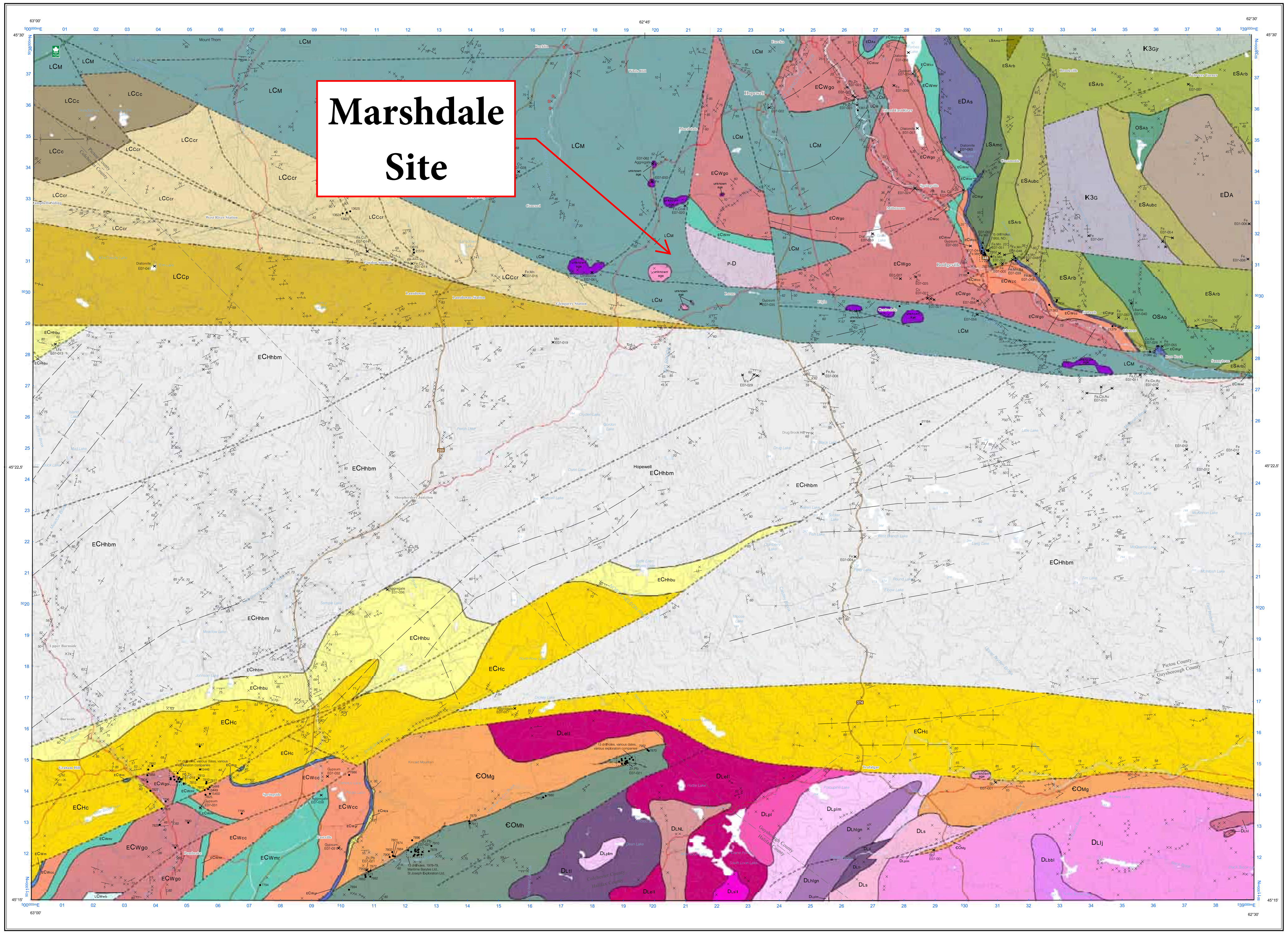
Naylor, R. D., Giles, P. S. and Brisco, D. C. 2005: Geological map of the Hopewell area (NTS 11E/07), Nova Scotia; Nova Scotia Department of Natural Resources, Open File Map 2005-119, scale 1:50 000.

Legend

- Contour
- Index Contour
- Depression Contour
- Index Depression Contour
- Coastline
- Lakes, Single-line Rivers, Streams
- 100 Series Highway
- Trans-Canada Highway
- Trunk Highway
- Collector Highway
- Hard Surface Road
- Road Under Construction
- Loose Surface/Resource Access Road
- Vehicle Track
- Trail/Footpath
- Railway
- Railway Inactive
- County Boundary

Geological Symbols

- Mineral occurrence
- Drillhole
- Outcrop
- Spore sample
- Minor fold axis: inclined, 1st generation
- Slicken striae
- Bedding: facing known (overturned, horizontal, inclined, vertical)
- Bedding: facing unknown (horizontal, inclined, vertical)
- First cleavage or foliation (inclined, vertical, horizontal)
- Shear: inclined (sinistral, dextral, normal, reverse)
- Shear: vertical (sinistral)
- Shear: sense unknown, inclined
- Fault - approximate
- Geological contact
- Unconformity (approximate)
- Anticline, syncline (approximate)
- Area of concentrated drilling



Geology Legend

PALEOZOIC

LATE CARBONIFEROUS

CUMBERLAND GROUP

- LCCc — *CROSS ROAD FORMATION* (LCCc): red and locally grey, granule to cobble, polymictic conglomerate interbedded with red, poorly sorted, granule-rich mudrock
- LCCcr — *CHIGANOIS RIVER FORMATION* (LCCcr): pale grey, fine- and local medium-grained sandstone interbedded with grey and red mudrock, local coal and rare bituminous limestone and oil shale
- LCCp — *PARRSBORO FORMATION* (LCCp): grey and red mudrock, dark grey and black shale, and thin (<4 m), red and grey, fine-grained sandstone units

MABOU GROUP

- LCM — (LCM): undivided red and grey mudrock, green sandstone
- LCMwb — *WATERING BROOK FORMATION* (LCMwb): grey mudrock and shale with intercalated gypsum, anhydrite and halite; evaporites most abundant in lower part of formation

EARLY CARBONIFEROUS

WINDSOR GROUP

- ECWgo — *GREEN OAKS FORMATION* (ECWgo): maroon to reddish-brown mudrock and fine-grained sandstone, with intercalated marine limestone and dolostone, with associated anhydrite or gypsum
- ECWmr — *MACDONALD ROAD FORMATION* (ECWmr): gypsum, anhydrite and minor halite, with interbeds of grey and maroon mudrock and sheet-like carbonate members; cyclic repetition of these rock units is characteristic
- ECWcc — *CARROLLS CORNER FORMATION* (ECWcc): anhydrite, gypsum, with minor dolostone and mudrock in thin beds; includes undifferentiated shale and mudrock breccia with minor gypsum and anhydrite
- ECWm — *MACUMBER FORMATION* (ECWm): limestone, in part dolostone, laminated and/or banded, peloidal, sparsely fossiliferous
- ECWgr — *GAYS RIVER FORMATION* (ECWgr): dolostone, minor limestone, thinly bedded, argillaceous and bituminous, locally thickly bedded and highly fossiliferous in mound-shaped deposits resting upon pre-Carboniferous rocks

HORTON GROUP

- ECHcs — *COLDSTREAM FORMATION* (ECHcs): reddish-brown, polymictic conglomerate and conglomeratic sandstone with minor dark grey mudrock
- ECHc — *CHEVERIE FORMATION* (ECHc): grey-green to minor maroon sandstone, locally granule to pebbly conglomerate, interbedded with maroon to minor grey-green mudrock

HORTON BLUFF FORMATION

- ECHhbu — UPPER MEMBER (ECHhbu): light- to medium-grey, thick sandstone (quartz arenite), interbedded with grey shale, micaceous mudrock, greenish-grey mudrock and nodular dolostone; minor granule conglomerate
- ECHhbm — MIDDLE MEMBER (ECHhbm): grey to dark grey shale (fissile), alternating, thinly bedded grey mudrock and fine sandstone, and green mudrock

DEVONIAN

LISCOMB COMPLEX

- DLsll, DLpl, DLnl, DLlj — SOUTH LOON LAKE (DLsll), PORCUPINE LAKE (DLpl), NELSON LAKE (DLnl) LEUCOMONZOGRANITE: fine- to medium-grained, equigranular; proportions of biotite and muscovite variable; pink to buff in colour

  LONG JOHN LAKE MONZOGRANITE (DLlj): medium-grained, pale pink to buff, equigranular, biotite > muscovite
- DLell, DLs, DLhl, DLbbl — EAST LOON LAKE (DLell) and SANCTUARY (DLs) MONZOGRANITES: megacrystic, medium- to coarse-grained, grey, biotite > muscovite; intruded by Porcupine Lake, Nelson Lake and South Loon Lake leucomonzogranites

  HATTIE LAKE MONZOGRANITE (DLhl): coarse-grained, grey, megacrystic biotite monzogranite

  BOTTLE BROOK LAKE MONZOGRANITE (DLbbl): fine- to medium-grained, pale pink, subporphyritic, biotite > muscovite, occurs as a large roof pendant in the Long John Lake monzogranite
- DLtl — TWIN LAKES GRANODIORITE (DLtl): medium-grained, in part megacrystic, grey, biotite is the single Fe-Mg mineral present, intrudes Pogue Lake metamorphic suite
- DLplm, DLhlgn — POGUE LAKE METAMORPHIC SUITE (DLplm): high-grade mafic and felsic gneiss, schist and quartzite, ubiquitous sillimanite

  HILL LAKE GNEISS (DLhlgn): quartz-feldspar-biotite gneiss, subdivision of the Pogue Lake metamorphic suite

ORDOVICIAN - EARLY DEVONIAN

ARISAIG GROUP

- EDA — (EDA): Undivided
- EDAs — *STONEHOUSE FORMATION* (EDAs): bluish-grey mudrock, calcareous mudrock
- LSAmo — *MOYDART FORMATION* (LSAmo): green and red mudrock
- LSAmc — *MCADAM FORMATION* (LSAmc): grey to green mudrock, shale, minor limestone
- ESArb — *ROSS BROOK FORMATION* (ESArb): blue-grey shale, mudrock
- ESAubc — *UPPER BEECHILL COVE FORMATION* (ESAubc): blue-green mudrock
- OSAb — *BEARS BROOK FORMATION* (OSAb): red, arkosic sandstone, conglomerate

CAMBRO-ORDOVICIAN

MEGUMA GROUP

- €OMh, €OMg — *HALIFAX FORMATION* (€OMh): metapelite, grey to dark grey, with thinly intercalated metagreywacke; highly magnetic

  GOLDENVILLE FORMATION (€OMg): metagreywacke with minor metapelite; medium grey to dark grey

NEOPROTEROZOIC

PRE-LATE DEVONIAN

- P-D — (P-D): Late Precambrian to early Devonian, mainly sedimentary basement rocks of the Antigonish Highlands

GEORGEVILLE GROUP

- K3G — (K3G): Undivided, sediments
- K3Gjr — *JAMES RIVER FORMATION* (K3Gjr): conglomerate, black and green mudrock, greywacke

UNKNOWN AGES

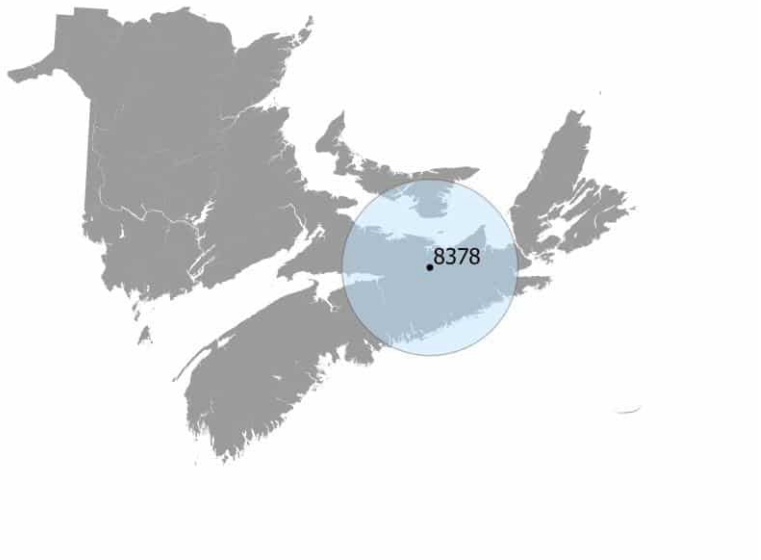
- unknown — MAFIC INTRUSION: gabbro, lesser diorite, fine- to medium- and coarse-grained varieties
- unknown — FELSIC INTRUSION: monzogranite, monzonite and gneissic granite

APPENDIX E
ACCDC REPORT

Data Report 8378: Hopewell, NS

Prepared 6 January 2025
by Kristen Tenwolde
Conservation Data Analyst

CONTENTS OF REPORT



Map 1. A 100 km buffer around the study area

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (AC CDC; www.accdc.com) is part of a network of NatureServe data centres and heritage programs serving 50 states in the U.S.A, 10 provinces and 1 territory in Canada, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The AC CDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. Although a non-governmental agency, the AC CDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees.

Upon request and for a fee, the AC CDC queries its database and produces customized reports of the rare and endangered flora and fauna known to occur in or near a specified study area. As a supplement to that data, the AC CDC includes locations of managed areas with some level of protection, and known sites of ecological interest or sensitivity.

1.1 DATA LIST

Included datasets:

Filename	Contents
HopewellNS_8378ob.xls	Rare or legally protected Flora and Fauna in your study area
HopewellNS_8378ob100km.xls	A list of Rare and legally protected Flora and Fauna within 100 km of your study area
HopewellNS_8378msa.xls	Managed and Biologically Significant Areas in your study area

1.2 RESTRICTIONS

The AC CDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By accepting AC CDC data, recipients assent to the following limits of use:

a) Data is restricted to use by trained personnel who are sensitive to landowner interests and to potential threats to rare and/or endangered flora and fauna posed by the information provided.
b) Data is restricted to use by the specified Data User; any third-party requiring data must make its own data request.
c) The AC CDC requires Data Users to cease using and delete data 12 months after receipt, and to make a new request for updated data, if necessary, at that time.
d) AC CDC data responses are restricted to the data in our Data System at the time of the data request.
e) Each record has an estimate of locational uncertainty, which must be referenced to understand the record's relevance to a particular location. Please see attached Data Dictionary for details.
f) AC CDC data responses are not to be construed as exhaustive inventories of taxa in an area.
g) The absence of a taxon cannot be inferred by its absence in an AC CDC data response.

1.3 ADDITIONAL INFORMATION

The accompanying Data Dictionary provides metadata for the data provided.

Please direct any additional questions about AC CDC data to the following individuals:

Plants, Lichens, Ranking Methods, All other Inquiries
Sean Blaney
Senior Scientist / Executive Director
(506) 364-2658
sean.blaney@accdc.ca

Animals (Fauna)
John Klymko
Zoologist
(506) 364-2660
john.klymko@accdc.ca

Data Management, GIS
Charity Robicheau
Senior Conservation Data Analyst
charity.robicheau@accdc.ca

Billing
Jean Breau
Financial Manager / Executive Assistant
(506) 364-2657
jean.breau@accdc.ca

Questions on the biology of Federal Species at Risk can be directed to AC CDC: (506) 364-2658, with questions on Species at Risk regulations to: Samara Eaton, Canadian Wildlife Service (NB and PE): (506) 364-5060 or Julie McKnight, Canadian Wildlife Service (NS): (902) 426-4196.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in New Brunswick, please contact Hubert Askanas, Energy and Resource Development: (506) 453-5873.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in Nova Scotia, please contact Donna Hurlburt, NS DLF: (902) 679-6886. To determine if location-sensitive species (section 4.3) occur near your study site please contact a NS DLF Regional Biologist:

Western: Emma Vost
(902) 670-8187
Emma.Vost@novascotia.ca

Western: Sarah Spencer
(902) 541-0081
Sarah.Spencer@novascotia.ca

Central: Shavonne Meyer
(902) 893-0816
Shavonne.Meyer@novascotia.ca

Central: Kimberly George
(902) 890-1046
Kimberly.George@novascotia.ca

Eastern: Harrison Moore
(902) 497-4119
Harrison.Moore@novascotia.ca

Eastern: Maureen Cameron-MacMillan
(902) 295-2554
Maureen.Cameron-MacMillan@novascotia.ca

Eastern: Elizabeth Walsh
(902) 563-3370
Elizabeth.Walsh@novascotia.ca

For provincial information about rare taxa and protected areas, or information about game animals, fish habitat etc., on Prince Edward Island, please contact Garry Gregory, PEI Dept. of Communities, Land and Environment: (902) 569-7595.

2.0 RARE AND ENDANGERED SPECIES

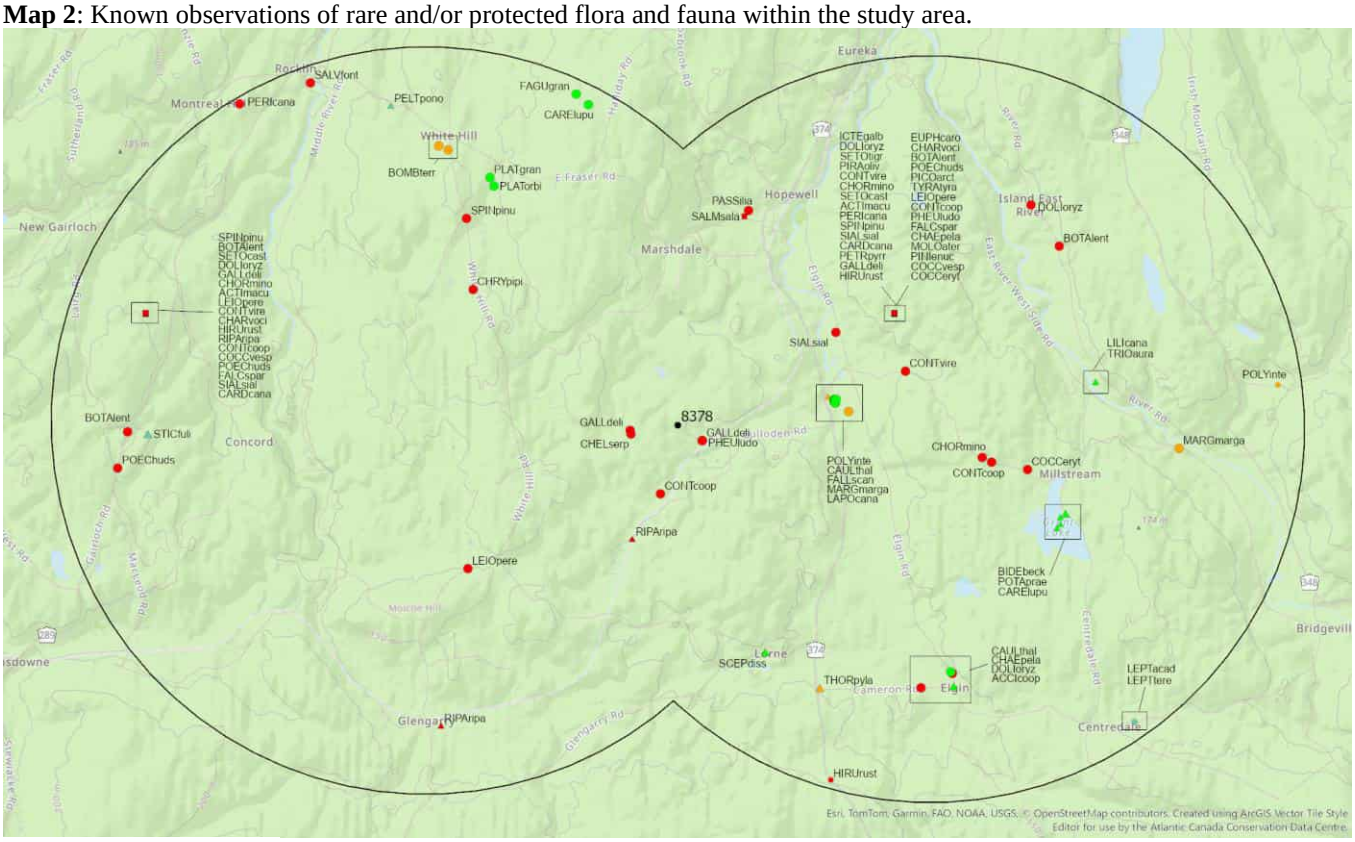
2.1 FLORA

The study area contains 22 records of 12 vascular and 4 records of 4 nonvascular flora (Map 2 and attached: *ob.xls), excluding 'location-sensitive' species.

2.2 FAUNA

The study area contains 128 records of 37 vertebrate and 7 records of 4 invertebrate fauna (Map 2 and attached data files - see 1.1 Data List), excluding 'location-sensitive species'. Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

Map 2: Known observations of rare and/or protected flora and fauna within the study area.



Resolution

- 1.0 = Within 10s of metres
- 1.7 = Within 50s of metres
- 2.0 = Within 100s of metres
- 2.7 = Within 500s of metres
- 3.0 = Within kilometres
- 3.7 = Within 5s of kilometres
- 4.0 = Within 10s of kilometres
- 4.7 = Within 50s of kilometres

Higher taxon

- Vertebrate fauna
- Invertebrate fauna
- Vascular flora
- Nonvascular flora

3.0 SPECIAL AREAS

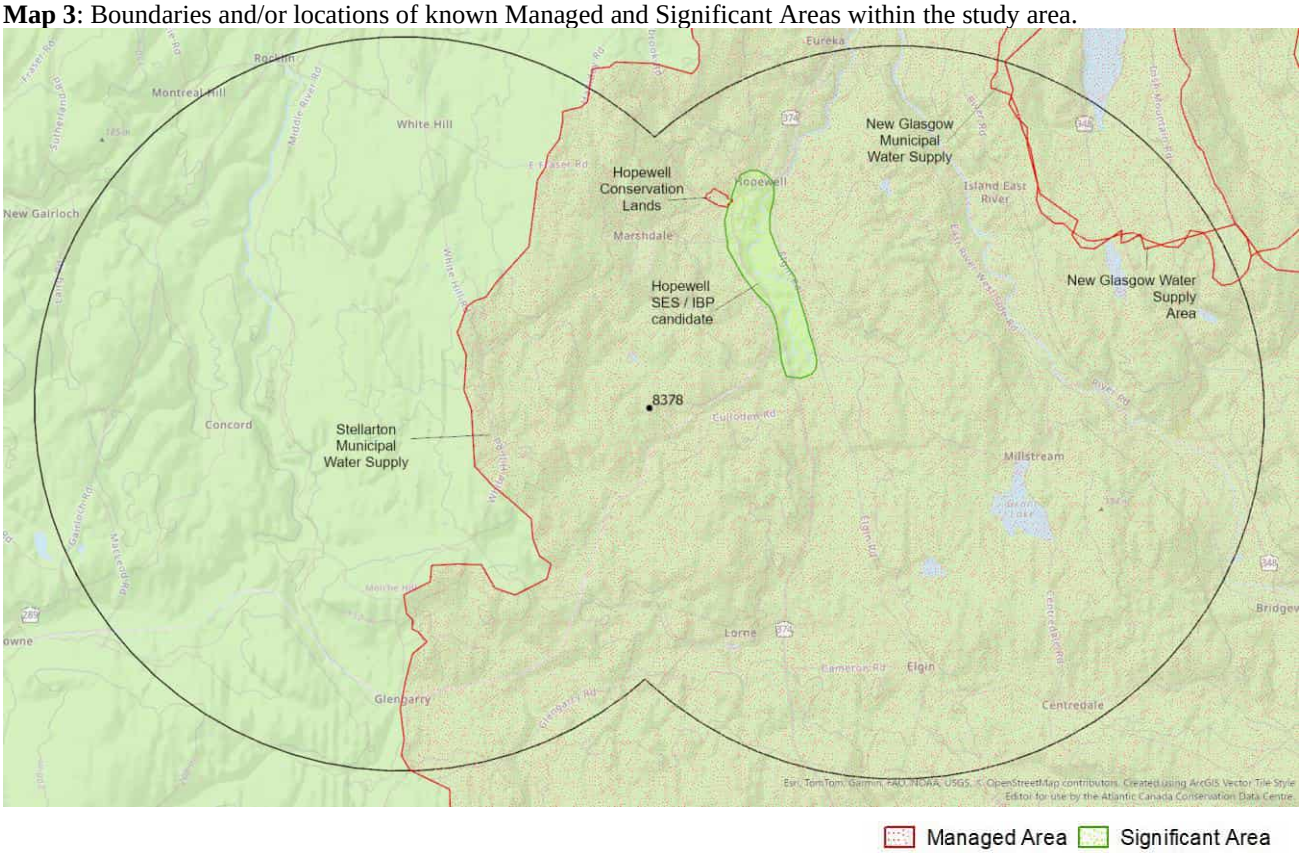
3.1 MANAGED AREAS

The GIS scan identified 4 managed areas in the vicinity of the study area (Map 3 and attached file: *msa.xls).

3.2 SIGNIFICANT AREAS

Significant Areas are sites with a conservation designation and management that qualifies them for listing in the Canadian Protected and Conserved Areas Database (CPCAD; https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/protected-conserved-areas-database.html). The absence of a "Significant Area" within a site or region does not indicate an absence of ecologically significant properties. The GIS scan identified 1 biologically significant site in the vicinity of the study area (Map 3 and attached file: *msa.xls).

Map 3: Boundaries and/or locations of known Managed and Significant Areas within the study area.



4.0 RARE SPECIES LISTS

Rare and/or endangered taxa (excluding "location-sensitive" species, section 4.3) within the study area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record). [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community. Note: records are from attached files *ob.xls/*ob.shp only.

4.1 FLORA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
N	*Peltigera ponojensis*	Pale-bellied Pelt Lichen				S1S2	1	5.7 ± 0.5
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3S4	1	7.1 ± 2.0
N	*Scytinium teretiusculum*	Curly Jellyskin Lichen				S3S4	1	7.3 ± 0.01
N	*Leptogium acadiense*	Acadian Jellyskin Lichen				S3S4	1	7.3 ± 0.01
P	*Lilium canadense*	Canada Lily				S2	1	5.6 ± 0.25
P	*Caulophyllum thalictroides*	Blue Cohosh				S2S3	8	2.1 ± 0.2
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S3	1	5.6 ± 0.25
P	*Laportea canadensis*	Canada Wood Nettle				S3	1	2.1 ± 0.2
P	*Carex lupulina*	Hop Sedge				S3	2	4.4 ± 0.2
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	1	4.1 ± 0.2
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3	1	5.3 ± 1.0
P	*Sceptridium dissectum*	Dissected Moonwort				S3	2	3.3 ± 1.0
P	*Bidens beckii*	Water Beggarticks				S3S4	2	5.3 ± 0.5
P	*Fagus grandifolia*	American Beech				S3S4	1	4.6 ± 0.2
P	*Fallopia scandens*	Climbing False Buckwheat				S3S4	1	2.1 ± 0.2
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3S4	1	4.0 ± 0.2

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2B	3	1.6 ± 0.5
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2S3B,S1M	3	3.3 ± 7.07
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	1	3.3 ± 7.07
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	1	0.6 ± 0.2
A	*Hirundo rustica*	Barn Swallow	Special Concern	Threatened	Endangered	S3B	7	3.2 ± 7.07
A	*Cardellina canadensis*	Canada Warbler	Special Concern	Threatened	Endangered	S3B	3	3.3 ± 7.07
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Special Concern	Threatened	S3B	6	3.2 ± 7.07
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Special Concern	Threatened	S3B	7	1.0 ± 0.15
A	*Dolichonyx oryzivorus*	Bobolink	Special Concern	Threatened	Vulnerable	S3B	10	3.2 ± 7.07
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern	Special Concern	Vulnerable	S3B,S3N,S3M	6	3.2 ± 7.07
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	6	3.1 ± 0.15
A	*Chrysemys picta picta*	Eastern Painted Turtle	Special Concern	Special Concern		S4	1	3.3 ± 0.2
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1?B,SUN,SUM	1	4.8 ± 0.2
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	3	2.4 ± 0.15
A	*Salmo salar*	Atlantic Salmon	E,T,SC			S1B,S1N	1	2.9 ± 6.61
A	*Molothrus ater*	Brown-headed Cowbird				S2B	1	3.3 ± 7.07
A	*Piranga olivacea*	Scarlet Tanager				S2B,SUM	1	3.3 ± 7.07
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	1	3.3 ± 7.07
A	*Icterus galbula*	Baltimore Oriole				S2S3B,SUM	1	3.3 ± 7.07
A	*Perisoreus canadensis*	Canada Jay				S3	2	3.3 ± 7.07
A	*Poecile hudsonicus*	Boreal Chickadee				S3	6	3.2 ± 7.07
A	*Spinus pinus*	Pine Siskin				S3	5	3.2 ± 7.07
A	*Salvelinus fontinalis*	Brook Trout				S3	1	6.7 ± 0.2
A	*Charadrius vociferus*	Killdeer				S3B	2	3.3 ± 7.07

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	4	3.2 ± 7.07
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	2	3.3 ± 7.07
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S3B	3	0.4 ± 0.15
A	*Falco sparverius*	American Kestrel				S3B,S4S5M	7	3.2 ± 7.07
A	*Gallinago delicata*	Wilson's Snipe				S3B,S5M	9	0.4 ± 0.15
A	*Pinicola enucleator*	Pine Grosbeak				S3B,S5N,S5M	1	3.3 ± 7.07
A	*Setophaga tigrina*	Cape May Warbler				S3B,SUM	2	3.3 ± 7.07
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	1	3.3 ± 7.07
A	*Botaurus lentiginosus*	American Bittern				S3S4B,S4S5M	7	3.3 ± 7.07
A	*Setophaga castanea*	Bay-breasted Warbler				S3S4B,S4S5M	3	3.3 ± 7.07
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S5M	5	3.2 ± 7.07
A	*Leiothlypis peregrina*	Tennessee Warbler				S3S4B,S5M	4	3.3 ± 7.07
A	*Passerella iliaca*	Fox Sparrow				S3S4B,S5M	1	3.0 ± 0.25
I	*Bombus terricola*	Yellow-banded Bumble Bee	Special Concern	Special Concern	Vulnerable	S3	2	4.8 ± 0.2
I	*Margaritifera margaritifera*	Eastern Pearlshell				S2	2	2.3 ± 0.2
I	*Polygonia interrogationis*	Question Mark				S3B	2	2.0 ± 0.5
I	*Cecropterus pylades*	Northern Cloudywing				S3S4	1	4.0 ± 2.5

4.3 LOCATION SENSITIVE SPECIES

The Department of Natural Resources in each Maritimes province considers a number of species "location sensitive". Concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in this report. Those intersecting your study area are indicated below with "YES".

Nova Scotia

Scientific *Name*	Common Name	SARA	Prov Legal Prot	Known within the Study Site?
Alces alces americana	Moose – Mainland population		Endangered	No
Fraxinus nigra	Black Ash		Threatened	No
Emydoidea blandingii	Blanding's Turtle - Nova Scotia pop.	Endangered	Endangered	No
Glyptemys insculpta	**Wood Turtle**	**Threatened**	**Threatened**	**YES**
Falco peregrinus pop. 1	Peregrine Falcon - anatum/tundrius pop.		Vulnerable	No
Bat Hibernaculum or bat species occurrence		**[Endangered][1]**	**[Endangered][1]**	**YES**
Snake hibernaculum		[Threatened][2]	[Threatened][2]	No

1 *Myotis lucifugus* (Little Brown Myotis), *Myotis septentrionalis* (Long-eared Myotis), and *Perimyotis subflavus* (Tri-colored Bat or Eastern Pipistrelle) are all Endangered under the Federal Species at Risk Act and the NS Endangered Species Act.
2 *Thamnophis sauritus* (Eastern Ribbonsnake) is Threatened under the Federal Species at Risk Act (SARA) and the Nova Scotia Endangered Species Act. Occurrences between October 15 – April 15 are considered location sensitive.

4.4 SOURCE BIBLIOGRAPHY

The recipient of these data shall acknowledge the AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

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5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 40473 records of 139 vertebrate and 1293 records of 74 invertebrate fauna; 7788 records of 243 vascular and 3182 records of 141 nonvascular flora (attached: *ob100km.xls).

Taxa within 100 km of the study site that are rare and/or endangered in the province in which the study site occurs (including “location-sensitive” species). All ranks correspond to the province in which the study site falls, even for out-of-province records. Taxa are listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record).

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Myotis lucifugus*	Little Brown Myotis	Endangered	Endangered	Endangered	S1	90	10.9 ± 0.15	NS
A	*Myotis septentrionalis*	Northern Myotis	Endangered	Endangered	Endangered	S1	46	62.9 ± 1.0	PE
A	*Perimyotis subflavus*	Tricolored Bat	Endangered	Endangered	Endangered	S1	4	67.2 ± 5.0	NS
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy population	Endangered	Endangered		S1	21	13.1 ± 0.5	NS
A	*Salmo salar pop. 6*	Atlantic Salmon - Nova Scotia Southern Upland population	Endangered			S1	38	16.9 ± 0.5	NS
A	*Charadrius melodus melodus*	Piping Plover melodus subspecies	Endangered	Endangered	Endangered	S1B	919	21.7 ± 7.07	NS
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1B	35	66.4 ± 0.5	NS
A	*Morone saxatilis pop. 2*	Striped Bass - Bay of Fundy population	Endangered			S2S3B,S2S3N	2	75.4 ± 0.5	NS
A	*Asio flammeus*	Short-eared Owl	Threatened	Special Concern		S1B	11	11.8 ± 7.07	NS
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2	8502	11.0 ± 0.02	NS
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2B	1519	1.6 ± 0.5	NS
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2S3B,S1M	715	10.9 ± 0.01	NS
A	*Limosa haemastica*	Hudsonian Godwit	Threatened			S2S3M	22	29.7 ± 0.2	NS
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened			S2S3N	2	64.5 ± 0.5	NS
A	*Hydrobates leucorhous*	Leach's Storm-Petrel	Threatened			S3B	59	34.1 ± 0.2	NS
A	*Tringa flavipes*	Lesser Yellowlegs	Threatened			S3M	489	19.6 ± 0.5	NS
A	*Anguilla rostrata*	American Eel	Threatened			S3N	72	20.9 ± 0.2	NS
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened		SUB	39	21.7 ± 7.07	NS
A	*Salmo salar pop. 12*	Atlantic Salmon - Gaspe - Southern Gulf of St. Lawrence population	Special Concern			S1	44	10.8 ± 0.5	NS
A	*Antrostomus vociferus*	Eastern Whip-Poor-Will	Special Concern	Threatened	Threatened	S1?B	7	57.1 ± 7.07	NS
A	*Passerculus sandwichensis princeps*	Ipswich Sparrow	Special Concern	Special Concern		S1B	12	73.5 ± 0.15	NS
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	280	11.3 ± 0.15	NS
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern population	Special Concern	Special Concern	Endangered	S2N	48	15.9 ± 0.2	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern	Special Concern		S2S3M	3	34.3 ± 0.2	NS
A	*Morone saxatilis pop. 1*	Striped Bass - Southern Gulf of St. Lawrence population	Special Concern			S2S3N	1	65.4 ± 1.0	NS
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	181	0.6 ± 0.2	NS
A	*Hirundo rustica*	Barn Swallow	Special Concern	Threatened	Endangered	S3B	1969	11.1 ± 7.07	NS
A	*Cardellina canadensis*	Canada Warbler	Special Concern	Threatened	Endangered	S3B	1133	10.7 ± 0.2	NS
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Special Concern	Threatened	S3B	400	11.1 ± 0.15	NS
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Special Concern	Threatened	S3B	1217	1.0 ± 0.15	NS
A	*Dolichonyx oryzivorus*	Bobolink	Special Concern	Threatened	Vulnerable	S3B	1696	11.1 ± 7.07	NS
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern	Special Concern	Vulnerable	S3B,S3N,S3M	839	11.3 ± 0.98	NS
A	*Podiceps auritus*	Horned Grebe	Special Concern	Special Concern		S3N,SUM	21	37.5 ± 0.2	NS
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	1156	10.6 ± 0.01	NS
A	*Phocoena phocoena pop. 1*	Harbour Porpoise - Northwest Atlantic Population	Special Concern			S4	7	34.1 ± 0.2	NS
A	*Chrysemys picta picta*	Eastern Painted Turtle	Special Concern	Special Concern		S4	81	12.6 ± 1.0	NS
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1?B,SUN,SUM	23	12.3 ± 0.15	NS
A	*Fulica americana*	American Coot	Not At Risk			S1B	19	33.1 ± 7.07	NS
A	*Chlidonias niger*	Black Tern	Not At Risk			S1B	4	29.6 ± 0.2	NS
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Not At Risk		Vulnerable	S1B,SUM	13	34.5 ± 0.2	NS
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S2?B,SUM	14	33.2 ± 0.15	NS
A	*Globicephala melas*	Long-finned Pilot Whale	Not At Risk			S2S3	1	55.2 ± 100.0	NS
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S3	13	10.6 ± 0.2	NS
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	446	20.8 ± 0.15	NS
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	62	11.9 ± 0.15	NS
A	*Buteo lagopus*	Rough-legged Hawk	Not At Risk			S3N	14	12.6 ± 0.2	NS
A	*Accipiter atricapillus*	American Goshawk	Not At Risk			S3S4	133	10.8 ± 0.2	NS
A	*Glaucomys volans*	Southern Flying Squirrel	Not At Risk			S3S4	1	30.7 ± 0.2	NS
A	*Lagenorhynchus acutus*	Atlantic White-sided Dolphin	Not At Risk			S3S4	1	85.5 ± 0.2	NS
A	*Ammospiza nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	210	11.8 ± 7.07	NS
A	*Calidris canutus rufa*	Red Knot rufa subspecies	E,SC	Endangered	Endangered	S2M	83	100.0 ± 0.57	PE
A	*Morone saxatilis*	Striped Bass	E,SC			S2S3B,S2S3N	17	39.3 ± 0.2	NS
A	*Gadus morhua*	Atlantic Cod	E,SC,DD			SNR	1	67.7 ± 0.2	NS
A	*Salmo salar*	Atlantic Salmon	E,T,SC			S1B,S1N	17	14.2 ± 0.2	NS
A	*Alces alces americana*	Moose			Endangered	S1	145	22.5 ± 0.5	NS
A	*Alces alces*	Moose				S1	9	44.4 ± 0.2	NS
A	*Picoides dorsalis*	American Three-toed Woodpecker				S1?	6	71.8 ± 7.07	NS
A	*Uria aalge*	Common Murre				S1?B	2	75.7 ± 0.2	NS
A	*Passerina cyanea*	Indigo Bunting				S1?B,SUM	24	24.6 ± 0.2	NS
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1B	1	70.3 ± 7.07	NS
A	*Oxyura jamaicensis*	Ruddy Duck				S1B	15	17.6 ± 0.35	NS
A	*Gallinula galeata*	Common Gallinule				S1B	7	34.6 ± 7.07	NS
A	*Myiarchus crinitus*	Great Crested Flycatcher				S1B	13	13.5 ± 7.07	NS
A	*Mimus polyglottos*	Northern Mockingbird				S1B	28	11.8 ± 7.07	NS
A	*Toxostoma rufum*	Brown Thrasher				S1B	12	11.8 ± 7.07	NS
A	*Charadrius semipalmatus*	Semipalmated Plover				S1B,S4M	787	100.0 ± 0.2	PE
A	*Calidris minutilla*	Least Sandpiper				S1B,S4M	443	19.6 ± 0.5	NS
A	*Anas acuta*	Northern Pintail				S1B,SUM	46	19.6 ± 0.2	NS
A	*Vireo gilvus*	Warbling Vireo				S1B,SUM	20	12.4 ± 0.2	NS
A	*Vespertilionidae sp.*	bat species				S1S2	103	13.5 ± 0.1	NS
A	*Pooecetes gramineus*	Vesper Sparrow				S1S2B,SUM	41	13.0 ± 7.07	NS
A	*Vireo philadelphicus*	Philadelphia Vireo				S2?B,SUM	68	14.5 ± 0.2	NS
A	*Alca torda*	Razorbill				S2B	12	37.4 ± 2.42	NS
A	*Fratercula arctica*	Atlantic Puffin				S2B	2	67.1 ± 7.07	NS
A	*Empidonax traillii*	Willow Flycatcher				S2B	19	42.9 ± 7.07	NS
A	*Molothrus ater*	Brown-headed Cowbird				S2B	165	11.8 ± 7.07	NS
A	*Somateria mollissima*	Common Eider				S2B,S2N,S4M	476	23.4 ± 0.2	NS
A	*Spatula clypeata*	Northern Shoveler				S2B,SUM	27	17.9 ± 0.2	NS
A	*Mareca strepera*	Gadwall				S2B,SUM	43	17.8 ± 0.2	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Piranga olivacea*	Scarlet Tanager				S2B,SUM	14	17.3 ± 7.07	NS
A	*Calidris alba*	Sanderling				S2N,S3M	400	19.6 ± 0.5	NS
A	*Martes americana*	American Marten			Endangered	S2S3	1	97.8 ± 0.2	NS
A	*Asio otus*	Long-eared Owl				S2S3	33	11.1 ± 7.07	NS
A	*Rallus limicola*	Virginia Rail				S2S3B	44	30.0 ± 0.15	NS
A	*Rissa tridactyla*	Black-legged Kittiwake				S2S3B	19	26.0 ± 0.2	NS
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	294	11.1 ± 7.07	NS
A	*Phalacrocorax carbo*	Great Cormorant				S2S3B,S2S3N	189	19.6 ± 0.2	NS
A	*Cathartes aura*	Turkey Vulture				S2S3B,S4S5M	43	11.8 ± 0.2	NS
A	*Setophaga pinus*	Pine Warbler				S2S3B,S4S5M	40	11.8 ± 0.2	NS
A	*Icterus galbula*	Baltimore Oriole				S2S3B,SUM	87	11.8 ± 7.07	NS
A	*Pluvialis dominica*	American Golden-Plover				S2S3M	55	23.1 ± 0.5	NS
A	*Numenius phaeopus hudsonicus*	Whimbrel				S2S3M	95	29.5 ± 0.5	NS
A	*Phalaropus fulicarius*	Red Phalarope				S2S3M	1	88.3 ± 0.36	NS
A	*Perisoreus canadensis*	Canada Jay				S3	610	11.1 ± 7.07	NS
A	*Poecile hudsonicus*	Boreal Chickadee				S3	1005	10.3 ± 0.2	NS
A	*Spinus pinus*	Pine Siskin				S3	539	11.1 ± 7.07	NS
A	*Salvelinus fontinalis*	Brook Trout				S3	104	10.8 ± 0.5	NS
A	*Salvelinus namaycush*	Lake Trout				S3	2	28.6 ± 0.5	NS
A	*Pekania pennanti*	Fisher				S3	11	26.0 ± 0.2	NS
A	*Calcarius lapponicus*	Lapland Longspur				S3?N,SUM	10	31.1 ± 0.2	NS
A	*Spatula discors*	Blue-winged Teal				S3B	214	17.3 ± 7.07	NS
A	*Charadrius vociferus*	Killdeer				S3B	636	10.3 ± 0.15	NS
A	*Tringa semipalmata*	Willet				S3B	950	17.7 ± 0.15	NS
A	*Sterna paradisaea*	Arctic Tern				S3B	41	61.1 ± 7.07	NS
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	114	11.1 ± 7.07	NS
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	299	11.8 ± 7.07	NS
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S3B	737	0.4 ± 0.15	NS
A	*Alosa pseudoharengus*	Alewife				S3B	34	10.8 ± 0.5	NS
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S4M	861	12.0 ± 0.15	NS
A	*Falco sparverius*	American Kestrel				S3B,S4S5M	500	11.1 ± 7.07	NS
A	*Mergus serrator*	Red-breasted Merganser				S3B,S4S5N,S5M	158	100.0 ± 0.25	NS
A	*Gallinago delicata*	Wilson's Snipe				S3B,S5M	945	0.4 ± 0.15	NS
A	*Setophaga striata*	Blackpoll Warbler				S3B,S5M	145	13.0 ± 7.07	NS
A	*Cardellina pusilla*	Wilson's Warbler				S3B,S5M	117	100.0 ± 0.25	NS
A	*Pinicola enucleator*	Pine Grosbeak				S3B,S5N,S5M	135	11.1 ± 7.07	NS
A	*Setophaga tigrina*	Cape May Warbler				S3B,SUM	306	12.2 ± 0.55	NS
A	*Branta bernicla*	Brant				S3M	1	98.0 ± 0.3	NS
A	*Pluvialis squatarola*	Black-bellied Plover				S3M	662	19.6 ± 0.5	NS
A	*Arenaria interpres*	Ruddy Turnstone				S3M	264	19.6 ± 0.5	NS
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	665	19.6 ± 0.5	NS
A	*Calidris melanotos*	Pectoral Sandpiper				S3M	49	19.6 ± 0.5	NS
A	*Limnodromus griseus*	Short-billed Dowitcher				S3M	314	19.6 ± 0.5	NS
A	*Chroicocephalus ridibundus*	Black-headed Gull				S3N	58	14.8 ± 0.2	NS
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	186	13.0 ± 7.07	NS
A	*Loxia curvirostra*	Red Crossbill				S3S4	178	11.3 ± 0.2	NS
A	*Sorex albibarbis*	Eastern Water Shrew				S3S4	2	74.0 ± 0.1	PE
A	*Botaurus lentiginosus*	American Bittern				S3S4B,S4S5M	407	11.8 ± 7.07	NS
A	*Setophaga castanea*	Bay-breasted Warbler				S3S4B,S4S5M	676	11.1 ± 7.07	NS
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S5M	798	11.8 ± 0.2	NS
A	*Leiothlypis peregrina*	Tennessee Warbler				S3S4B,S5M	665	11.1 ± 7.07	NS
A	*Passerella iliaca*	Fox Sparrow				S3S4B,S5M	109	12.3 ± 0.2	NS
A	*Calidris maritima*	Purple Sandpiper				S3S4N	27	27.3 ± 0.2	NS
A	*Lanius borealis*	Northern Shrike				S3S4N	8	52.1 ± 0.2	NS
A	*Bucephala clangula*	Common Goldeneye				S4B,S4N,S5M	226	15.0 ± 0.99	NS
A	*Morus bassanus*	Northern Gannet				SHB	69	28.0 ± 0.2	NS
A	*Aythya americana*	Redhead				SHB	17	22.3 ± 0.2	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Leucophaeus atricilla*	Laughing Gull				SHB	5	73.6 ± 0.2	NS
A	*Progne subis*	Purple Martin				SHB	7	71.8 ± 7.07	NS
A	*Eremophila alpestris*	Horned Lark				SHB,S4S5N,S5M	26	31.0 ± 0.97	NS
I	*Bombus bohemicus*	Ashton Cuckoo Bumble Bee	Endangered	Endangered	Endangered	S1	32	24.0 ± 5.0	NS
I	*Danaus plexippus*	Monarch	Endangered	Endangered	Endangered	S2?B,S3M	270	11.8 ± 0.2	NS
I	*Barnea truncata*	Atlantic Mud-piddock	Threatened	Threatened		S1	4	83.6 ± 1.0	NS
I	*Bombus suckleyi*	Suckley's Cuckoo Bumble Bee	Threatened			SH	3	45.2 ± 5.0	NS
I	*Alasmidonta varicosa*	Brook Floater	Special Concern	Special Concern	Threatened	S3	18	32.8 ± 0.1	NS
I	*Bombus terricola*	Yellow-banded Bumble Bee	Special Concern	Special Concern	Vulnerable	S3	156	11.8 ± 0.2	NS
I	*Coccinella transversoguttata richardsoni*	Transverse Lady Beetle	Special Concern		Endangered	SH	7	19.6 ± 2.5	NS
I	*Gomphurus ventricosus*	Skillet Clubtail	Special Concern	Endangered		SH	1	86.6 ± 0.5	NS
I	*Erora laeta*	Early Hairstreak				S1	1	96.7 ± 0.5	PE
I	*Pachydiplax longipennis*	Blue Dasher				S1	1	77.0 ± 0.2	NS
I	*Polygonia satyrus*	Satyr Comma				S1?	20	40.5 ± 5.0	NS
I	*Euphyes bimacula*	Two-spotted Skipper				S1S2	2	17.3 ± 0.1	NS
I	*Boloria chariclea grandis*	Purple Lesser Fritillary				S1S2	1	50.3 ± 2.5	NS
I	*Somatochlora brevicincta*	Quebec Emerald				S1S2	1	93.6 ± 0.1	NS
I	*Agonum deceptivum*	Deceptive Harp Ground Beetle				S2	1	55.2 ± 0.3	NS
I	*Hippodamia tredecimpunctata tibialis*	Thirteen-spotted Lady Beetle				S2	4	76.1 ± 0.21	NS
I	*Tournotaris bimaculata*	Two-spotted Brachycerid Weevil				S2	1	96.3 ± 0.2	PE
I	*Tharsalea dospassosi*	Maritime Copper				S2	63	30.8 ± 1.0	NS
I	*Satyrium acadica*	Acadian Hairstreak				S2	14	24.9 ± 2.5	NS
I	*Neurocordulia michaeli*	Broad-tailed Shadowdragon				S2	26	21.4 ± 0.05	NS
I	*Coenagrion resolutum*	Taiga Bluet				S2	44	59.9 ± 0.5	PE
I	*Margaritifera margaritifera*	Eastern Pearlshell				S2	180	11.4 ± 0.1	NS
I	*Pantala hymenaea*	Spot-Winged Glider				S2?B	1	56.6 ± 1.0	NS
I	*Nymphalis l-album j-album*	Compton Tortoiseshell				S2S3	10	11.2 ± 0.2	NS
I	*Aglais milberti*	Milbert's Tortoiseshell				S2S3	18	13.1 ± 2.5	NS
I	*Lanthus vernalis*	Southern Pygmy Clubtail				S2S3	8	32.5 ± 0.05	NS
I	*Somatochlora kennedyi*	Kennedy's Emerald				S2S3	1	93.9 ± 1.0	PE
I	*Williamsonia fletcheri*	Ebony Boghaunter				S2S3	4	70.2 ± 0.5	NS
I	*Enallagma geminatum*	Skimming Bluet				S2S3	1	78.1 ± 0.2	NS
I	*Stylurus scudderi*	Zebra Clubtail				S2S3	4	72.0 ± 0.5	NS
I	*Alasmidonta undulata*	Triangle Floater				S2S3	19	31.2 ± 1.1	NS
I	*Sphaeroderus nitidicollis*	Polished Snail-eating Beetle				S3	1	65.1 ± 0.2	NS
I	*Psephenus herricki*	Herrick's Water Penny Beetle				S3	7	35.0 ± 0.2	NS
I	*Hormorus undulatus*	Undulated Broad-nosed Weevil				S3	1	96.3 ± 0.2	PE
I	*Platydracus fossator*	Digging Rove Beetle				S3	2	28.2 ± 0.36	NS
I	*Carabus serratus*	Serrated Ground Beetle				S3	1	61.3 ± 0.2	NS
I	*Chrysochus auratus*	Dogbane Leaf Beetle				S3	3	75.3 ± 0.2	NS
I	*Naemia seriata*	Seaside Lady Beetle				S3	4	59.3 ± 0.54	NS
I	*Tachyerges ephippiatus*	Caparison Weevil				S3	1	75.4 ± 0.2	NS
I	*Chilocorus stigma*	Twice-stabbed Lady Beetle				S3	3	44.2 ± 0.2	NS
I	*Myzia pullata*	Streaked Lady Beetle				S3	1	95.1 ± 0.2	PE
I	*Iphthiminus opacus*	Cloudy Darkling Beetle				S3	1	60.5 ± 0.2	PE
I	*Monochamus marmorator*	Balsam Fir Sawyer				S3	3	25.9 ± 0.2	NS
I	*Astylopsis sexguttata*	Six-speckled Long-horned Beetle				S3	3	96.3 ± 0.2	PE
I	*Satyrium calanus falacer*	Falacer Hairstreak				S3	4	15.7 ± 2.5	NS
I	*Callophrys lanoraieensis*	Bog Elfin				S3	10	20.9 ± 0.2	NS
I	*Phanogomphus descriptus*	Harpoon Clubtail				S3	4	77.1 ± 1.0	NS
I	*Ophiogomphus aspersus*	Brook Snaketail				S3	1	94.3 ± 0.1	NS
I	*Ophiogomphus mainensis*	Maine Snaketail				S3	14	18.8 ± 0.05	NS
I	*Ophiogomphus rupinsulensis*	Rusty Snaketail				S3	55	31.8 ± 0.05	NS
I	*Epitheca princeps*	Prince Baskettail				S3	11	70.2 ± 0.5	NS
I	*Somatochlora forcipata*	Forcipate Emerald				S3	3	88.5 ± 1.0	PE
I	*Enallagma vernale*	Vernal Bluet				S3	4	65.4 ± 1.0	NS

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I	*Strophitus undulatus*	Creeper				S3	6	96.4 ± 1.0	NS
I	*Polygonia interrogationis*	Question Mark				S3B	48	11.2 ± 0.01	NS
I	*Cecropterus pylades*	Northern Cloudywing				S3S4	27	12.1 ± 1.0	NS
I	*Amblyscirtes hegon*	Pepper and Salt Skipper				S3S4	16	24.9 ± 2.5	NS
I	*Cupido comyntas*	Eastern Tailed Blue				S3S4	3	39.2 ± 0.1	NS
I	*Argynnis aphrodite winni*	Aphrodite Fritillary				S3S4	25	12.2 ± 100.0	NS
I	*Polygonia faunus*	Green Comma				S3S4	17	13.1 ± 2.5	NS
I	*Oeneis jutta ascerta*	Jutta Arctic				S3S4	9	18.7 ± 0.01	NS
I	*Aeshna clepsydra*	Mottled Darner				S3S4	9	67.3 ± 1.0	NS
I	*Aeshna constricta*	Lance-Tipped Darner				S3S4	25	15.4 ± 0.2	NS
I	*Boyeria grafiana*	Ocellated Darner				S3S4	14	12.4 ± 0.2	NS
I	*Gomphaeschna furcillata*	Harlequin Darner				S3S4	5	10.6 ± 0.2	NS
I	*Somatochlora franklini*	Delicate Emerald				S3S4	4	78.4 ± 1.0	NS
I	*Erythrodiplax berenice*	Seaside Dragonlet				S3S4	8	33.9 ± 0.2	NS
I	*Nannothemis bella*	Elfin Skimmer				S3S4	6	11.8 ± 0.2	NS
I	*Sympetrum danae*	Black Meadowhawk				S3S4	7	53.3 ± 1.0	NS
I	*Enallagma vesperum*	Vesper Bluet				S3S4	1	98.4 ± 0.2	NS
I	*Amphiagrion saucium*	Eastern Red Damsel				S3S4	4	24.7 ± 0.01	NS
I	*Sphaerophoria pyrrhina*	Violaceous Globetail				SH	1	44.5 ± 5.0	NS
I	*Icaricia saepiolus amica*	Greenish Blue				SH	3	15.2 ± 2.5	NS
I	*Polygonia gracilis*	Hoary Comma				SH	2	13.1 ± 2.5	NS
N	*Erioderma mollissimum*	Graceful Felt Lichen	Endangered	Endangered	Endangered	S1	34	52.4 ± 0.01	NS
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1	545	35.0 ± 0.5	NS
N	*Peltigera hydrothyria*	Eastern Waterfan	Threatened	Threatened	Threatened	S1	87	25.7 ± 0.01	NS
N	*Pannaria lurida*	Wrinkled Shingle Lichen	Threatened	Threatened	Threatened	S2S3	30	42.5 ± 0.1	NS
N	*Anzia colpodes*	Black-foam Lichen	Threatened	Threatened	Threatened	S3	34	25.0 ± 0.5	NS
N	*Fuscopannaria leucosticta*	White-rimmed Shingle Lichen	Threatened			S3	11	44.8 ± 0.01	NS
N	*Heterodermia squamulosa*	Scaly Fringe Lichen	Threatened			S3	9	44.3 ± 0.1	NS
N	*Pectenia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	214	11.7 ± 0.01	NS
N	*Sclerophora peronella (Atlantic pop.)*	Frosted Glass-whiskers (Atlantic population)	Special Concern	Special Concern		S3S4	32	42.9 ± 0.1	NS
N	*Pseudevernia cladonia*	Ghost Antler Lichen	Not At Risk			S2S3	12	40.0 ± 1.1	NS
N	*Fissidens exilis*	Pygmy Pocket Moss	Not At Risk			S3	6	26.5 ± 0.2	NS
N	*Chaenotheca servitii*	Flexuous Golden Stubble	Data Deficient			S1	1	33.4 ± 1.0	NS
N	*Aloina brevirostris*	Short-Beaked Rigid Screw Moss				S1	1	96.8 ± 0.2	NS
N	*Orthotrichum gymnostomum*	Aspen Bristle Moss				S1	1	70.4 ± 0.2	NS
N	*Sematophyllum demissum*	a Moss				S1	1	99.6 ± 2.5	NS
N	*Cyrto-hypnum minutulum*	Tiny Cedar Moss				S1	1	33.6 ± 0.01	NS
N	*Usnea perplexans*	Powdered Beard Lichen				S1	1	94.7 ± 0.2	NS
N	*Scytinium schraderi*	Wrinkled Jellyskin Lichen				S1	1	67.7 ± 0.05	NS
N	*Lichina confinis*	Marine Seaweed Lichen				S1	2	72.6 ± 2.0	NS
N	*Polychidium muscicola*	Eyed Mossthorns Woollybear Lichen				S1	1	35.6 ± 0.2	NS
N	*Peltigera lepidophora*	Scaly Pelt Lichen				S1	4	62.2 ± 0.01	PE
N	*Hypogymnia hultenii*	Powdered Honeycomb Lichen				S1	15	70.6 ± 5.0	NS
N	*Calypogeia neogaea*	Common Pouchwort				S1?	1	98.6 ± 0.01	NS
N	*Jubula pennsylvanica*	a liverwort				S1?	4	27.2 ± 0.2	NS
N	*Aloina rigida*	Aloe-Like Rigid Screw Moss				S1?	2	68.0 ± 0.1	NS
N	*Campylostelium saxicola*	a Moss				S1?	2	96.3 ± 1.0	PE
N	*Tortula obtusifolia*	a Moss				S1?	3	39.9 ± 0.01	NS
N	*Grimmia laevigata*	a Moss				S1?	2	72.3 ± 0.24	NS
N	*Sphagnum cyclophyllum*	a Moss				S1?	1	55.2 ± 1.0	NS
N	*Enchylium limosum*	Lime-loving Tarpaper Lichen				S1?	1	87.6 ± 0.01	PE
N	*Scytinium intermedium*	Forty-five Jellyskin Lichen				S1?	1	67.5 ± 4.0	NS
N	*Sematophyllum marylandicum*	a Moss				S1S2	2	90.9 ± 6.5	NS
N	*Timmia megapolitana*	Metropolitan Timmia Moss				S1S2	1	65.9 ± 0.01	NS
N	*Pseudotaxiphyllum*	a Moss				S1S2	1	80.0 ± 0.01	NS

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	distichaceum								
N	*Haplocladium microphyllum*	Tiny-leaved Haplocladium Moss				S1S2	1	63.0 ± 5.0	NS
N	*Placidium squamulosum*	Limy Soil Stipplescale Lichen				S1S2	1	40.5 ± 6.0	NS
N	*Cladonia labradorica*	Labrador Lichen				S1S2	1	81.5 ± 0.05	NS
N	*Peltigera ponojensis*	Pale-bellied Pelt Lichen				S1S2	1	5.7 ± 0.5	NS
N	*Pilophorus cereolus*	Powdered Matchstick Lichen				S1S2	1	93.7 ± 3.0	NS
N	*Parmotrema reticulatum*	Netted Ruffle Lichen				S1S2	1	96.7 ± 0.5	NS
N	*Solorina spongiosa*	Fringed Chocolate Chip Lichen				S1S2	11	51.8 ± 0.2	NS
N	*Parmeliella parvula*	Poor-man's Shingles Lichen				S1S2	22	52.7 ± 0.01	NS
N	*Heterodermia galactophylla*	Branching Fringe Lichen				S1S3	2	81.2 ± 0.01	NS
N	*Peltigera neckeri*	Black-saddle Pelt Lichen				S1S3	2	58.3 ± 0.3	NS
N	*Stereocaulon grande*	Grand Foam Lichen				S1S3	1	65.3 ± 0.5	NS
N	*Anacamptodon splachnoides*	a Moss				S2	1	98.4 ± 0.2	NS
N	*Sphagnum platyphyllum*	Flat-leaved Peat Moss				S2	2	95.2 ± 3.0	NS
N	*Sphagnum subnitens*	Lustrous Peat Moss				S2	1	79.5 ± 2.0	NS
N	*Scytinium imbricatum*	Scaly Jellyskin Lichen				S2	1	93.1 ± 4.0	NS
N	*Nephroma resupinatum*	a lichen				S2	3	72.1 ± 0.5	NS
N	*Placynthium flabellosum*	Scaly Ink Lichen				S2	1	71.4 ± 17.5	NS
N	*Moerckia flotoviana*	Flotow's Ruffwort				S2?	1	94.2 ± 0.01	PE
N	*Riccardia multifida*	Delicate Germanderwort				S2?	3	60.5 ± 0.01	NS
N	*Anomodon viticulosus*	a Moss				S2?	1	68.9 ± 5.0	NS
N	*Atrichum angustatum*	Lesser Smoothcap Moss				S2?	3	38.5 ± 2.5	NS
N	*Drepanocladus polygamus*	Polygamous Hook Moss				S2?	2	68.1 ± 0.01	NS
N	*Ditrichum rhynchostegium*	a Moss				S2?	1	63.2 ± 0.5	PE
N	*Kiaeria starkei*	Starke's Fork Moss				S2?	1	80.2 ± 10.0	NS
N	*Philonotis marchica*	a Moss				S2?	2	35.5 ± 0.01	NS
N	*Platydictya jungermannioides*	False Willow Moss				S2?	3	67.5 ± 0.01	NS
N	*Saelania glaucescens*	Blue Dew Moss				S2?	1	46.3 ± 0.1	NS
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2?	1	46.3 ± 0.1	NS
N	*Platylomella lescurii*	a Moss				S2?	2	62.2 ± 0.2	NS
N	*Oxyrrhynchium hians*	Light Beaked Moss				S2S3	1	62.3 ± 25.0	NS
N	*Platydictya subtilis*	Bark Willow Moss				S2S3	1	96.4 ± 0.8	PE
N	*Moelleropsis nebulosa*	Blue-gray Moss Shingle Lichen				S2S3	60	43.3 ± 0.5	NS
N	*Moelleropsis nebulosa ssp. frullaniae*	Blue-gray Moss Shingle Lichen				S2S3	3	55.3 ± 0.5	NS
N	*Ramalina thrausta*	Angelhair Ramalina Lichen				S2S3	16	23.2 ± 0.5	NS
N	*Collema leptaleum*	Crumpled Bat's Wing Lichen				S2S3	114	50.8 ± 0.5	NS
N	*Usnea hirta*	Bristly Beard Lichen				S2S3	1	62.9 ± 0.2	NS
N	*Usnea rubicunda*	Red Beard Lichen				S2S3	3	55.4 ± 0.24	NS
N	*Ahtiana aurescens*	Eastern Candlewax Lichen				S2S3	7	22.7 ± 6.33	NS
N	*Cetraria muricata*	Spiny Heath Lichen				S2S3	1	94.2 ± 1.7	NS
N	*Cladonia incrassata*	Powder-foot British Soldiers Lichen				S2S3	1	50.6 ± 0.05	NS
N	*Cladonia parasitica*	Fence-rail Lichen				S2S3	1	76.9 ± 1.5	NS
N	*Scytinium tenuissimum*	Birdnest Jellyskin Lichen				S2S3	20	38.3 ± 0.2	NS
N	*Melanohalea septentrionalis*	Northern Camouflage Lichen				S2S3	2	93.6 ± 0.2	PE
N	*Parmelia fertilis*	Fertile Shield Lichen				S2S3	11	25.0 ± 0.5	NS
N	*Hypotrachyna minarum*	Hairless-spined Shield Lichen				S2S3	1	74.1 ± 0.05	NS
N	*Parmeliopsis ambigua*	Green Starburst Lichen				S2S3	2	24.9 ± 1.7	NS
N	*Fuscopannaria sorediata*	a Lichen				S2S3	15	39.9 ± 0.2	NS
N	*Stereocaulon condensatum*	Granular Soil Foam Lichen				S2S3	20	23.6 ± 0.05	NS
N	*Physcia subtilis*	Slender Rosette Lichen				S2S3	1	70.1 ± 0.05	NS
N	*Cladonia coccifera*	Eastern Boreal Pixie-cup Lichen				S2S3	2	33.0 ± 1.5	NS
N	*Cladonia deformis*	Lesser Sulphur-cup Lichen				S2S3	1	99.8 ± 0.01	PE
N	*Ephemerum serratum*	a Moss				S3	2	37.6 ± 3.0	NS
N	*Fissidens taxifolius*	Yew-leaved Pocket Moss				S3	5	14.6 ± 0.01	NS
N	*Anomodon tristis*	a Moss				S3	3	56.7 ± 0.01	NS
N	*Sphagnum contortum*	Twisted Peat Moss				S3	4	98.7 ± 4.0	NS

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N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S3	4	40.9 ± 0.2	NS
N	*Rostania occultata*	Crusted Tarpaper Lichen				S3	3	53.1 ± 0.5	NS
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S3	18	39.9 ± 2.0	NS
N	*Solorina saccata*	Woodland Owl Lichen				S3	6	51.8 ± 0.2	NS
N	*Fuscopannaria ahlneri*	Roughened Shingle Lichen				S3	108	26.3 ± 0.5	NS
N	*Scytinium lichenoides*	Tattered Jellyskin Lichen				S3	35	48.3 ± 0.01	NS
N	*Leptogium milligranum*	Stretched Jellyskin Lichen				S3	3	62.5 ± 3.0	NS
N	*Nephroma bellum*	Naked Kidney Lichen				S3	15	20.3 ± 0.01	NS
N	*Placynthium nigrum*	Common Ink Lichen				S3	4	39.9 ± 0.05	NS
N	*Platismatia norvegica*	Oldgrowth Rag Lichen				S3	3	82.2 ± 0.01	NS
N	*Punctelia appalachensis*	Appalachian Speckleback Lichen				S3	5	82.5 ± 0.01	NS
N	*Viridothelium virens*	a lichen				S3	1	93.9 ± 0.2	PE
N	*Ephebe lanata*	Waterside Rockshag Lichen				S3	3	35.6 ± 0.2	NS
N	*Phaeophyscia adiastola*	Powder-tipped Shadow Lichen				S3	4	63.6 ± 0.01	PE
N	*Phaeophyscia pusilloides*	Pompom-tipped Shadow Lichen				S3	14	15.9 ± 0.5	NS
N	*Peltigera collina*	Tree Pelt Lichen				S3	31	43.8 ± 0.2	NS
N	*Barbula convoluta*	Lesser Bird's-claw Beard Moss				S3?	1	60.5 ± 0.01	PE
N	*Calliergon giganteum*	Giant Spear Moss				S3?	1	92.5 ± 2.0	PE
N	*Elodium blandowii*	Blandow's Bog Moss				S3?	2	28.2 ± 3.0	NS
N	*Sphagnum lindbergii*	Lindberg's Peat Moss				S3?	1	76.3 ± 0.01	NS
N	*Sphagnum riparium*	Streamside Peat Moss				S3?	3	62.1 ± 0.01	NS
N	*Cladonia stygia*	Black-footed Reindeer Lichen				S3?	8	61.4 ± 0.01	NS
N	*Encalypta ciliata*	Fringed Extinguisher Moss				S3S4	1	99.1 ± 2.5	NS
N	*Encalypta procera*	Slender Extinguisher Moss				S3S4	9	65.8 ± 0.01	NS
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	1	46.3 ± 0.1	NS
N	*Splachnum ampullaceum*	Cruet Dung Moss				S3S4	2	46.7 ± 0.01	NS
N	*Thamnobryum alleghaniense*	a Moss				S3S4	2	92.1 ± 0.01	NS
N	*Tomentypnum nitens*	Golden Fuzzy Fen Moss				S3S4	2	81.2 ± 2.5	NS
N	*Schistidium agassizii*	Elf Bloom Moss				S3S4	2	67.4 ± 3.0	NS
N	*Bryoria pseudofuscescens*	Mountain Horsehair Lichen				S3S4	6	68.2 ± 0.2	PE
N	*Enchylium tenax*	Soil Tarpaper Lichen				S3S4	9	48.3 ± 0.01	NS
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3S4	55	33.0 ± 0.01	NS
N	*Arctoparmelia incurva*	Finger Ring Lichen				S3S4	38	63.3 ± 0.01	NS
N	*Scytinium teretiusculum*	Curly Jellyskin Lichen				S3S4	11	31.0 ± 0.2	NS
N	*Leptogium acadiense*	Acadian Jellyskin Lichen				S3S4	70	24.7 ± 0.2	NS
N	*Scytinium subtile*	Appressed Jellyskin Lichen				S3S4	45	36.3 ± 0.01	NS
N	*Felipes leucopellaeus*	a lichen				S3S4	1	95.8 ± 0.2	NS
N	*Bacidia laurocerasi*	a Lichen				S3S4	2	94.7 ± 0.2	NS
N	*Vahliella leucophaea*	Shelter Shingle Lichen				S3S4	11	42.1 ± 0.2	NS
N	*Heterodermia speciosa*	Powdered Fringe Lichen				S3S4	55	11.7 ± 0.01	NS
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S3S4	42	33.0 ± 0.01	NS
N	*Melanohalea olivacea*	Spotted Camouflage Lichen				S3S4	3	25.4 ± 3.3	NS
N	*Parmeliopsis hyperopta*	Gray Starburst Lichen				S3S4	4	25.0 ± 1.6	NS
N	*Parmotrema perlatum*	Powdered Ruffle Lichen				S3S4	1	63.1 ± 0.01	NS
N	*Peltigera hymenina*	Cloudy Pelt Lichen				S3S4	1	64.1 ± 1.6	NS
N	*Sphaerophorus fragilis*	Fragile Coral Lichen				S3S4	13	81.0 ± 0.2	NS
N	*Sclerophora peronella*	Frosted Glass-whiskers Lichen				S3S4	1	89.0 ± 0.01	NS
N	*Coccocarpia palmicola*	Salted Shell Lichen				S3S4	814	20.7 ± 0.5	NS
N	*Physcia tenella*	Fringed Rosette Lichen				S3S4	4	70.6 ± 3.5	NS
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	119	32.7 ± 3.0	NS
N	*Evernia prunastri*	Valley Oakmoss Lichen				S3S4	77	25.6 ± 5.0	NS
N	*Heterodermia neglecta*	Fringe Lichen				S3S4	72	22.2 ± 0.5	NS
P	*Fraxinus nigra*	Black Ash	Threatened		Threatened	S1S2	1490	8.0 ± 0.01	NS
P	*Lilaeopsis chinensis*	Eastern Lilaeopsis	Special Concern	Special Concern	Vulnerable	S3	20	90.3 ± 0.01	NS
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	S3	13	75.2 ± 0.05	NS
P	*Floerkea proserpinacoides*	False Mermaidweed	Not At Risk			S2S3	3	38.1 ± 7.07	NS
P	*Acer saccharinum*	Silver Maple				S1	4	90.9 ± 0.2	PE
P	*Betula minor*	Dwarf White Birch				S1	1	80.4 ± 0.01	NS

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P	*Cochlearia tridactylites*	Limestone Scurvy-grass				S1	8	74.0 ± 0.01	NS
P	*Lobelia spicata*	Pale-Spiked Lobelia				S1	6	67.6 ± 7.07	NS
P	*Hudsonia tomentosa*	Woolly Beach-heath				S1	7	25.1 ± 7.07	NS
P	*Elatine americana*	American Waterwort				S1	1	98.7 ± 0.2	NS
P	*Ribes americanum*	Wild Black Currant				S1	2	45.3 ± 5.0	NS
P	*Fraxinus pennsylvanica*	Red Ash				S1	5	78.9 ± 0.03	PE
P	*Persicaria careyi*	Carey's Smartweed				S1	1	50.0 ± 3.0	NS
P	*Ranunculus pensylvanicus*	Pennsylvania Buttercup				S1	31	71.9 ± 0.01	NS
P	*Salix myrtillifolia*	Blueberry Willow				S1	1	62.1 ± 0.01	NS
P	*Salix serissima*	Autumn Willow				S1	2	62.1 ± 0.01	NS
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S1	1	95.1 ± 1.5	NS
P	*Carex alopecoidea*	Foxtail Sedge				S1	4	75.5 ± 0.5	NS
P	*Carex garberi*	Garber's Sedge				S1	4	27.0 ± 0.01	NS
P	*Carex plantaginea*	Plantain-Leaved Sedge				S1	5	20.3 ± 0.2	NS
P	*Carex tincta*	Tinged Sedge				S1	2	75.5 ± 1.0	NS
P	*Carex viridula var. saxilittoralis*	Greenish Sedge				S1	4	74.5 ± 0.3	NS
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	6	64.7 ± 0.01	NS
P	*Cyperus lupulinus ssp. macilentus*	Hop Flatsedge				S1	18	25.3 ± 0.2	NS
P	*Scirpus atrovirens*	Dark-green Bulrush				S1	2	69.9 ± 0.2	NS
P	*Iris prismatica*	Slender Blue Flag				S1	2	54.1 ± 1.5	NS
P	*Juncus vaseyi*	Vasey Rush				S1	3	31.6 ± 0.02	NS
P	*Trillium grandiflorum*	White Trillium				S1	1	85.5 ± 1.31	PE
P	*Malaxis monophyllos var. brachypoda*	North American White Adder's-mouth				S1	2	93.6 ± 7.07	NS
P	*Elymus hystrix*	Spreading Wild Rye				S1	5	10.6 ± 1.6	NS
P	*Potamogeton nodosus*	Long-leaved Pondweed				S1	1	75.7 ± 5.0	NS
P	*Adiantum pedatum*	Northern Maidenhair Fern				S1	2	46.9 ± 1.0	NS
P	*Solidago hispida*	Hairy Goldenrod				S1?	1	31.3 ± 7.07	NS
P	*Suaeda rolandii*	Roland's Sea-Blite				S1?	1	93.8 ± 2.0	NS
P	*Carex pensylvanica*	Pennsylvania Sedge				S1?	3	54.6 ± 3.0	NS
P	*Bolboschoenus robustus*	Sturdy Bulrush				S1?	2	70.6 ± 7.07	NS
P	*Allium schoenoprasum*	Wild Chives				S1?	5	11.6 ± 0.2	NS
P	*Allium schoenoprasum var. sibiricum*	Wild Chives				S1?	1	47.9 ± 7.07	NS
P	*Cypripedium arietinum*	Ram's-Head Lady's-Slipper			Endangered	S1S2	22	70.1 ± 0.01	NS
P	*Sanicula odorata*	Clustered Sanicle				S1S2	4	15.1 ± 10.0	NS
P	*Ageratina altissima*	White Snakeroot				S1S2	2	66.5 ± 7.07	NS
P	*Proserpinaca intermedia*	Intermediate Mermaidweed				S1S2	1	68.3 ± 0.9	NS
P	*Anemone virginiana var. alba*	Virginia Anemone				S1S2	5	36.2 ± 5.0	NS
P	*Parnassia parviflora*	Small-flowered Grass-of-Parnassus				S1S2	1	54.8 ± 1.5	NS
P	*Carex haydenii*	Hayden's Sedge				S1S2	4	40.4 ± 0.05	NS
P	*Platanthera huronensis*	Fragrant Green Orchid				S1S2	1	44.4 ± 10.0	NS
P	*Calamagrostis stricta ssp. stricta*	Slim-stemmed Reed Grass				S1S2	1	89.8 ± 0.01	PE
P	*Carex vacillans*	Estuarine Sedge				S1S3	5	67.8 ± 0.01	NS
P	*Zizia aurea*	Golden Alexanders				S2	43	24.0 ± 0.01	NS
P	*Antennaria parlinii ssp. fallax*	Parlin's Pussytoes				S2	2	32.2 ± 0.01	NS
P	*Rudbeckia laciniata*	Cut-Leaved Coneflower				S2	21	27.5 ± 0.01	NS
P	*Desmodium canadense*	Canada Tick-trefoil				S2	22	6.3 ± 0.01	NS
P	*Anemonastrum canadense*	Canada Anemone				S2	4	43.6 ± 0.2	NS
P	*Hepatica americana*	Round-lobed Hepatica				S2	27	22.5 ± 0.01	NS
P	*Ranunculus sceleratus*	Cursed Buttercup				S2	2	78.8 ± 0.2	PE
P	*Galium boreale*	Northern Bedstraw				S2	3	76.9 ± 5.0	NS
P	*Comandra umbellata*	Bastard's Toadflax				S2	41	72.0 ± 5.0	NS
P	*Gratiola neglecta*	Clammy Hedge-Hyssop				S2	6	41.6 ± 0.1	NS
P	*Dirca palustris*	Eastern Leatherwood				S2	5	68.9 ± 7.07	NS

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P	*Carex gynocrates*	Northern Bog Sedge				S2	2	62.1 ± 0.01	NS
P	*Carex pellita*	Woolly Sedge				S2	12	7.8 ± 0.01	NS
P	*Carex livida*	Livid Sedge				S2	12	40.6 ± 0.01	NS
P	*Juncus greenei*	Greene's Rush				S2	4	67.8 ± 1.0	NS
P	*Juncus alpinoarticulatus ssp. americanus*	Northern Green Rush				S2	1	97.0 ± 0.01	PE
P	*Luzula spicata*	Spiked Woodrush				S2	1	64.7 ± 0.01	NS
P	*Allium tricoccum*	Wild Leek				S2	9	27.5 ± 0.1	NS
P	*Lilium canadense*	Canada Lily				S2	131	5.6 ± 0.25	NS
P	*Cypripedium parviflorum var. pubescens*	Yellow Lady's-slipper				S2	36	32.3 ± 7.07	NS
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	1	96.5 ± 0.01	NS
P	*Cypripedium reginae*	Showy Lady's-Slipper				S2	85	26.6 ± 0.01	NS
P	*Platanthera flava var. herbiola*	Pale Green Orchid				S2	12	27.1 ± 7.07	NS
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S2	18	29.7 ± 5.0	NS
P	*Bromus latiglumis*	Broad-Glumed Brome				S2	33	23.8 ± 0.01	NS
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S2	19	35.8 ± 0.01	NS
P	*Elymus wiegandii*	Wiegand's Wild Rye				S2	20	9.5 ± 0.01	NS
P	*Festuca subverticillata*	Nodding Fescue				S2	5	74.2 ± 1.0	NS
P	*Sparganium hyperboreum*	Northern Burreed				S2	1	91.9 ± 0.1	NS
P	*Cryptogramma stelleri*	Steller's Rockbrake				S2	1	93.2 ± 0.01	NS
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2?	9	20.2 ± 1.2	NS
P	*Rumex persicarioides*	Peach-leaved Dock				S2?	1	87.8 ± 5.0	PE
P	*Crataegus submollis*	Quebec Hawthorn				S2?	5	39.3 ± 7.07	NS
P	*Carex peckii*	White-Tinged Sedge				S2?	3	43.2 ± 0.1	NS
P	*Thuja occidentalis*	Eastern White Cedar			Vulnerable	S2S3	965	47.4 ± 0.2	NS
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2S3	17	10.9 ± 0.01	NS
P	*Bidens hyperborea*	Estuary Beggarticks				S2S3	3	66.2 ± 1.0	NS
P	*Erigeron philadelphicus*	Philadelphia Fleabane				S2S3	4	36.4 ± 5.0	NS
P	*Lactuca hirsuta*	Hairy Lettuce				S2S3	2	90.9 ± 5.0	PE
P	*Impatiens pallida*	Pale Jewelweed				S2S3	2	63.5 ± 7.07	NS
P	*Caulophyllum thalictroides*	Blue Cohosh				S2S3	70	16.1 ± 1.0	NS
P	*Boechera stricta*	Drummond's Rockcress				S2S3	7	32.9 ± 0.03	NS
P	*Stellaria humifusa*	Saltmarsh Starwort				S2S3	6	69.9 ± 0.1	NS
P	*Oxybasis rubra*	Red Goosefoot				S2S3	8	21.7 ± 7.07	NS
P	*Hypericum majus*	Large St John's-wort				S2S3	20	63.1 ± 0.01	PE
P	*Hypericum x dissimulatum*	Disguised St. John's-wort				S2S3	4	77.2 ± 1.0	NS
P	*Euphorbia polygonifolia*	Seaside Spurge				S2S3	12	37.0 ± 2.5	NS
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S2S3	10	33.6 ± 0.1	NS
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	6	16.3 ± 5.0	NS
P	*Oenothera fruticosa ssp. tetragona*	Narrow-leaved Evening Primrose				S2S3	3	27.1 ± 7.07	NS
P	*Polygonum aviculare ssp. buxiforme*	Box Knotweed				S2S3	4	17.8 ± 0.2	NS
P	*Polygonum oxyspermum ssp. raii*	Ray's Knotweed				S2S3	1	97.0 ± 1.0	NS
P	*Rumex triangulivalvis*	Triangular-valve Dock				S2S3	4	72.4 ± 0.1	NS
P	*Primula mistassinica*	Mistassini Primrose				S2S3	17	25.2 ± 7.07	NS
P	*Anemone quinquefolia*	Wood Anemone				S2S3	22	28.9 ± 0.2	NS
P	*Caltha palustris*	Yellow Marsh Marigold				S2S3	106	29.9 ± 0.1	NS
P	*Potentilla canadensis*	Canada Cinquefoil				S2S3	2	63.2 ± 5.0	NS
P	*Salix pellita*	Satiny Willow				S2S3	5	41.6 ± 0.3	NS
P	*Tiarella stolonifera*	Stoloniferous Foamflower				S2S3	224	9.0 ± 7.07	NS
P	*Agalinis purpurea var. parviflora*	Small-flowered Purple False Foxglove				S2S3	12	13.3 ± 0.2	NS
P	*Boehmeria cylindrica*	Small-spike False-nettle				S2S3	3	76.8 ± 0.01	NS

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P	*Carex adusta*	Lesser Brown Sedge				S2S3	6	44.6 ± 0.5	NS
P	*Carex comosa*	Bearded Sedge				S2S3	13	56.1 ± 0.1	NS
P	*Carex houghtoniana*	Houghton's Sedge				S2S3	6	54.5 ± 1.2	NS
P	*Carex hystericina*	Porcupine Sedge				S2S3	7	40.4 ± 0.03	NS
P	*Eleocharis ovata*	Ovate Spikerush				S2S3	7	34.2 ± 0.5	NS
P	*Scirpus pedicellatus*	Stalked Bulrush				S2S3	8	36.9 ± 0.01	NS
P	*Vallisneria americana*	Wild Celery				S2S3	9	53.8 ± 1.0	NS
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S2S3	4	60.2 ± 0.2	NS
P	*Spiranthes casei var. novaescotiae*	Case's Ladies'-Tresses				S2S3	8	54.7 ± 0.2	NS
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2S3	23	7.9 ± 0.05	NS
P	*Calamagrostis stricta*	Slim-stemmed Reed Grass				S2S3	3	88.9 ± 0.01	PE
P	*Potamogeton friesii*	Fries' Pondweed				S2S3	5	42.1 ± 5.0	NS
P	*Woodsia glabella*	Smooth Cliff Fern				S2S3	1	70.4 ± 1.0	NS
P	*Botrychium lanceolatum ssp. angustisegmentum*	Narrow Triangle Moonwort				S2S3	7	15.3 ± 0.01	NS
P	*Botrychium simplex*	Least Moonwort				S2S3	4	15.3 ± 0.01	NS
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	1	31.5 ± 0.01	NS
P	*Potamogeton pulcher*	Spotted Pondweed			Vulnerable	S3	3	40.7 ± 2.5	NS
P	*Angelica atropurpurea*	Purple-stemmed Angelica				S3	7	38.2 ± 0.01	NS
P	*Conioselinum chinense*	Chinese Hemlock-parsley				S3	2	16.7 ± 5.0	NS
P	*Hieracium robinsonii*	Robinson's Hawkweed				S3	3	29.3 ± 7.07	NS
P	*Senecio pseudoarnica*	Seabeach Ragwort				S3	28	47.9 ± 7.07	NS
P	*Symphyotrichum boreale*	Boreal Aster				S3	67	47.9 ± 7.07	NS
P	*Symphyotrichum ciliolatum*	Fringed Blue Aster				S3	21	49.7 ± 0.01	NS
P	*Betula michauxii*	Michaux's Dwarf Birch				S3	44	44.5 ± 0.5	NS
P	*Betula pumila*	Bog Birch				S3	69	62.4 ± 0.01	NS
P	*Cardamine parviflora*	Small-flowered Bittercress				S3	4	76.4 ± 0.01	NS
P	*Palustricodon aparinoides*	Marsh Bellflower				S3	37	12.2 ± 0.2	NS
P	*Mononeuria groenlandica*	Greenland Stitchwort				S3	2	75.3 ± 0.15	NS
P	*Sagina nodosa*	Knotted Pearlwort				S3	10	72.9 ± 1.5	NS
P	*Sagina nodosa ssp. borealis*	Knotted Pearlwort				S3	7	72.9 ± 0.01	NS
P	*Stellaria longifolia*	Long-leaved Starwort				S3	15	27.5 ± 0.4	NS
P	*Ceratophyllum echinatum*	Prickly Hornwort				S3	12	36.7 ± 0.01	NS
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S3	112	5.6 ± 0.25	NS
P	*Viburnum edule*	Squashberry				S3	3	23.5 ± 0.01	NS
P	*Empetrum eamesii*	Pink Crowberry				S3	1	88.7 ± 5.0	PE
P	*Halenia deflexa*	Spurred Gentian				S3	1	65.9 ± 1.0	NS
P	*Geranium bicknellii*	Bicknell's Crane's-bill				S3	6	46.7 ± 0.2	NS
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S3	2	35.2 ± 0.01	NS
P	*Epilobium densum*	Downy Willowherb				S3	51	44.6 ± 5.0	NS
P	*Polygala sanguinea*	Blood Milkwort				S3	48	16.1 ± 1.0	NS
P	*Persicaria arifolia*	Halberd-leaved Tearthumb				S3	46	21.2 ± 0.2	NS
P	*Plantago rugelii*	Rugel's Plantain				S3	7	12.2 ± 0.01	NS
P	*Samolus parviflorus*	Seaside Brookweed				S3	19	60.8 ± 1.6	NS
P	*Pyrola minor*	Lesser Pyrola				S3	2	32.1 ± 0.01	NS
P	*Anemone virginiana*	Virginia Anemone				S3	29	8.2 ± 1.0	NS
P	*Galium labradoricum*	Labrador Bedstraw				S3	102	34.1 ± 0.01	NS
P	*Salix pedicellaris*	Bog Willow				S3	55	31.6 ± 7.07	NS
P	*Salix sericea*	Silky Willow				S3	1	89.0 ± 1.0	NS
P	*Lindernia dubia*	Yellow-seeded False Pimperel				S3	39	6.5 ± 0.01	NS
P	*Laportea canadensis*	Canada Wood Nettle				S3	49	2.1 ± 0.2	NS
P	*Pilea pumila*	Dwarf Clearweed				S3	16	25.2 ± 6.0	NS
P	*Viola nephrophylla*	Northern Bog Violet				S3	8	6.9 ± 0.01	NS
P	*Carex bebbii*	Bebb's Sedge				S3	16	33.7 ± 0.01	NS
P	*Carex castanea*	Chestnut Sedge				S3	38	54.2 ± 0.01	NS
P	*Carex cryptolepis*	Hidden-scaled Sedge				S3	15	34.8 ± 0.01	NS
P	*Carex eburnea*	Bristle-leaved Sedge				S3	39	48.2 ± 0.01	NS

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P	*Carex hirtifolia*	Pubescent Sedge				S3	44	8.6 ± 0.01	NS
P	*Carex lupulina*	Hop Sedge				S3	33	4.4 ± 0.2	NS
P	*Carex rosea*	Rosy Sedge				S3	19	9.0 ± 0.01	NS
P	*Carex tenera*	Tender Sedge				S3	10	16.4 ± 1.5	NS
P	*Carex tribuloides*	Blunt Broom Sedge				S3	12	40.3 ± 2.0	NS
P	*Carex tuckermanii*	Tuckerman's Sedge				S3	8	18.1 ± 0.05	NS
P	*Eleocharis nitida*	Quill Spikerush				S3	2	95.8 ± 5.0	NS
P	*Eleocharis flavescens var. olivacea*	Bright-green Spikerush				S3	7	36.5 ± 0.01	NS
P	*Eriophorum gracile*	Slender Cottongrass				S3	6	44.6 ± 10.0	NS
P	*Schoenoplectus americanus*	Olney's Bulrush				S3	1	64.7 ± 0.01	NS
P	*Coeloglossum viride*	Long-bracted Frog Orchid				S3	1	78.1 ± 0.05	NS
P	*Cypripedium parviflorum*	Yellow Lady's-slipper				S3	46	16.3 ± 0.25	NS
P	*Neottia bifolia*	Southern Twayblade				S3	40	43.3 ± 0.01	NS
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	174	4.1 ± 0.2	NS
P	*Platanthera hookeri*	Hooker's Orchid				S3	28	47.5 ± 0.1	NS
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S3	4	11.8 ± 7.07	NS
P	*Piptatheropsis canadensis*	Canada Ricegrass				S3	7	50.0 ± 3.0	NS
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S3	1	95.1 ± 0.01	PE
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3	27	5.3 ± 1.0	NS
P	*Potamogeton richardsonii*	Richardson's Pondweed				S3	5	21.8 ± 0.01	NS
P	*Potamogeton zosteriformis*	Flat-stemmed Pondweed				S3	14	37.0 ± 0.01	NS
P	*Asplenium viride*	Green Spleenwort				S3	1	78.0 ± 7.07	NS
P	*Dryopteris fragrans*	Fragrant Wood Fern				S3	4	37.1 ± 7.07	NS
P	*Sceptridium dissectum*	Dissected Moonwort				S3	5	3.3 ± 1.0	NS
P	*Polypodium appalachianum*	Appalachian Polypody				S3	14	30.3 ± 0.01	NS
P	*Persicaria amphibia var. emersa*	Long-root Smartweed				S3?	3	50.7 ± 0.01	NS
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S3?	75	19.9 ± 0.2	NS
P	*Diphasiastrum x sabinifolium*	Savin-leaved Ground-cedar				S3?	8	32.3 ± 0.01	NS
P	*Bidens vulgata*	Tall Beggarticks				S3S4	5	44.6 ± 0.2	NS
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3S4	40	50.4 ± 0.01	NS
P	*Hieracium paniculatum*	Panicled Hawkweed				S3S4	7	24.6 ± 0.01	NS
P	*Bidens beckii*	Water Beggarticks				S3S4	13	41.8 ± 10.0	NS
P	*Packera paupercula*	Balsam Groundsel				S3S4	85	11.5 ± 0.2	NS
P	*Atriplex glabriuscula var. franktonii*	Frankton's Saltbush				S3S4	3	48.2 ± 2.5	NS
P	*Vaccinium boreale*	Northern Blueberry				S3S4	6	72.1 ± 1.0	NS
P	*Vaccinium cespitosum*	Dwarf Bilberry				S3S4	56	19.2 ± 0.01	NS
P	*Vaccinium corymbosum*	Highbush Blueberry				S3S4	1	67.2 ± 0.2	NS
P	*Fagus grandifolia*	American Beech				S3S4	652	4.6 ± 0.2	NS
P	*Bartonia virginica*	Yellow Bartonia				S3S4	1	89.0 ± 7.07	NS
P	*Proserpinaca pectinata*	Comb-leaved Mermaidweed				S3S4	2	23.7 ± 1.0	NS
P	*Decodon verticillatus*	Swamp Loosestrife				S3S4	1	15.8 ± 0.2	NS
P	*Nuphar microphylla*	Small Yellow Pond-lily				S3S4	3	11.7 ± 2.7	NS
P	*Persicaria pensylvanica*	Pennsylvania Smartweed				S3S4	23	8.3 ± 0.01	NS
P	*Fallopia scandens*	Climbing False Buckwheat				S3S4	40	2.1 ± 0.2	NS
P	*Rumex pallidus*	Seabeach Dock				S3S4	2	65.6 ± 0.01	NS
P	*Pyrola asarifolia*	Pink Pyrola				S3S4	13	29.0 ± 0.01	NS
P	*Endotropis alnifolia*	Alder-leaved Buckthorn				S3S4	443	34.0 ± 0.01	NS
P	*Amelanchier spicata*	Running Serviceberry				S3S4	8	26.0 ± 2.0	NS
P	*Crataegus succulenta*	Fleshy Hawthorn				S3S4	1	99.4 ± 5.0	PE
P	*Fragaria vesca ssp. americana*	Woodland Strawberry				S3S4	64	23.1 ± 0.19	NS
P	*Fragaria vesca*	Woodland Strawberry				S3S4	4	39.6 ± 0.01	NS
P	*Galium aparine*	Common Bedstraw				S3S4	20	33.3 ± 4.0	NS
P	*Geocaulon lividum*	Northern Comandra				S3S4	22	26.3 ± 0.2	NS
P	*Limosella australis*	Southern Mudwort				S3S4	19	62.8 ± 1.0	PE

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P	*Ulmus americana*	White Elm				S3S4	99	8.3 ± 2.2	NS
P	*Verbena hastata*	Blue Vervain				S3S4	237	7.1 ± 0.05	NS
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S3S4	4	78.2 ± 0.2	NS
P	*Viola selkirkii*	Great-Spurred Violet				S3S4	4	78.2 ± 0.05	NS
P	*Carex argyrantha*	Silvery-flowered Sedge				S3S4	1	68.2 ± 5.0	PE
P	*Triglochin gaspensis*	Gaspé Arrowgrass				S3S4	18	72.8 ± 0.01	NS
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	3	50.2 ± 0.01	NS
P	*Juncus subcaudatus*	Woods-Rush				S3S4	21	18.0 ± 5.0	NS
P	*Luzula parviflora ssp. melanocarpa*	Black-fruited Woodrush				S3S4	5	36.6 ± 0.01	NS
P	*Goodyera repens*	Lesser Rattlesnake-plantain				S3S4	3	57.5 ± 1.0	PE
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	12	57.1 ± 5.0	PE
P	*Platanthera obtusata*	Blunt-leaved Orchid				S3S4	6	56.0 ± 10.0	NS
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3S4	30	4.0 ± 0.2	NS
P	*Alopecurus aequalis*	Short-awned Foxtail				S3S4	23	38.8 ± 1.0	NS
P	*Dichanthelium clandestinum*	Deer-tongue Panic Grass				S3S4	120	39.0 ± 0.01	NS
P	*Panicum philadelphicum*	Philadelphia Panicgrass				S3S4	11	71.4 ± 0.01	NS
P	*Koeleria spicata*	Narrow False Oats				S3S4	9	6.9 ± 0.01	NS
P	*Equisetum pratense*	Meadow Horsetail				S3S4	10	36.3 ± 0.01	NS
P	*Diphasiastrum complanatum*	Northern Ground-cedar				S3S4	14	19.0 ± 0.16	NS
P	*Diphasiastrum sitchense*	Sitka Ground-cedar				S3S4	5	34.2 ± 0.2	NS
P	*Huperzia appressa*	Mountain Firmoss				S3S4	6	42.2 ± 5.0	NS
P	*Sceptridium multifidum*	Leathery Moonwort				S3S4	8	8.6 ± 0.01	NS
P	*Botrychium matricariifolium*	Daisy-leaved Moonwort				S3S4	5	31.8 ± 10.0	NS
P	*Viola canadensis*	Canada Violet				SH	1	38.1 ± 7.07	NS

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The recipient of these data shall acknowledge the AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

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1	Belliveau, A.G. E.C. Smith Herbarium Specimen Database 2019. E.C. Smith Herbarium, Acadia University. 2019.
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APPENDIX F
FRESHWATER AQUATIC ENVIRONMENT

Wetland ID	Date	Wetland Type	Area (m^2)	Delineation Type	Alterations Present? (Y/N)	Landform	Water Flow	Soil Type	Surface/ Hydrological Conditions	Dominant Vegetation		
										Herbaceous	Shrub	Trees
WL1	02-07-25	Treed Swamp	2,209.00	Partial	N	Flat	Isolated	Histic Epipedon (A2)	Saturation, Water Marks, Surface Soil Cracks, Dry-season Water Table, Stunted or Stressed Plants	*Lysimachia borealis* (Northern Starflower), *Carex trisperma* (Three-seeded Sedge), *Maianthemum canadense* (Wild Lily-of-The-Valley), *Coptis trifolia* (Goldthread), *Osmundastrum cinnamomeum* (Cinnamon Fern)	*Picea mariana* (Black Spruce), *Acer rubrum* (Red Maple), *Abies balsamea* (Balsam Fir), *Betula alleghaniensis* (Yellow Birch)	*Abies balsamea* (Balsam Fir), *Betula alleghaniensis* (Yellow Birch), *Acer rubrum* (Red Maple)
WL2	02-07-25	Shrub Swamp	3,681.00	Full	Y	Basin	Isolated	Histosol (A1)	Surface Water, High Water Table, Saturation	*Onoclea sensibilis* (Sensitive Fern), *Carex trisperma* (Three-seeded Sedge), *Rubus hispidus* (Bristly Dewberry), *Typha angustifolia* (Narrow-Leaved Cattail), *Solidago canadensis* (Canada Goldenrod)	*Betula populifolia* (Gray Birch), *Alnus incana* (Speckled Alder), *Acer rubrum* (Red Maple)	*Abies balsamea* (Balsam Fir), *Acer rubrum* (Red Maple), *Betula alleghaniensis* (Yellow Birch)
WL3	02-07-25	Shrub Swamp	1,651.00	Full	N	Basin	Throughflow	Depleted Below Dark Surface (A11)	Surface Water, High Water Table, Saturation, Water-stained Leaves	*Onoclea sensibilis* (Sensitive Fern), *Glyceria striata* (Fowl Manna Grass), *Solidago canadensis* (Canada Goldenrod), *Impatiens capensis* (Spotted Jewelweed)	*Alnus incana* (Speckled Alder), *Betula papyrifera* (Paper Birch)	*Acer rubrum* (Red Maple)
WL4	03-07-25	Treed Swamp	16,648.00	Full	Y	Slope	Isolated	Histosol (A1)	Surface Water, High Water Table, Saturation	*Onoclea sensibilis* (Sensitive Fern), *Osmundastrum cinnamomeum* (Cinnamon Fern), *Rubus pubescens* (Dwarf Red Raspberry), *Typha angustifolia* (Narrow-Leaved Cattail)	*Betula populifolia* (Gray Birch), *Betula alleghaniensis* (Yellow Birch), *Acer rubrum* (Red Maple)	*Betula populifolia* (Gray Birch), *Acer rubrum* (Red Maple), *Picea mariana* (Black Spruce), *Fraxinus americana* (White Ash)
WL5	03-07-25	Treed Swamp	651.00	Full	Y	Basin	Isolated	Histic Epipedon (A2)	High Water Table, Saturation	*Glyceria grandis* (Common Tall Manna Grass), *Solidago canadensis* (Canada Goldenrod), *Impatiens parviflora* (Small-flowered Jewelweed), *Osmundastrum cinnamomeum* (Cinnamon Fern), *Ranunculus acris* (Common Buttercup)	*Abies balsamea* (Balsam Fir), *Acer spicatum* (Mountain Maple), *Acer rubrum* (Red Maple), *Betula alleghaniensis* (Yellow Birch)	*Betula alleghaniensis* (Yellow Birch), *Acer rubrum* (Red Maple), *Fraxinus americana* (White Ash)
WL6	03-07-25	Shrub Swamp	362.00	Full	Y	Basin	Outflow (WC3)	Depleted Below Dark Surface (A11)	Saturation, Water-stained Leaves, Surface Soil Cracks, Drainage Patterns, Stunted or Stressed Plants	*Oclemena acuminata* (Whorled Wood Aster), *Maianthemum canadense* (Wild Lily-of-The-Valley), *Dryopteris campyloptera* (Mountain Wood Fern), *Osmundastrum cinnamomeum* (Cinnamon Fern), *Coptis trifolia* (Goldthread), *Aralia nudicaulis* (Wild Sarsaparilla), *Carex trisperma* (Three-seeded Sedge), *Glyceria grandis* (Common Tall Manna Grass), *Solidago rugosa* (Rough-stemmed Goldenrod), *Rubus pubescens* (Dwarf Red Raspberry)	*Alnus incana* (Speckled Alder), *Acer rubrum* (Red Maple), *Abies balsamea* (Balsam Fir), *Acer spicatum* (Mountain Maple)	*Picea mariana* (Black Spruce), *Abies balsamea* (Balsam Fir)
WL7	03-07-25	Shrub Swamp	837.00	Full	N	Flat	Isolated	Histic Epipedon (A2)	High water table, Saturation	*Abies balsamea* (Balsam Fir), *Betula papyrifera* (Paper Birch), *Acer rubrum* (Red Maple), *Fraxinus americana* (White Ash), *Dryopteris intermedia* (Evergreen Wood Fern), *Osmundastrum cinnamomeum (*Cinnamon Fern*), Dryopteris campyloptera* (Mountain Wood Fern), *Maianthemum canadense* (Wild Lily-of-The-Valley), *Aralia nudicaulis* (Wild Sarsaparilla)	*Alnus incana* (Speckled alder)	N/A
WL8	03-07-25	Treed Swamp	514.00	Full	N	Flat	Isolated	Loamy Gleyed Matrix (F2)	High water table, Saturation	*Maianthemum canadense* (Wild Lily-of-The-Valley), *Dryopteris intermedia* (Evergreen Wood Fern), *Lysimachia borealis* (Northern Starflower)	*Fraxinus americana* (White Ash), *Abies balsamea* (Balsam Fir), *Acer rubrum* (Red Maple), *Betula alleghaniensis* (Yellow Birch)	*Fraxinus americana* (White Ash), *Abies balsamea* (Balsam Fir), *Acer rubrum* (Red Maple), *Betula alleghaniensis* (Yellow Birch)

Photo 1: A representative photo of WL1.

Photo 2: A representative photo of WL2.

Photo 3: A representative photo of WL3.

Photo 4: A representative photo of WL4.

Photo 5: A representative photo of WL5.

Photo 6: A representative photo of WL6.

Photo 7: A representative photo of WL7.

Photo 8: A representative photo of WL8.

Photo 9: A representative photo of WC1.

Photo 10: A representative photo of WC2.

Photo 11: A representative photo of WC3.

Photo 12: A representative photo of WC4.

APPENDIX G
PRIORITY SPECIES LIST

Scientific Name	Common Name	S-RANK	COSEWIC Status	SARA Status	ESA Status	Habitat Description
BIRDS						
Aegolius funereus	Boreal Owl	S2?B,SUM				Year-round resident, mainly in Cape Breton (MBBA, as of July 2021). Does not migrate regularly, but is nomadic and moves outside of range when prey is scarce. Boreal Owls occur in stands of spruce, aspen, poplar, birch and fir in the boreal forest (muskeg, mixed-wood and conifer forests). They also occur in high elevation mountains with subalpine forests in Canada. In the winter, they forage in spruce-fir forests where uncrusted snow under the trees facilitates access to prey. In spring, they often forage in clearcuts and agricultural fields where small mammals are easier to locate. Beginning in late winter or early spring, male sings at night to defend territory and attract a female (Audubon and The Cornell Lab, 2025).
Ammospiza nelsoni	Nelson's Sparrow	S3S4B				They spend most of their time on or near the ground in dense marsh vegetation. Nelson's Sparrow breed mainly in fresh and saltwater marshes in the northern Great Plains and along the northern Atlantic Coast. Breeds between April and July (Audubon and The Cornell Lab, 2025).
Antrostomus vociferus	Eastern Whip-Poor-Will	S1?B	Threatened	Threatened	Threatened	Roughly 5% of home ranges consisted of open habitats, used primarily for foraging. Common habitat choices include rock or sand barrens with scattered trees, savannahs, old burns or other disturbed sites in a state of early to mid-forest succession, or open conifer plantations. Accordingly, pine (barrens and plantations), oak (barrens and savannahs), aspen, and birch (early to mid-succession) are common tree species associations. Individuals will often feed in nearby shrubby pastures or wetlands where perches, and power-line and roadway corridors are also occupied. Other necessary habitat elements are thought to involve ground-level vegetation and woodland size. Areas with little ground cover are preferred.
Cardellina canadensis	Canada Warbler	S3B	Special Concern	Threatened	Endangered	Forest undergrowth, shady thickets. Breeds in mature mixed hardwoods of extensive forests and streamside thickets. Prefers to nest in moist habitat: in luxuriant undergrowth, near swamps, on stream banks, in rhododendron thickets, in deep, rocky ravines and in moist deciduous second-growth.
Cardellina pusilla	Wilson's Warbler	S3B,S5M				Found in thickets along wooded streams, moist tangles, low shrubs, willows, alders. Breeds in thickets, second-growth, bogs, or in alder and willow groves near streams and ponds. In migration and winter, occurs from hot lowland thickets up to cool mountain woods; always in scrubby overgrown clearings and thin woods, not in the interior of dense forest. Breeds between April and July (Cornell Lab, Audubon, 2025).
Chordeiles minor	Common Nighthawk	S3B	Special Concern	Special Concern	Threatened	Common Nighthawk breeds in a range of open and partially open habitats, including forest openings and post-fire habitats, prairies, bogs, and rocky or sandy natural habitats, as well as disturbed areas. It is also found in settled areas that meet its habitat needs, those with open areas for foraging and bare or short-cropped surfaces for nesting. The species use of a wide range of habitats makes it difficult to estimate trends in habitat availability, except in urban habitats, where their main nesting sites – flat graveled roofs – are disappearing.
Coccyzus erythropthalmus	Black-billed Cuckoo	S3B				Black-billed Cuckoos are birds of woodlands and thickets, including aspen, poplar, birch, sugar maple, hickory, hawthorn and willow. They tend to occur more frequently in larger and denser woodlands than the Yellow-billed Cuckoo. On their wintering grounds, they live in forest, woodlands and scrub. A long-distance migrant, going to South America for the winter. Migrates at night; sometimes heard calling in flight overhead at night during the spring. During migration, they seek any kind of dense vegetation cover (e.g. young trees or tall shrubs). Common breeder in Nova Scotia. Breeds mostly in deciduous thickets and shrubby places, often on the edges of woodland or around marshes. Also in second growth of mixed deciduous-coniferous woods, or along their brushy edges. Breeds between April and July (Audubon and The Cornell Lab, 2025).
Contopus cooperi	Olive-sided Flycatcher	S3B	Special Concern	Special Concern	Threatened	Olive-sided Flycatcher has been widely observed in open coniferous or mixed coniferous forests, often located near water or wetlands with the presence of tall snags or trees from which the species sallies for prey and advertises its territory. Mature conifer stands within patchy landscapes influenced by natural disturbance (e.g., recent burns) support the highest densities of Olive-sided Flycatcher. Nests are generally placed toward the tip of coniferous branches (although other tree types have been used).
Euphagus carolinus	Rusty Blackbird	S2B	Special Concern	Special Concern	Endangered	Breeding habitat is characterized by coniferous-dominated forests adjacent to wetlands, such as slow-moving streams, peat bogs, sedge meadows, marshes, swamps and beaver ponds. On migration, the Rusty Blackbird is primarily associated with wooded wetlands. In winter, it occurs primarily in lowland forested wetlands, cultivated fields and pecan groves. Suitable habitat for the species appears to be decreasing on its breeding range and wintering grounds, due mainly to the loss and degradation of wetlands by human activities.
Haemorhous purpureus	Purple Finch	S3S4N, S4S5B,S5M				Found throughout the entire province year-round. Purple finches can be found in woods, groves, suburbs. Breeds mostly in coniferous and mixed woods, both in forest interior and along edges. In migration and winter, found in a wide variety of wooded and semi-open areas, including forest, suburbs, swamps, and overgrown fields. Breeding occurs from April to July (The Cornell Lab, Audubon, 2025)
Hirundo rustica	Barn Swallow	S3B	Special Concern	Threatened	Endangered	Barn Swallows forage over a wide range of open and semi-open habitats including natural and anthropogenic grasslands, other farmland, open wetlands, open water, savannah, tundra, highways and other cleared right-of-ways, and cities and towns. They avoid forested regions and high mountains. Barn Swallows throughout the world have adapted to nesting in or on human structures, including buildings, barns, bridges, culverts, wells and mine shafts. Use of natural nest sites such as caves or rock cliffs with crevices or ledges protected by overhangs is rarely reported. Nocturnal roosts are typically in reed or cane beds or other dense vegetation, usually in or near water.
Myiarchus crinitus	Great Crested Flycatcher	S1B				Uncommon breeder throughout mainland Nova Scotia, not Cape Breton (MBBA, as of July 2021). Migrates mostly at night. Breeds mainly in deciduous forest or mixed forest, but avoids pure stands of conifers. May be found in either continuous deep forest or in more open wooded areas, around edges of clearings or abandoned orchards. Dead snags and dying trees are important sources of the cavities they need for nesting (will even search out cavities in old orchards and in woody urban areas like parks, cemeteries, and golf courses). If there are enough trees, they will claim territories in pastures, along streams and rivers, and in swamps and wetlands. Breeds between April and July (Audubon and The Cornell Lab, 2025).

Scientific Name	Common Name	S-RANK	COSEWIC Status	SARA Status	ESA Status	Habitat Description
Pheucticus ludovicianus	Rose-breasted Grosbeak	S3B				Look for these birds in forest edges and woodlands. Rose-breasted Grosbeaks breed in moist deciduous forests, deciduous-coniferous forests, thickets, and semiopen habitats. They gravitate toward second-growth woods, suburban areas, parks, gardens, and orchards, as well as shrubby forest edges next to streams, ponds, marshes, roads, or pastures. They favour edges or openings with combination of shrubs and tall trees, rather than unbroken forest. Breeds from April to July (The Cornell Lab, Audubon, 2025)
Picoides arcticus	Black-backed Woodpecker	S3S4				Known throughout Nova Scotia year-round. Not strictly migratory, but may move around in response to changing conditions (e.g. destruction of habitat). Eastern birds occasionally stage southward irruptions in winter, with scattered individuals showing up well south of breeding range. Habitat includes boreal forests of firs and spruces (pine, Douglas-fir, hemlock, tamarack and spruce, especially spruce bogs). Favours areas of dead or dying trees (coniferous and deciduous), and may concentrate at burned or flooded areas with many standing dead trees. Frequents lowlands in the north and mountains in the west. Breeds between April and July (Audubon and The Cornell Lab, 2025).
Sialia sialis	Eastern Bluebird	S3B				Uncommon breeder throughout Nova Scotia. In the north, arrives quite early in spring, and lingers late in fall. These birds live in semi-open country with scattered trees, but with little understory and sparse ground cover. Original habitats probably included open, frequently burned pine savannas, beaver ponds, mature (but open) woods and forest clearings/openings. Today, they are most common along pastures, roadsides, agricultural fields, suburban parks, backyards and golf courses. Breeds between April and July (Audubon and The Cornell Lab, 2025).
Toxostoma rufum	Brown Thrasher	S1B				Not common and rarely seen in Nova Scotia, with no recorded sightings in Cape Breton (MBBA, as of July 2021). In eastern North America, Brown Thrashers nest in thickets, brush, shubbery, hedgerows, forest edges and overgrown clearings in deciduous forest. On rare occasions they breed in backyards and gardens with shrubs and hedges (but in general - areas of dense low growth, especially thickets around edges of deciduous or mixed woods, shrubby edges of swamps or undergrowth in open pine woods). Breeds between April and July (Audubon and The Cornell Lab, 2025).
Tringa solitaria	Solitary Sandpiper	S3S4M, SUB				Common migrant in Nova Scotia. A long-distance migrant that mostly migrates alone and at night. They are rarely seen on mudflats or saltmarshes with other shorebirds and will frequent areas with little water in almost any setting, from inner city to forest interior (e.g. fields, ditches, swamps, wooded wetlands at higher elevation, etc.). This bird often stops at lakes, ponds, or streams similar to their nesting habitat (areas with bog habitat and spruce trees), especially where there are extensive muddy margins. Breeds between April and July (Audubon and The Cornell Lab, 2025).
Tyrannus tyrannus	Eastern Kingbird	S3B				Common breeder throughout Nova Scotia. A long-distance migrant that uses many habitats and migrates in flocks. Unlike many of the migratory songbirds, kingbirds may travel mostly by day. The Eastern Kingbird usually breeds in fields with scattered shrubs and trees, in orchards and along forest edges (also clearings, roadsides, parks, newly burned forest, beaver ponds, golf courses and urban environments with tall trees and scattered open spaces). It is drawn to water, often nesting densely in trees that overhang rivers or lakes. In summer, requires open space for hunting. Often common around edges of marshes, farmland and native tallgrass prairie. Breeds between April and July (Audubon and The Cornell Lab, 2025).
HERPETOFAUNA						
Glyptemys insculpta	Wood Turtle	S2	Threatened	Threatened	Threatened	Wood Turtles are strongly associated with meandering, shallow rivers with sand, gravel, and/or cobble bottoms; these rivers are typically clear, with moderate current and frequent oxbows. Wood Turtles hibernate aquatically in streams and rivers (October to April, depending on location). Overwintering sites are usually on the bottom of deep pools, often with fallen debris that provides structure and prevents dislodging during high flow events. Found throughout the Province with concentrations in Guysborough and Annapolis Counties. Local plants include alders, chokecherry, hawthorn and mixed wood stands of deciduous and coniferous trees. Females lay their eggs in sandy bars along rivers and other gravel areas (driveways, roadsides, borrow pits) in June.
Hemidactylium scutatum	Four-toed Salamander	S3				Four-toed salamanders have specialized habitat requirements which require suitable breeding wetlands within or adjacent to mature forests. They prefer mature, mesic forests with dense canopy cover to preserve body moisture, an abundance of downed woody debris for cover and foraging opportunities, and vernal pools, ponds, bogs, shallow marshes, or other fishless bodies of water for nesting and larval success. Wooded wetlands such as seepage swamps or cedar swamps with many moss mats are ideal. Male adults can be located under leaves, bark, and logs in the upland forest, while females are most often found during the breeding season nesting in moss mats which overhang pools of water. (Harding, 1997).
INVERTEBRATES						
Bombus suckleyi	Suckley's Cuckoo Bumble Bee	SH	Threatened			Suckley's Cuckoo Bumble Bee occurs in most Canadian ecozone including the Atlantic Maritimes. Suckley's Cuckoo Bumble Bee occurs in diverse habitats including open meadows and prairies, farms and croplands, urban areas, boreal forest, and montane meadows. Records are from sea level to 12 m although the species could potentially occur at higher elevations where its host(s) occur. In the early spring, hosts typically establish nests in abandoned underground rodent burrows or other dry natural hollows; because Suckley's Cuckoo Bumble Bee is a nest parasite these same host residence sites also serve as its habitat. Adults have been recorded feeding on pollen and nectar from many flowers (COSEWIC Assessment and Status Report).
Bombus terricola	Yellow-banded Bumble Bee	S3	Special Concern	Special Concern	Vulnerable	Habitat generalist within open coniferous, deciduous and mixed-wood forests, wet and dry meadows and prairie grasslands, meadows bordering riparian zones, and along roadsides, urban parks, gardens and agricultural areas, subalpine habitats and more isolated natural areas.

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Coccinella transversoguttata	Transverse Lady Beetle	SH	Special Concern	Special Concern	Endangered	The Canadian range of the Transverse Lady Beetle stretches from St. John's, Newfoundland and Labrador, west to Vancouver Island. The Transverse Lady Beetle is a habitat generalist and known to occur within agricultural areas, suburban gardens, parks, coniferous forests, deciduous forests, prairie grasslands, meadows, and riparian areas. The Transverse Lady Beetle can also be found in a wide variety of non-agricultural vegetation including birch, pine, spruce, maple, mountain ash, poplar, willow, sage, cherry, alder, thistles, grasslands, and scruff pea plants along the edge of sand dunes. Overwintering adults tend to aggregate in well ventilated microhabitats such as under stones, rock crevices, in grass tussocks, in leaf litter, or in tree bark (COSEWIC Assessment and Status Report).
Danaus plexippus	Monarch	S2?B,S3M	Endangered	Special Concern	Endangered	The breeding habitat of the Eastern and Western populations in Canada is confined to where milkweeds grow, since leaves of these plants are the sole food of the caterpillars. The different species of milkweeds grow in a variety of environments, including meadows in farmlands, along roadsides and in ditches, open wetlands, dry sandy areas, short and tall grass prairie, river banks, irrigation ditches, arid valleys, and south-facing hillsides. Milkweeds are also often planted in gardens. The Monarch is known to breed on native milkweeds within their natural ranges. The most commonly used other sources of nectar are goldenrods (Solidago spp.), asters (Doellingeria, Eurybia, Oclemena, Symphyotrichum and Virgulus), the introduced Purple Loosestrife (Lythrum salicaria), and various clovers (Trifolium spp. and Melilotus spp.)
MAMMALS						
Alces alces americana	Mainland Moose	S1			Endangered	Moose are herbivores who live in boreal and mixed-wood forests. They are often found where there is an abundance of food (twigs, stems, and foliage of young deciduous trees and shrubs). In spring, islands and peninsulas are often used by cows when giving birth. In summer, access to wetlands (and aquatic vegetation) is important.
Lasionycteris noctivagans	Silver-haired Bat	S1M, SUB				Most commonly found in boreal or coniferous and deciduous forests near bodies of water. Summer day roosts are typically under loose bark in trees such as, willows, maple, ash, and dead trees. Maternity colonies can be found in cavities in these trees. Uncommonly, they use human structures (garages, sheds, etc.). During the winter, these bats have been found in caves and other rocky areas that provide shelter, in tree cavities, and in buildings.
Myotis lucifugus	Little Brown Myotis	S1	Endangered	Endangered	Endangered	Little Brown Myotis is one of the few bat species that uses buildings and other anthropogenic structures (e.g., bat boxes, bridges, and barns) to roost (particularly for maternity roosting), but it will also use cavities of canopy trees, foliage, tree bark, crevices on cliffs, and other structures.
Myotis septentrionalis	Northern Myotis	S1	Endangered	Endangered	Endangered	Northern Myotis may hibernate in cooler sections of a cave. Northern Myotis will generally return to the same hibernaculum, but not always in consecutive years. Northern Myotis roost singly or in small groups and favour tree roosts (under raised bark and in tree cavities and crevices), but they can also be found in anthropogenic structures (e.g., under shingles). Northern Myotis' maternity roosts are strongly associated with forest cover, streams, and tree characteristics (e.g., species, height, diameter, age, and decay). Females prefer to roost in tall, large diameter trees in early- to mid-stages of decay. Maternity colonies in Nova Scotia were generally in larger-than-average trees. Males generally roost alone under raised bark or within cavities of trees in mid-stages of decay.
Pekania pennanti	Fisher	S3				They are often found in deciduous and mixedwood forest stands in the forested region. They can also be found in wetland vegetation types including shrubby swamps, shrubby bogs, and marshes. There is a higher likelihood to find them in harvested stands compared to naturally regenerating stands of similar age.
Perimyotis subflavus	Tri-colored Bat	S1	Endangered	Endangered	Endangered	Tri-colored Bat often select the deepest part of caves or mines where temperature is the least variable, have strong humidity level preferences, and use warmer walls than other species. They have been recorded within any one hibernacula, possibly because they tend to hibernate solitarily (i.e., not in clusters) in the deepest sections of the caves/mines. Tri-colored Bats exhibit high fidelity to hibernacula. Roosts provide thermal regulation, shelter from weather and predation, and can be sites for social interaction. Individuals may switch roosts regularly and therefore, may use a network of roosts in a roosting area. The tendency to switch roosts may depend on species, sex, age, reproductive status, and roost type.
Synaptomys cooperi	Southern Bog Lemming	S3				They are often found in sphagnum bogs and low moist places, but they are also found in grasslands, mixed deciduous/coniferous forests, spruce-fir forests, freshwater wetlands, marshes, and meadows. They prefer areas with a thick mat of herbaceous and shrubby vegetation.
VASCULAR FLORA						
Acer saccharinum	Silver Maple	S1				Generally found near flowing water and in wetlands. In Nova Scotia, it has been found along the Cornwallis River, Kings Co. (Munro, Newell & Hill, 2014).
Agalinis purpurea	Purple False-Foxglove	S2S3				Bogs, calcareous and mafic fens, open floodplain swamps, depression ponds, interdune swales, tidal freshwater marshes and swamps; more numerous in a variety of wet to mesic, open, disturbed habitats, including old fields, clearings, and roadsides. Flowers in late summer to early fall (Digital Atlas of Virginia Forest, nd).
Agalinis purpurea var. parviflora	Small-flowered Purple False Foxglove	S2S3				Sandy soils of stream and lake margins, bogs, and barren (NatureServe, 2021)

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Agalinis tenuifolia	Slender Agalinis	S1				Anthropogenic (man-made or disturbed habitats), brackish or salt marshes and flats, fresh tidal marshes or flats, meadows and fields, woodlands https://gobotany.nativeplanttrust.org/species/agalinis/tenuifolia/; Exotic to Nova Scotia, http://www.accdc.com/webranks/NSall.htm.
Ageratina altissima	White Snakeroot	S1S2				Grows in moist soils at the edge of fields and forests. Flowers late summer, August and September. Known from Mill Brook, McGahey Brook and a brook near Refugee Cove, all in Cape Chignecto Provincial Park; older collection from Antigonish County. (Munro, Newell and Hill, 2014)
Ageratina altissima var. altissima	White Snakeroot	S1S2				Grows in moist soils at the edge of fields and forests. Flowers late summer, August and September. Known from Mill Brook, McGahey Brook and a brook near Refugee Cove, all in Cape Chignecto Provincial Park; older collection from Antigonish County. (Munro, Newell and Hill, 2014)
Allium schoenoprasum	Wild Chives	S1?				Wet meadows, rocky or gravelly stream banks and lake shores. Flowering June to August (Flora North America).
Allium schoenoprasum var. sibiricum	Wild Chives	S1?				Wet meadows, rocky or gravelly stream banks and lake shores. Flowering June to August (Flora North America).
Amelanchier fernaldii	Fernald's Serviceberry	S2S3				Thickets, open barrens, shores, and ravines. Occurs mostly in calcareous areas. Grows in riparian and shrub wetlands (Nature Serve Explorer, nd). Flowers June - August (Munro, Newell & Hill, 2014).
Amelanchier spicata	Running Serviceberry	S3S4				Man-made or disturbed habitats, cliffs, balds, ledges, forest edges, grassland, meadows and fields, woodlands (GoBotany, nd). Flowers in the spring (NC State Extension, nd)
Angelica atropurpurea	Purple-stemmed Angelica	S3				Grows in swamps, meadows, in ditches and along streams. Flowers late May until September. Very abundant in northern Cape Breton (Munro, Newell & Hill, 2014)
Bartonia virginica	Yellow Bartonia	S3S4				Flowers July to September. Dry barrens, sandy or peaty soils, bogs, lakeshores. Common in the southwestern counties becoming scarcer east to Annapolis and Halifax; St. Peter’s area of Cape Breton.
Bidens beckii	Water Beggarticks	S3S4				Found in shallows of sluggish streams and ponds. Flowers during August and September. Scattered throughout but more abundant from Pictou northward. (Munro, Newell and Hill, 2014).
Botrychium lanceolatum	Triangle Moonwort	S2S3				Kentville Ravine (Kings County); Colchester, Cumberland and a few sites in western Cape Breton. Rare where found and of limited distribution in the Northern counties. Found where there are fertile soils on wooded hillsides. Bogs, fens, forests, meadows, fields, swamps and edges of wetlands. This species releases its spores later than most moonworts (July to August) (Minnesota Environment and Natural Resources Trust Fund, Go Botany and Munro et al., 2014).
Botrychium lanceolatum ssp. angustisegmentum	Narrow Triangle Moonwort	S2S3				Kentville Ravine (Kings County); Colchester, Cumberland and a few sites in western Cape Breton. Rare where found and of limited distribution in the Northern counties. Found where there are fertile soils on wooded hillsides. Bogs, fens, forests, meadows, fields, swamps and edges of wetlands. This species releases its spores later than most moonworts (July to August) (Minnesota Environment and Natural Resources Trust Fund, Go Botany and Munro et al., 2014).
Botrychium lunaria	Common Moonwort	S1				Known from Conrad’s Beach, Halifax County and from New Campbellton and Indian Brook in northern Cape Breton. Found on open slopes, sand or gravel; shores and meadows. Basic soils. Anthropogenic habitats (man-made or disturbed habitats), fields and edges of wetlands. Spores are produced throughout the summer (Go Botany and Munro et al., 2014).
Botrychium lunaria var. lunaria	Moonwort Grapefern	S1				Known from Conrad’s Beach, Halifax County and from New Campbellton and Indian Brook in northern Cape Breton. Found on open slopes, sand or gravel; shores and meadows. Basic soils. Anthropogenic habitats (man-made or disturbed habitats), fields and edges of wetlands. Spores are produced throughout the summer (Go Botany and Munro et al., 2014).
Bromus latiglumis	Broad-Glumed Brome	S2				Floodplain (River or stream floodplains), forest, shores of rivers or lakes (Go Botany).
Carex normalis	a Sedge	S1				Open, often wet, woods, thickets, meadows and roadsides. Fruiting early summer (Flora of North America, nd).
Coleataenia longifolia	Long-leaved Panicgrass	S3S4				Marshes, meadows and fields, shores of rivers or lakes (GO Botany).
Coleataenia longifolia ssp. longifolia	Coastal Plain Panicgrass	S3S4				Marshes, meadows and fields, shores of rivers or lakes (GO Botany).
Conioselinum chinense	Chinese Hemlock-parsley	S3				Found in treed swamps, mossy coniferous forest, seepy coastal slopes. Flowers from August to October. Common on Saint Paul Island and infrequent elsewhere (Munro, Newell & Hill, 2014).
Crataegus succulenta	Fleshy Hawthorn	S3S4				Forest edges, forests, meadows and fields. Also found in abandoned farmland, along streams and in forest openings. Flowers in late spring (Natural Resources Canada, nd).
Crataegus succulenta var. succulenta	Fleshy Hawthorn	S3S4				Forest edges, forests, meadows and fields. Also found in abandoned farmland, along streams and in forest openings. Flowers in late spring (Natural Resources Canada, nd).

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Cuscuta cephalanthi	Buttonbush Dodder	S2?				Flowers during August and September. Low-lying coastal areas, often seen parsitizing Symphyotrichum novi-begii.Anthropogenic (man-made or disturbed habitats), meadows and fields, shores of rivers or lakes, swamps
Cyperus lupulinus ssp. macilentus	Hop Flatsedge	S1				Various well-drained, open places. Fruiting summer (Flora North America).
Cypripedium parviflorum var. makasin	Small Yellow Lady's-Slipper	S2				Mesic to wet fens, prairies, meadows, thickets, open coniferous, and mixed forest. Flowering in May to August (Flora of North America).
Eleocharis flavescens	Pale Spikerush	S3				Bogs, brackish or salt marshes and flats, floodplain (river or stream floodplains), marshes, shores of rivers or lakes, wetland margins (edges of wetlands) (Go Botany).
Eleocharis flavescens var. olivacea	Bright-green Spikerush	S3				Bogs, cold springs, dry stream banks, lake and pond margins, maritime mud flats, marshes, moist meadows, swamps. Fruiting summer-winter (June-November) (Flora North America).
Epilobium strictum	Downy Willowherb	S3				Scattered through throughout Cape Breton Island, infrequently elsewhere. Found in bogs and other peatlands. Flowers July to September (Munro, Newell & Hill, 2014)
Fallopia scandens	Climbing False Buckwheat	S3S4				Uncommon and local, from Digby to Richmond counties on the northern side of the province. Grows on low ground in riparian zones. Flowers mid-August to October (Munro, Newell & Hill, 2014)
Fimbristylis autumnalis	Slender Fimbry	S1				Moist to wet sands, peats, slits, or clays primarily of disturbed, sunny ground such as seeps, ditches, savanna, stream banks, reservoir drawdowns, and pond shores (Flora of North America)
Fraxinus nigra	Black Ash	S1S2	Threatened		Threatened	Black ash is typically found in poorly drained areas that are often seasonally flooded. It is most common on peat and muck soils, but also grows on fine sands over sands and loams. Although this species can tolerate still semi-stagnant conditions, there is a preference for swampy woodland stream and river banks with moving water. It is often associated with species such as Red maple, Speckled alder, Balsam poplar, and Black spruce. The species is shade intolerant, and seedlings, saplings and sprouts tend to regenerate only in partially opened forest canopies.
Fraxinus pennsylvanica	Red Ash	S1				Flowers May - June. Found in riparian and upland forest and shelter belts (Minnesota Wildflowers, nd).
Goodyera repens	Lesser Rattlesnake-plantain	S3S4				Shady, moist, coniferous or mixed woods, on mossy or humus-covered ground. Sometimes it is found in bogs or cedar swamps. Flowering early July-early September (Flora North America).
Humulus lupulus var. lupuloides	Common Hop	S1?				Anthropogenic (man-made or disturbed habitats), floodplain (river or stream floodplains), forests, shrublands, or thickets.
Huperzia selago	Northern Firmoss	S1?				Limited to the northern half of the province, as far west as Brier Island, Digby County. Many localities clustered about the Bay of Fundy, inland to the south-facing slopes of the Cobequids and along the slopes of northern Cape Breton. Grows in rock crevices along streams and moist ravines. Anthropogenic habitats (man-made or disturbed habitats), cliffs, balds, or ledges, forests, meadows and fields, shores of rivers or lakes. Flowers from summer to early fall (Minnesota Environment and Natural Resources Trust Fund, Go Botany and Munro et al., 2014).
Hylodesmum glutinosum	Large Tick-trefoil	S2				Anthropogenic (man-made or disturbed habitats), cliffs, balds, or ledges, forest edges, forests, ridges or ledges, talus and rocky slopes. Flowers June to August.
Juncus alpinoarticulatus	Northern Green Rush	S2				Fen, fresh tidal marshes or flats, marshes, meadows and fields, shores of rivers or lakes. Fruiting mid summer to fall (Go Botany).
Juncus anthelatus	Greater Poverty Rush	S1?				Exposed or partially shaded sites in moist or seasonally wet sandy or clay soils. Flowering and fruiting in spring (Flora North America).
Juncus stygius ssp. americanus	Moor Rush	S3				Wet moss, bogs and bog-pools. Flowering and fruiting in mid to late summer.
Liparis loeselii	Loesel's Twayblade	S3S4				Cool, moist ravines, bogs, or fens, wet peaty or sandy meadows, and exposed sand along edges of lakes, often colonizing previously open and disturbed habitats during early and middle stages of reforestation. Flowering May-August (Go Botany).
Lorinseria areolata	Netted Chain Fern	S3S4				Bogs, meadows and fields, swamps, wetland margins (edges of wetlands) (Go Botany).
Luzula parviflora ssp. melanocarpa	Black-fruited Woodrush	S3S4				Uncommon in damp coniferous or mixed woods, cool ravines and banks (Hinds, 2001).
Malaxis monophyllos var. brachypoda	North American White Adder's-mouth	S1				Found in swamps and bogs. Flower in summer (Flora of North America).

Scientific Name	Common Name	S-RANK	COSEWIC Status	SARA Status	ESA Status	Habitat Description
Neottia bifolia	Southern Twayblade	S3				Bogs and swamps (Go Botany).
Ophioglossum pusillum	Northern Adder's-tongue	S2S3				Known from Yarmouth and Digby Counties; scattered east to Halifax and Amherst; a single Cape Breton record from George River. Found in sterile soils, swamps and sandy or cobbly lakeshores. Anthropogenic habitats (man-made or disturbed habitats), marshes, meadows, fields and edges of wetland margins. Spores produced May to August (Go Botany and Munro et al., 2014).
Osmorhiza longistylis	Smooth Sweet Cicely	S2S3				Intervale soils where fertility is high; deciduous forests. Flowers Late June to July. Scattered along the North Mountain in Annapolis and Kings counties to Cumberland Cobequids, infrequent in Cape Breton (Munro, Newell and Hill, 2014).
Panicum dichotomiflorum ssp. puritanorum	Spreading Panicgrass	S1?				Flowering and fruiting from June through October.
Persicaria amphibia var. emersa	Long-root Smartweed	S3?				Bloom on moist soil and are terrestrial-adapted. Flower June - September (Flora of North America).
Persicaria arifolia	Halberd-leaved Tearthumb	S3				Found inf shaded swamps, ponds, tidal marshes along rivers, wet ravine in forests. Flowers July - October (Flora of North America, nd).
Persicaria careyi	Carey's Smartweed	S1				Low thickets, swamps, bogs, moist shorelines, clearings, recent burns, cultivated ground. Flowering July - October (Flora of North America, nd).
Persicaria pensylvanica	Pennsylvania Smartweed	S3S4				Moist, disturbed places, ditches, riverbanks, cultivated fields, shorelines of ponds and reservoirs. Flowers May - December (Flora of North America, nd).
Platanthera flava var. herbiola	Pale Green Orchid	S2				Known from a variety of habitats: sandy, gravelly or peaty shorelines of lakes or streams; bogs, swamps and meadows. Found along the Tusket River, Yarmouth Co., Medway River, Queens County, and north to Kings and Colchester County (Kemptown) (Munro, Newell & Hill, 2014).
Platanthera huronensis	Fragrant Green Orchid	S1S2				No good record found. Habitat are known from streamsides, in wetlands, even forests. Flowers throughout the summer (Munro, et al., 2014).
Platanthera obtusata	Blunt-leaved Orchid	S3S4				Fens, forests, meadows, fields, and swamps,
Polygonum aviculare ssp. buxiforme	Box Knotweed	S2S3				Roadsides, vacant lots, sidewalks, packed and non-drifting sands, borders of marshes and dunes. Flowering July - December (Flora of North America, nd).
Polygonum aviculare ssp. neglectum	Narrow-leaved Knotweed	S3?				Found in disturbed areas. Flowers June - November (Flora of North America, nd).
Potamogeton polygonifolius	Oblong-leaved pondweed	S1				Occurs in almost any wet or semi-wet oligotrophic and/or acidic habitat so long as flow is not too rapid. It may be found in lakes, slow-flowing rivers, ponds, ditches, seeps and among bog mosses (Wikipedia).
Ranunculus pensylvanicus	Pennsylvania Buttercup	S1				Found in wet fields, ditches, marshes, along shores. Flowers June - August (Minnesota Wildflowers, nd).
Ranunculus sceleratus	Cursed Buttercup	S2				Anthropogenic (man-made or disturbed habitats), fresh tidal marshes or flats, marshes, swamps (GoBotany, n.d.). Flowers May - September (Minnesota Wildflowers, nd).
Rhinanthus minor ssp. groenlandicus	Little Yellow Rattle	S1				Grows on disturbed, compacted soils as on roadsides, abandoned fields and the like. Flowers from mid-June through July (Munro, Newell & Hill, 2014).
Rudbeckia laciniata	Cut-Leaved Coneflower	S2				Grows in wet fertile soils along the edge of swamps, swales or streams. Often colonial. Flowers in August. Common in Kings County, isolated colonies from Annapolis and Cumberland counties to Guysborough (Munro, Newell & Hill, 2014).
Rumex triangulivalvis	Triangular-valve Dock	S2S3				Grows in moist areas and disturbed habitats, meadows, and fields (GoBotany, nd).
Sagina nodosa	Knotted Pearlwort	S3				Flowers from July to September. Coastal cliffs, sand flats and dune slopes. Cliffs, balds, or ledges, coastal beaches (sea beaches), meadows and fields, ridges or ledges Scattered from Annapolis to Guysborough counties. Nova Scotia Plants by Munro, Newell & Hill (2014).
Salix pedicellaris	Bog Willow	S3				Grows in acidic substrate as in bogs; nutrient-rich marshes and in sphagnous lacustrine habitats. Flowers from May - July. Queens County, occasionally seen along Sharpe Brook in Kings County. Collections from South Branch, Stewiacke River, Colchester Co., Black River fen, Inverness Co. and several Queens Co. localities are recent. (Munro, Newell & Hill, 2014).
Salix serissima	Autumn Willow	S1				Fens, meadows and fields, swamps (GoBotany, nd). Also found in brackish marshy strands, marly lakeshores, treed bogs, gravelly stream banks, lakeshores. Flowers from early June to early July (Flora of North America, nd).

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Sceptridium dissectum	Dissected Moonwort	S3				Frequent in the southwestern counties and scattered eastward to Cape Breton. Not abundant but often seen. Generally in sandy, gravelly, grassy or open soils. Spores from September to November (Munro et al., 2014).
Solidago rugosa var. sphagnophila	Cedar-swamp Goldenrod	S1S3				Frequents waste soils, forests and fallow fields. Flowers late in August through September. Common throughout the province (Munro, Newell & Hill, 2014).
Symphyotrichum boreale	Boreal Aster	S3				Favours lacustrine gravels, streamsides and edges of peatlands. Flowers during August and September. Scattered from Yarmouth to Cape Breton uncommon (Munro, Newell & Hill, 2014).
Triosteum aurantiacum var. aurantiacum	Orange-fruited Tinker's Weed	S3				Dry-mesic to mesic forests, woodlands, and forest borders.
Utricularia ochroleuca	Yellowish-white Bladderwort	S1				Shallow (generally <3cm) acidic waters. Flowers June - September (Jepson Herbarium, 2021).
Veronica catenata	Pink Water-Speedwell	S1				Shores of rivers or lakes, wetland margins (edges of wetlands) (GoBotany, nd). Flowers May - September (Minnesota Wildflowers, nd).
Viola nephrophylla	Northern Bog Violet	S3				Cool, mossy sites: bogs, streamsides and wet woods. Flowers May - July (Munro, Newell & Hill, 2014).
Zizia aurea	Golden Alexanders	S2				Found in meadows, shores, thickets and wooded swamps. Flowers May and June. Occasionally reported in: Pomquet and South River, Antigonish County, Upper Musquodoboit, Halifax County (Munro, Newell and Hill, 2014).
LICHENS						
Sclerophora peronella	Frosted Glass-whiskers (Atlantic population)	S3S4	Special Concern	Special Concern		Collections from Nova Scotia were on exposed heartwood of living red maple trees growing in old-growth hardwood stands. Frosted Glass-whiskers grows on old deciduous trees, usually on the exposed heartwood of living trunks and more rarely on bark, in humid and rather shaded situations. This arboreal lichen is often associated with old-growth forests in coastal regions, but it is also found in open forests, in clearings, and on the margins of old deciduous forests (COSEWIC Assessment and Status Report).