Appendix D

Biophysical Survey Report – Tote Road Quarry Expansion Project

BIOPHYSICAL SURVEY REPORT

Tote Road Quarry Expansion Project

PREPARED FOR

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EXECUTIVE SUMMARY

Scotian Materials Limited are proposing the expansion of an existing quarry (the Project) located on PID 41457821 in the community of Head of St. Margarets Bay, Halifax County, Nova Scotia.

In support of the submission of a provincial Environmental Assessment (EA) Registration Document (EARD) with Nova Scotia Environment and Climate Change (NSECC), this Study has been completed to identify the biophysical conditions existing within, and in proximity to the proposed site (the Study Area, represented by PID 41457821). This was achieved by completing a review of background desktop resources in combination with field studies to identify potential environmental constraints and sensitivities.

In September of 2020, field components of the biophysical EA were initiated. These field components continued through until August 2021 complying with the requirements for a *Class I* undertaking under Section 9(1) of the *Nova Scotia Environmental Assessment Regulations*. The field studies were focused on highlighting the ecological linkages within the Study Area, as well as with the habitats surrounding the Study Area. The field components included:

1. Vascular plant surveys (June 15, 2021 [early botany] and September 12, 2020 [late botany]);
2. Lichen surveys (September 12, 2020);
3. Vegetation community classification (April 9, 2021);
4. Avian surveys
    a) Nocturnal owl (April 15, 28 and May 4, 2021);
    b) Spring migration (May 1, 14 and 26, 2021);
    c) Breeding bird (June 14 and 24, 2021);
    d) Common nighthawk (June 24 and July 7, 2021);
    e) Fall migration (September 12, 27, October 12, 2020);
    f) Winter birds (January 27 and February 12, 2021)
5. Wetland and watercourse evaluations (April 9 and July 5, 2021);
6. Fish and fish habitat assessment (August 27, 2021); and,
7. Species at Risk (SAR) surveys;
    a) Mainland moose (Winter Tracking – January 27 and February 12, 2021; pellet group inventory – March 23, May 6, and May 11, 2021)
    b) Incidental SAR (all seasons).

Implementation of the above surveys was completed within the Study Area and the Aquatic Study Area (wetland, watercourse, fish and fish habitat surveys). These Study Areas encompass the full extent of the Quarry Expansion Area (QEA).

<u>Vegetative Community, Vascular Plants, and Lichens</u>
The Study Area is primarily comprised of regenerative softwood stands, wetlands, and disturbed areas. Disturbed portions of the Study Area include the existing quarry footprint, gravel roads, and historic

timber harvesting. The majority of the historic timber harvesting has occurred in the central portion of the Study Area. Within the Study Area, two upland vegetation types and two wetland vegetation types were present. The upland vegetation types belong to the Spruce Hemlock Forest Group (SH) and the wetland vegetation types belong to the Wet Coniferous Forest Group (WC) and the 'cut-over' group.

A total of 101 vascular plant species were observed within the Study Area, one of which was a SOCI: the Nova Scotia agalinis (*Agalinis neoscotica*; ACCDC S3S4). No priority vascular plant species were observed within the QEA. Within the Study Area, 6% of the observed vascular plant species (n=6) comprised of exotics, 94% (n=95) were native and of the native species less than 2.1% (n=2) belonged to the Atlantic Coastal Plain Flora Group.

A total of 22 lichen species were observed within the Study Area. Two were determined to be priority species, the frosted glass whiskers (*Sclerophora peronella*; Atlantic population; SARA & COSEWIC Special Concern; ACCDC S1?) and fringe lichen (*Heterodermia neglecta*; ACCDC S3S4). The frosted glass whiskers is located outside of the QEA, however, the fringe lichen is located within the QEA. One additional priority lichen species, Blue felt lichen (*Pectenia plumbea*; SARA & COSEWIC Special Concern; NSESA Vulnerable; ACCDC S3), was identified 8 m north of the Study Area. A 100 m buffer will be maintained between the QEA and the two priority lichen species.

Fauna

Winter and pellet group inventory (PGI) surveys found signs of eastern coyote (*Canis latrans*), snowshoe hare (*Lepus americanus*), white-tailed deer (*Odocoileus virginianus*), American red squirrel (*Tamiasciursus hudsonicus*), white-footed deermouse (*Peromyscus leucopus*), North American porcupine (*Erethizon dorsatum*), and bobcat (*Lynx rufus*).

The Study Area is within a mainland moose concentration area and mainland moose core habitat but there are no mainland moose shelter patches within the Study Area. The ACCDC report states that mainland moose have been observed 20.1 km from the Study Area. No sign of mainland moose was observed during winter transect surveys or during the (PGI) surveys.

The ACCDC report identifies a bat hibernaculum as being located within 5 km of the Study Area (location sensitive) and notes that bat species (*Vespertilionidae sp.)* were identified within 4.4 km from the Study Area. The NSDNRR confirmed that individual occurrences and monitoring occurrences of Species at Risk bats were made under 5 km from the Study Area, but no known hibernacula are located within 5 km of the Study Area. No bats or potential hibernacula were identified during field surveys.

No priority herpetofauna species were observed during field surveys. According to the ACCDC, no Species at Risk herpetofauna were observed within 5 km of the Study Area, however, snapping turtle, eastern painted turtle, and wood turtle were noted within 8.5 km, 13.5 km, and 17.9 km of the Study Area, respectively. No wood turtle Special Management Practices buffers exist within the Study Area, the closest stream buffer is over 15 km to the east. Additionally, no identified wood turtle core habitat is located within or near the Study Area.

Avifauna

Baseline point count surveys for birds (spring migration, breeding season, fall migration, common nighthawk surveys, and nocturnal owl surveys) resulted in the observation of 1,041 individuals, representing 62 species. An additional 54 individuals representing 21 species were identified during winter surveys (winter surveys 1 and 2, as well as Moose PGI surveys 1 and 2) and 42 individuals representing 14 species were recorded incidentally.

Across all survey seasons a total of fourteen priority species were observed, as follows:

- Bay-breasted warbler (*Dendroica castanea*; ACCDC S3S4B);
- Blackpoll warbler (*Setophaga striata*; ACCDC S3S4B);
- Boreal chickadee (*Poecile hudsonica*; ACCDC S3);
- Cape May warbler *(Setophaga tigrina*; ACCDC S2B);
- Canada Jay (*Perisoreus canadensis*; ACCDC S3);
- Olive-sided flycatcher (*Contopus cooperi*; SARA Special Concern, NSESA Threatened; ACCDC S2B);
- Pine siskin (*Spinus pinus*; ACCDC S2S3);
- Red-breasted nuthatch (*Sitta canadensis*; ACCDC S3);
- Red crossbill (*Loxia curvirostra*; ACCDC S3S4);
- Ruby-crowned kinglet (*Regulus calendula*; ACCDC S3S4B);
- Swainson's thrush (*Catharus ustulatus*; ACCDC S3S4B);
- Turkey vulture (*Cathartes aura*; ACCDC S2S3B);
- Wood thrush (*Hylocichla mustelina*; SARA Threatened; ACCDC SUB); and,
- Yellow-bellied flycatcher (*Empidonax flaviventris*; ACCDC S3S4B).

All species observed are native species in this region; they are typical species commonly found within the Study Area habitat and its surroundings. Except for a flock of common grackle observed, no obvious concentrations of one particular bird group were identified, nor was an identifiable migratory pathway noted.

Wetlands

Four wetlands were identified within the Aquatic Study Area, none of which are within the QEA. Three wetlands exist as swamps (WL1, 2 and 4) and the remaining wetland (WL3) exists as a fen. Of the four wetlands identified, three exist as isolated features (WL1, 2, and 3) and one exists as a headwater wetland (i.e., watercourse outflow; WL4).

Functional assessment of the wetlands was completed using the Wetland Ecosystem Services Protocol – Atlantic Canada (WESP-AC). This quantitative decision-making tool did not identify any wetland as scoring significantly higher than any others: wetlands within the Aquatic Study Area function similarly to others on the landscape.

One wetland of special significance (WSS) was identified within the Study Area: WL1 is categorized as a WSS due to the presence of blue felt lichen (*Pectenia plumbea;* SARA & COSEWIC Special Concern; NSESA Vulnerable; ACCDC S3). Blue felt lichen was observed outside of the Study Area, in the northern extent of WL1. This wetland and the 100 m buffer from the blue felt lichen will not be directly impacted by the proposed quarry expansion.

Surface Water and Fish Habitat

One watercourse (WC1) and one waterbody (Pond1) were identified within the Aquatic Study Area during field surveys. WC1, which drains south to north into Island Lake, is first order stream sourced from a headwater wetland (WL4). Pond1 is an anthropogenically developed pond that has since naturalized. Pond1 is sourced from roadside ditching and has no outlet or connectivity to a fisheries resource.

Fish habitat surveys were completed in WC1 which included electrofishing (two reaches). No fish were captured or observed. Fish may access this the upper reaches of this watercourse, though only during periods of high flow or after heavy rain events. Fish habitat within the watercourse is limited by dry conditions, subterranean sections, and dechannelized surface flow through wetland habitat. As a first order stream, the watercourse does not provide passage to any upgradient aquatic features. Based on these characteristics, this watercourse may provide suitable habitat for juvenile American eel in the form of fine substrates and moderate cover as they have the ability to travel terrestrially over wet substrates and as such, may be able to circumvent the subterranean reaches. The watercourse provides poor quality habitat for other fish species found in Nova Scotia including salmonids, suckers and minnows due to the inconsistent flow, poor water quality, and subterranean sections acting as impediments to fish passage throughout watercourse. Outside of the watercourse but within WL4, fish habitat is also limited.

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LIST OF ACRONYMS

ACCDC	Atlantic Canadian Conservation Data Centre
ACPF	Atlantic Coastal Plain Flora
AMO	Abandoned Mine Opening
BFL	Boreal Felt Lichen
CCME	Canadian Council of Ministers of the Environment
CM	Centimeters
CNALH	Consortium of North American Lichen Herbaria
CONI	Common nighthawk
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Services
DFO	Fisheries and Oceans Canada
DO	Dissolved Oxygen
DS	Downstream
EA	Environmental Assessment
EC	Environment Canada
ECCC	Environment and Climate Change Canada
EQS	Environmental Quality Standards
FEC	Forest Ecosystem Classification for Nova Scotia
FACW	Facultative Wetland
FAC	Facultative
FWAL	Protection of Aquatic Life for Freshwater Guidelines
GIS	Geographic Information System
GPS	Global Positioning System
HA	Hectares
HR	Hour
IA	Industrial Approval
IBA	Important Bird Area
IBOF	Inner Bay of Fundy
KM	Kilometer
Ltd	Limited
M	Meters
MBBA	Maritime Breeding Bird Atlas
MBS	Migratory Bird Sanctuary
MEL	McCallum Environmental Ltd.
MTRI	Mersey Tobeatic Research Institute
NS	Nova Scotia
NSDEL	Nova Scotia Department of Environment and Labour
NSDNR	Nova Scotia Department of Natural Resources
NSDNRR	Nova Scotia Department of Natural Resources and Renewables
NSE	Nova Scotia Environment
NSECC	Nova Scotia Environment and Climate Change

NSESA	Nova Scotia Endangered Species Act
NSDFA	Nova Scotia Department of Fisheries and Aquaculture
NSL&F	Nova Scotia Department of Lands and Forestry
NSTDB	Nova Scotia Topographic Database
OBL	Obligate
PC	Point Counts
PGI	Pellet Group Inventory
PID	Property Identification Number
QEA	Quarry Expansion Area
SAR	Species at Risk
SARA	Species at Risk Act
SH	Spruce Hemlock
SMP	Special Management Practices
SOCI	Species of Conservation Interest
SPC	Specific Conductivity
SRank	Status rank
TDS	Total Dissolved Solids
US	Upstream
UTM	Universal Transform Mercator
VT	Vegetation Type
WESP-AC	Wetland Ecosystem Services Protocol – Atlantic Canada
WSS	Wetland of Special Significance
WC	Watercourse
WL	Wetland

1 INTRODUCTION

Scotian Materials Limited are proposing the expansion of an existing quarry (the Project) located on PID 41457821 in the community of Head of St. Margarets Bay, Halifax County, Nova Scotia (Figure 1, Appendix A).

In support of the submission of a provincial Environmental Assessment (EA) Registration document (EARD) with Nova Scotia Environment and Climate Change (NSECC), this Study has been completed to identify the biophysical conditions existing within, and in proximity to the proposed site (the Study Area). This was achieved by completing a review of background desktop resources in combination with field studies to identify potential environmental constraints and sensitivities.

This report outlines the methods and results of the biophysical assessments completed within the Study Area to support the EARD. The following sections describe the methods and results for each assessment completed. The report concludes with a summary of the Study findings.

1.1 Biophysical Assessments

In September of 2020, biophysical field components of the EA were initiated. These field components continued through until August 2021 complying with the requirements for a *Class I* undertaking under Section 9(1) of the *Nova Scotia Environmental Assessment Regulations*. The field studies were focused on highlighting the ecological linkages within the Study Area, as well as with the habitats surrounding the Study Area. The field components included:

1. Vascular plant surveys (June 15, 2021 [early botany] and September 12, 2020 [late botany]);
2. Lichen surveys (September 12, 2020);
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    a) Mainland moose (Winter Tracking – January 27 and February 12, 2021; pellet group inventory – March 23, May 6, and May 11, 2021)
    b) Incidental SAR (all seasons)

1.2 Study Team

A project team was assembled for the completion of this Study. The team was selected based on level of proficiency in their respective roles. The team members and their individual roles are presented in Table 1-2.

Table 1-1. Project Team

Team Member	Role
Andy Walter, B.Hort.	Senior reviewer
Melanie MacDonald, MREM	Senior reviewer
Jeff Bonazza, M.Env.Sci	Project manager and report writer
John Gallop, B.Sc., P.Biol Emma Posluns, MSc. Meaghan Quanz, MES Jessica Lohnes, B.Sc. Emma Halupka, MSc. Jillian Saulnier, MSc. Jose Mulino-Devoe, B.Sc.	Biologists, wetland delineator and assessors, Species at Risk evaluators, birders, reporting and GIS support
Chris Pepper (subcontractor)	Qualified ornithologist

Curriculum Vitae for the above-mentioned team members are provided in Appendix B.

1.3 Priority Species

Assessment of wildlife, vegetation, and habitat was completed based on the requirements outlined in the Nova Scotia Environment (NSE) *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document* (NSE, 2009). The priority species list was created in accordance with this guide as outlined below; and it is used for the following purposes:

1. To identify which targeted surveys were recommended based on species and habitats available within the Study Area;
2. To identify key detection times for targeted surveys; and,
3. To inform field staff of priority species which may be encountered during biophysical surveys.

Priority species include:

1. All species listed as Endangered, Threatened, or of Special Concern under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Federal Species-at Risk Act (SARA);
2. All species listed as Endangered, Threatened, or Vulnerable under the Nova Scotia Endangered Species Act (NSESA); and,

3. All species designated with a Conservation Rank of S1, S2, or S3 or any combination thereof (i.e., S3S4 is considered a priority species) as defined by the Atlantic Canada Conservation Data Centre (ACCDC).

This umbrella grouping includes species of conservation interest (SOCI) that are not listed species under provincial or federal legislation (i.e., COSEWIC species and/or ACCDC S1, S2, and S3 species or any combination thereof (i.e., S3S4 is considered a SOCI), and Species at Risk (SAR) which are listed under SARA or NSESA.

1.3.1 Development of a Priority Species List

The compilation of a priority species list is habitat driven, rather than observation driven (e.g., ACCDC report of Maritime Breeding Bird Atlas [MBBA]). This is based on the recognition that observation-based datasets are not comprehensive lists of species identified in any given area. As such, the information provided by observation driven sources are supplementary to the priority species list, rather than forming the basis of the priority species list.

The Project Team compiled a list of all priority species, as defined above, with habitat preferences and geographic distribution (if known) included. To complete the Project-specific priority species list, the province-wide list was narrowed based on:

- Broad geographic area (for this Project, the broad geographic area considered is south-central mainland Nova Scotia);
- Habitat preferences; and,
- Presence of preferred habitat within the Study Area based on desktop review

A single desktop priority species list is developed for all seasons for the Project using the methodology provided above. The seasonality of mobile species is not used to screen species into, or out of, the desktop priority species list. The generated priority species lists are based on habitat rather than observations (i.e., they are not based on observational reports such as ACCDC and Maritime Breeding Bird Atlas (MBBA), for example), recognizing that observation-based datasets are not comprehensive lists of species identified in a given area. As such, the information provided by observation-driven sources are supplementary to the priority species list, rather than forming the basis of the priority species list.

All field staff reviewed the desktop evaluation for priority species prior to commencing field work to ensure they were familiar with priority species identification and their status ranks. The priority species list is referenced across the various biophysical assessments and is provided in Appendix C. See Table 1-1 for status rank definitions across multiple regulatory levels. More information on the priority species list is provided in Section 2.9.

Table 1-2. Status Ranks Definitions

Protection	Status	Definition
COSEWIC	**Extinct**	A wildlife species that no longer exists.
COSEWIC	**Extirpated**	A wildlife species that no longer exists in the wild in Canada, but exists elsewhere
COSEWIC	**Endangered**	A wildlife species facing imminent extirpation or extinction
COSEWIC	**Threatened**	A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction
COSEWIC	**Special Concern**	A wildlife species that may become threated or endangered because of a combination of biological characteristics and identified threats.
COSEWIC	**Data Deficient**	A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.
COSEWIC	**Not at Risk**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
SARA	**Extirpated**	Species which no longer exist in the wild in Canada but exist elsewhere in the wild.
SARA	**Endangered**	Species facing imminent extirpation of extinction.
SARA	**Threatened**	Species which are likely to become endangered if nothing is done to reverse the factors leading to their extirpation or extinction.
SARA	**Special Concern**	Species which may become threatened or endangered because of a combination of biological characteristics and identified threats.
NSESA	**Endangered**	A species facing imminent extirpation or extinction.
NSESA	**Threatened**	A species likely to become endangered if limiting factors are not reversed.
NSESA	**Vulnerable**	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
NSESA	**Extirpated**	A species that no longer exists in the wild in the Province but exists in the wild outside of the Province.
NSESA	**Extinct**	A species that no longer exists.

Protection	Status	Definition
ACCDC	**SX**	**Presumed Extirpated** - Species or community is believed to be extirpated from the province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
ACCDC	**S1**	**Critically Imperiled** - Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
ACCDC	**S2**	**Imperiled** - Imperiled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
ACCDC	**S3**	**Vulnerable** - Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
ACCDC	**S4**	**Apparently Secure** - Uncommon but not rare; some cause for long-term concern due to declines or other factors.
ACCDC	**S5**	**Secure** - Common, widespread, and abundant in the province.
ACCDC	**SNR**	**Unranked** - Nation or state/province conservation status not yet assessed.
ACCDC	**SU**	**Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
ACCDC	**SNA**	**Not Applicable** - A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
ACCDC	**S#S#**	**Range Rank** - A numeric range rank (e.g. S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g. SU is used rather than S1S4).
ACCDC	**Not Provided**	Species is not known to occur in the province.
ACCDC	**Breeding Status Qualifiers**	
ACCDC	**Qualifier**	**Definition**
ACCDC	**B**	Breeding - Conservation status refers to the breeding population of the species in the province.
ACCDC	**N**	Nonbreeding - Conservation status refers to the non-breeding population of the species in the province.

Protection	Status	Definition
ACCDC	**M**	Migrant - Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the province.

1.3.2 Additional Desktop Priority Species Review

Several sources were used to supplement the desktop priority species list. These sources are described herein and include observations-based datasets (i.e., ACCDC data) and proximal datasets (i.e., abandoned mine openings database). Proximal datasets are those that provide information that may support the understanding of priority species in proximity to an area. For example, abandoned mine openings (AMO) may support bat hibernacula, but this dataset does not represent known bat hibernacula or observations of the species.

The ACCDC houses the most comprehensive biodiversity database available in Atlantic Canada. The centre compiles and distributes georeferenced data on species occurrences to governments, private industry, and academia. Additionally, the ACCDC data include conservation status ranks that are assessed in collaboration with experts. ACCDC reports provide important supplementary, observation-driven data sources including sightings of priority species recorded within 5 km and 100 km (report included in Appendix D). An ACCDC report was prepared for the Study Area on July 27, 2020.

When the ACCDC prepares a rare species report, they provide the user with georeferenced shapefile points of rare species records within 5 km of the center of the study area. However, Nova Scotia Department of Natural Resources and Renewables (NSDNRR) has classified several species as 'location sensitive', meaning that ACCDC is not permitted to provide specific location data for these species in their reports. Concern about exploitation of location-sensitive species precludes inclusion of coordinates in the rare species reports. Location sensitive species in Nova Scotia include black ash (*Fraxinus nigra*), Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), peregrine falcon populations (*Falco peregrinus, pop.1*), and any bat hibernaculum. If any of these species are present within 5 km of the center of the Study Area, the ACCDC report will simply identify that they are present but will not provide specific location data. If noted in the ACCDC report, MEL will consult with NSDNRR to obtain additional information on the observation.

Additional datasets reviewed during the desktop review for priority species include:

- Lichen databases, included those provided by the Mersey Tobeatic Research Institute (MTRI), that were assessed to identify potential for priority lichen species including vole ears (*Erioderma mollissimum*) and boreal felt lichen;
- Provincial government records of AMOs were reviewed as AMOs that are uncapped and unflooded may provide bat hibernacula;
- The NSDNRR significant species and habitats database;

- Maritime Breeding Bird Atlas (MBBA)
- Canada Wildlife Service Migratory Bird Sanctuary (MBS)
- Canada Important Bird Area (IBA)
- SARA critical habitat layers
- SARA recovery strategies
- DFO critical habitat mapping
- Atlantic salmon atlas
- Freshwater fish species distribution records
- Mainland moose core habitat layer (NSDNRR, 2021b)
- Provincial Landscape Viewer – Atlantic Coastal Plain Flora (ACPF) Buffer, Lynx Buffer, Marten Range Patches 2019, Marten Range Patches 2030, Marten Habitat Management Zones, Mainland Moose Concentration Areas
- Provincial Special Management Practice layers – wood turtle, vole ears, mainland moose, etc.

1.4 Study Area

The biophysical field studies occurred within two Study Areas; the General Study Area (hereafter 'Study Area') and the Aquatic Study Area. The Study Areas are in Halifax County, on land situated north of St. Margarets Bay. They are approximately 8 km southwest of Pockwock, 5 km northwest of Upper Tantallon, and 1 km north of Highway 103 (Figure 1, Appendix A).

The Study Area is located on 32.6 ha of private property (PID 41457821), owned by Scotian Materials Limited (Figure 2, Appendix A). The Study Area is defined by the boundaries of this property and is approximately 520 m wide by 700 m long. The Study Area contains the current quarry, previously logged areas, and forested land. All biophysical assessments used this Study Area as the spatial boundary.

During a preliminary field assessment, a wetland was identified immediately west of the Study Area (on crown land). To be inclusive of potential indirect impacts from the Project on this wetland, an Aquatic Study Area was created. The Aquatic Study Area (40.4 ha) includes the entirety of the Study Area and an additional 7.8 ha to the west (which includes this wetland and a mapped watercourse but excludes a second mapped wetland downstream), located on crown land (PIDs 41388141 and 41388133; Figure 2, Appendix A). The Aquatic Study Area is an extended area for the evaluation of wetlands, fish and fish habitat, and herpetofauna. The Aquatic Study Area consists of forested land and previously logged areas.

1.5 Quarry Expansion Area

The proposed Quarry Expansion Area (QEA) is 20.5 ha and is confined to the Study Area (Figure 2, Appendix A). The QEA adheres to the setbacks required within the Pit and Quarry Guidelines (NSDEL, 1999).

2 BIOPHYSICAL ASSESSMENT METHODS

The field components of the biophysical assessment commenced in September of 2020 and continued through until August 2021. The field components included:

- Vascular plant surveys (late and early) for priority species;
- Lichen surveys;
- Vegetation community and classification surveys.
- Avian baseline surveys: nocturnal owl surveys, spring bird migration, breeding bird, common nighthawk surveys, fall bird migration, and overwintering surveys;
- Wildlife surveys, including targeted mainland moose surveys and opportunistic herpetofauna, mammal and other taxonomic group surveys for priority species;
- Wetland and watercourse identification and evaluation; and
- Fish habitat assessments and electrofishing.

The biophysical assessment methods were shared with NSDNRR, for review and comment, on July 28, 2021. To date, NSDNRR has not provided comments on the proposed methods.

2.1 Vegetation Community and Classification

The following are the desktop and field survey methodologies used during the vegetation community and classification survey program. The purpose of defining the vegetation communities within the Study Area is to determine what vegetation communities are present, what habitats and species they can support and if unique or rare habitats are present within the Study Area. The methods below describe MEL's approach to vegetation community and classification both from a desktop and field level.

2.1.1 Desktop Review

Prior to field work commencing, a desktop review was conducted using a suite of available Geographic Information System (GIS) datasets and the provincial landscape viewer (NSDNR, 2020), as follows:

- Provincial Forestry GIS Database
- Wetland Inventory
- Ecological Land Classification
- Nova Scotia Old Forestry Policy Polygons

2.1.2 Field Survey

Vegetation community surveys took place in April 2021 throughout the Study Area. This timing was selected as it facilitates proper detection and characterization of the vegetation communities and allows the findings to dictate other surveys (i.e., targeted locations for vascular plant surveys). Surveys were completed by ecologists qualified to identify vegetation species and habitats. Vegetation community surveys were completed in the field by walking meandering transects. Figure 4 outlines forest types within the Study Area and habitats targeted as part of the vegetation community and classification surveys.

Classification of forested and non-forested community types were completed by merging several existing classification systems:

- Nova Scotia Department of Natural Resources (NSDNR) Forest Ecosystem Classification (FEC) (Neily, Basquill, Quigley, Stewart, & Keys, Part 1: Vegetation Types. Forest Ecosystem Classification for Nova Scotia, 2010);
- Maine Natural Areas Program - Natural Communities and Ecosystems (NCE) (Government of Maine, 2013); and,
- Classification of Heathlands and Related Plant Communities on Barrens Ecosystems in Nova Scotia - DRAFT (Porter, Basquill, & Lundholm, 2020).

As the FEC only describes forested communities, many of which are found in uplands, several classification systems may be necessary. Use of only the FEC could result in a bias in the survey results and would not provide an accurate representation of all the vegetation community types within the Study Area. Using the additional classification systems listed above, along with the FEC, provides a more detailed overview of the vegetation types which may be present within the Study Area.

The Maine NCE classification was referenced and used as a guideline because Nova Scotia does not have any published non-forested classification systems available. Due to the geographical location of Maine and its proximity to Nova Scotia, many parallels exist between the two locations. Nova Scotia and Maine are both within the Acadian Forest region, which is characterized by temperate broadleaf and mixedwood forests and are subject to coastal influences. As a result, many of the community types described in the NCE are directly applicable to Nova Scotia, and therefore, it is a suitable classification system to use for these surveys.

If vegetation community types are observed that do not meet the definitions outlined in the above-mentioned classification systems, MEL biologists will apply a name that best describes the community type. For example, if an upland vegetation community dominated by the shrub species mountain ash (*Sorbus americana*) and wild raisin (*Viburnum nudum*) were encountered, the name Mountain Ash - Wild Raisin Shrubland would be applied. The classification name references the dominant species that are characteristic of the community type. In the event two species were dominant within the same strata, a dash (-) is applied, while a slash (/) is applied to dominant species of different strata. This naming convention is then followed by a descriptor of the community such as shrubland, barren, forest etc. In certain circumstances, particularly in the case of a recent disturbance (e.g., a clear cut within five years) vegetation types may be in early successional stages. This applies to both uplands and wetlands. In this instance, the habitat type “cut-over” would be applied and dominant species in that community type would be recorded.

All vegetation community types encountered within the Study Area were georeferenced using a handheld Garmin GPS unit, and the following information was recorded:

1. Dominant tree, shrub, and herbaceous species

2. Presence of disturbance
    a. Anthropogenic (e.g., cut block)
    b. Natural (e.g., windthrow)
    c. None
3. Approximate stand age
    a. Regenerative
    b. Mature
4. Representative photographs
5. Approximate boundary of the habitat types (if not clearly visible from aerial imagery)
6. Vegetation community and classification

Both wetland and upland vegetation communities were assessed, acknowledging that additional wetland information will be recorded during detailed wetland evaluations. The data collected in the field was processed to approximate boundaries of the vegetation types within the Study Area. This was aided by the use of aerial imagery.

The objective of the vegetation community survey is to document the key forested and non-forested vegetative plant communities within the Study Area and to identify areas with a higher potential for rare plants or lichens.

2.2 Vascular Plants

Desktop and field survey methodologies were implemented during the vascular plant survey program and these survey methodologies are discussed below.

2.2.1 Desktop Review

Prior to undertaking the field assessment, a detailed desktop review of known vascular plant observations and potential habitat for rare plants within the Study Area was conducted. The desktop review process involved three components: a review of the ACCDC database results (Appendix D), a review of mapped wetland habitat, a review of the vegetation communities and classification (Section 2.1), and a review of the Priority Species List.

2.2.2 Field Survey

Dedicated vascular plant surveys were completed early (June 15, 2021) and late (September 12, 2020) in the growing season (June 1 to September 30) to capture plant species with different flowering periods. These surveys were completed within the Study Area by qualified MEL botanists, Melanie MacDonald and John Gallop. Additionally, incidental vascular plant observations, particularly priority species, were recorded throughout the suite of the biophysical surveys conducted in 2020 and 2021.

The available GIS databases have been checked for information pertaining to vascular plant community assemblages. GIS databases include the ACCDC report, ACPF Buffers (Nova Scotia Department of Natural Resources, 2019), the ecological land classifications of Nova Scotia (Neily, Basquill, Quigley, &

Keys, 2017), and others listed in Section 2.2. This background research helped inform field surveys by notifying surveyors if there is an increased likelihood of priority vascular plant species. The ecological land classifications helped inform surveyors of landscape characteristics that may shape the prevalence of priority vascular plant species. All suitable habitats, as identified within the field, were surveyed.

Meandering transects were completed on foot, and all major habitat types were assessed to create a species list of vascular species and community assemblages observed within the Study Area. All encountered vascular plant species were identified. If a species could not be identified in the field, detailed photographs were taken to capture diagnostic features, and, if required, specimens were collected and preserved for identification later. Specimens were only collected if they were abundant on site and were not collected if only one or two individuals were observed. All SAR/SOCI observed were georeferenced, counted (when possible), photographed, and a description of their habitat was recorded. If specimens were present in tufts or in large numbers and counting individuals became a challenge, the areas of these clumps were measured (e.g., 10 m x 10 m). The following literature were the primary references used during the field surveys and identification process:

- Roland's Flora of Nova Scotia (Zinck, 1998);
- Nova Scotia Plants (Munro, Newell, & Hill, 2014);
- Flora of New Brunswick (Hinds, 2000);
- Go Botany (Native Plant Trust, 2020);
- Field Manual of Michigan Flora (Voss & Reznicek, 2012);
- Sedges of Maine (Arsenault, et al., 2013); and,
- Grasses and Rushes of Maine (Mittelhauser, Arsenault, Cameron, & Doucette, 2019).

Through the vascular plant survey, MEL biologists developed a list of species observed, along with a figure identifying locations of priority vascular flora species. All plant species were reviewed to determine if they are a member of the ACPF group, according to the NS wetland indicator plant list.

2.3 Lichens

The following are the desktop and field survey methodologies implemented during the lichen survey program.

2.3.1 Desktop Review

Prior to undertaking the field assessment, a detailed desktop review of known lichen observations and potential habitat for rare lichens within the Study Area was conducted. The desktop review process involved a review of the following:

- ACCDC database results (Appendix D);
- NSDNR predictive habitat mapping for boreal felt lichen (*Erioderma pedicellatum*) (2010);
- MTRI Vole Ears and extant BFL GIS databases; and,
- The Priority Species List (Appendix C).

2.3.2 Field Survey

All suitable lichen habitats within the Study Area, as identified within the field, were surveyed by qualified lichenologist John Gallop on September 12, 2020. Lichens, unlike vascular plants, can be surveyed all year-round if their hosts (tree trunks, the forest floor, and rocky outcrops) are not covered by snow. Meandering transects were completed on foot and targeted mature trees appropriate for hosting lichen SAR and SOCI. These trees were visually inspected, focusing on tree trunks, branches, and twigs. Any identified SAR and SOCI lichens were clearly marked with flagging tape.

The following information was collected for any priority lichen species identified during field surveys, along with a photograph, and any other relevant comments:

- Surveyor name
- Weather condition
- Survey condition
- General site location
- Date
- Scientific name
- Count (# of thalli)
- Size of thallus or thalli
- Habitat (host tree and general habitat – including within a wetland or upland)
- Location (waypoint in UTM NAD83)
- Height of the specimen
- Direction that the specimen is facing

A general list of common lichens was recorded with focus on macrolichens (i.e., foliose, fruticose, and squamulose).

If a lichen specimen could not be readily identified in the field, photos and/or specimens were collected and identified at a later date. Specimens were only collected if they were abundant on site and were not collected if only one or two individuals were observed. If necessary, collected samples were inspected via microscope and standard chemical spot tests in accordance with Brodo *et al.* (2001), to determine the species. The following literature was referenced during the surveys and identification process:

- The Macrolichens of New England (Hinds & Hinds, 2007);
- Lichens of North America (Brodo, Sharnoff, & Sharnoff, 2001);
- Keys to Lichens of North American – Revised and Expanded (Brodo, Sharnoff, & Sharnoff, Keys to Lichens of North America - Revised and Expanded, 2016);
- Microlichens of the Pacific Northwest – Volume 1 – Key to The Genera (McCune, 2009);
- Microlichens of the Pacific Northwest – Volume 2 – Key to the Species (McCune, 2009); and
- Common Lichens of Northeastern North America (McMullin & Anderson, 2014).

Through the lichen survey, MEL biologists developed a species list of lichens observed, along with a figure identifying locations of priority lichen species.

2.4 Wildlife

Desktop and field survey methodologies were implemented during the wildlife survey program and these methodologies are discussed below.

2.4.1 Desktop Review

A desktop review was conducted using the available GIS forestry database (NSDNR, 2016) to determine the forest cover types within and surrounding the Study Area. The significant habitat database was reviewed to determine presence of SAR/SOCI wildlife (NSDNR, 2016). In addition, the mainland moose (*Alces alces americana*) concentration area GIS layer (NSDNR, 2012), the mainland moose core habitat (NSDNRR, 2021b), and the NSDNRR mainland moose shelter patches were used to determine if mainland moose use habitat within or surrounding the Study Area. Government records of Abandoned Mine Openings (AMOs; NSDNR, 2017) were reviewed as AMOs can provide bat habitat. The wood turtle (*Glyptemys insculpta*) Special Management Practices (SMP) spatial file provided by NSDNRR was reviewed as was the ACCDC report with its accompanying GIS files. These databases were reviewed to determine what wildlife or habitat is potentially within the Study Area and to support wildlife survey design.

2.4.2 Field Surveys

Wildlife surveys were completed opportunistically throughout the suite of biophysical surveys in 2020 and 2021 as well as during Mainland Moose surveys (Figure 5; Section 2.9.2.2). All observations were identified and recorded, resulting in an overall species list. Wildlife habitat availability was assessed concurrently with other biophysical surveys, within wetland and upland habitat. The following literature was referenced during the surveys and identification process:

- Mammal Tracks & Signs: A Guide to North American Species (Elbroch, 2003);
- A Field Guide to Animal Tracks (Murie, 1974);
- Dragonflies and Damselflies of the East (Paulson, 2011); and
- Tracking & the Art of Seeing (Rezendes, 1999).

Incidental observations and dedicated surveys (i.e., Mainland moose surveys) provide the broadest coverage of the Study Area, both spatially and temporally. Instead of limiting wildlife surveys to transects, incidental observations during other survey types provide a holistic and overarching understanding of wildlife on the landscape.

Specific field methods to identify priority fauna species are provided in Section 2.9.2.

2.5 Avifauna

The following desktop and field survey methodologies were implemented during the avifauna survey program and are discussed below.

2.5.1 Desktop Review

A review of the Canada Important Bird Areas database, ACCDC report, MBBA square 20MQ25, and Canada Wildlife Service MBS was completed to support bird survey design and methodology. This desktop review was completed to identify avifauna species found in the general area, prior to conducting field surveys.

2.5.2 Field Surveys

According to the *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document*, activities that have the potential to impact migratory avifauna species require field surveys (NSE, 2009). Avifauna surveys, including migratory surveys, were completed given the potential impact to avifauna species through habitat alteration, direct mortality, and sensory disturbance. The avifauna field programs are designed following specific guidance from *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds* (EC CWS, 2007), *Atlassing for Species at Risk in the Maritime Provinces* (MBBA, 2008), and a selection of peer-reviewed literature.

Avifauna surveys were conducted using point count (PC) methodology as they are a commonly used survey technique for determining avian species composition (FAO, 2007). Methodology is based on Canada Wildlife Services (CWS) protocols as they relate to survey site selection, survey duration, and season selection. PC locations were chosen to represent major habitat types and are spaced 250 m apart to avoid double counting species observations (Howe, Wolf, & Rinaldi, 1997; EC CWS, 2007). PCs allow for a 360-degree survey arc around a fixed point and are especially useful for detecting shy birds that would otherwise hide during transect surveys (FAO, 2007). PCs are placed both within and outside of the Study Area, allowing reference points for pre- and post-construction monitoring. Additionally, common nighthawk (*Chordeiles minor*) and nocturnal owl surveys were conducted due to their inclusion within the ACCDC report and the potential for their habitat within the Study Area, based on desktop review. Refer to the following subsections for additional details.

Avian field survey programs were completed by MEL biologist(s) and Mr. Chris Pepper, personnel qualified to identify avifauna by both sight and sound. Avian survey locations are provided in Figure 6 (Appendix A). Detailed methods, provided in the sections below, were completed for the following surveys:

- Spring migration
- Breeding bird
- Fall migration
- Common nighthawk
- Nocturnal owl
- Winter

Bird species were identified based on functional bird groups to understand how each group of birds is

using the Study Area. These functional groups include waterfowl, shorebirds, other water birds (i.e., that are not waterfowl or shorebirds), diurnal raptors, nocturnal raptors, passerines (excluding dippers), and other landbirds.

The following literature were referenced during the surveys and identification process:

- Birds of Nova Scotia (Tufts, 1986);
- Field Guide to the Birds of North America (National Geographic, 2002);
- Peterson Field Guide to Birds of Eastern & Central North America (Peterson, 2020); and
- The Sibley Field Guide to Birds of Eastern North America (Sibley, 2016).

Additionally, smartphone applications such as iBird Pro, eBird, and iNaturalist, were used in the field to provide identification clarification. The goal of all avifauna surveys is to develop a robust species list, document breeding evidence, and map observed priority species.

2.5.2.1 *Spring Migration, Fall Migration, and Breeding Surveys*

PC locations were used for spring migration, breeding bird, and fall migration surveys. PCs are in a variety of habitats as outlined in Table 2-1 (PC locations shown in Figure 6, Appendix A). The same suite of PC locations were used for each set of seasonal surveys conducted in spring, breeding season, and fall.

PC locations were chosen prior to the finalization of the QEA; all attempts were made to cover a wide variety of habitat types without knowing the exact quarry expansion location. PC locations are distanced by approximately 250 m, to prevent the risk of double-counting individuals, as recommended in *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds* (EC CWS, 2007). PC were selected as the preferred method for avian usage surveys as they allow identification of a broad range of species.

PC locations were selected using available aerial imagery and habitat type information and were spread throughout and surrounding the Study Area to provide representative coverage of the largest area possible. PC locations cover various habitats that are representative of those within the Study Area, including mixedwood forests, wetlands, trails, disturbed and undisturbed habitats. It is MEL's understanding that PC locations provide representative sampling of avifauna habitats. All attempts were made to establish PCs within and surrounding the Study Area, should post-construction monitoring of avifauna be necessary.

Given the relatively small size of the Study Area, only six PCs could be placed within it without encroaching on the 250 m separation distance. An additional six PCs have been established outside of the Study Area to the north and east to help provide more regional information on avian usage, and to serve as post-construction monitoring points, if required.

Table 2-1: Avifauna Point Count Habitat Descriptions

PC	Habitat	Vegetation Type[1]	Rationale for Placement
1	Disturbed (current quarry footprint)	N/A	Within the QEA, Study Area, and in proximity to settling pond.
2	Disturbed (current quarry footprint)	N/A	Within the QEA and Study Area.
3	Disturbed (current quarry footprint)	N/A	Within the QEA, Study Area.
4	Regenerating stand	SH8; SH5	Within the QEA, Study Area, and in proximity to mixedwood forest.
5	Edge of wetland	WC1	Outside of the Study Area. Wetland is contiguous with Wetland 1, within the Study Area.
6	Mixed age mixedwood forest	SH5	Outside of the Study Area. Similar habitat exists in northern portion of the Study Area.
7	Regenerating stand	SH8	Outside of the Study Area. Similar historic clear-cut habitat exists within the Study Area.
8	Regenerating stand	SH8	Within the QEA and Study Area.
9	Regenerating stand	SH8	Outside of the Study Area. Similar historic clear-cut habitat exists within the Study Area.
10	Regenerating stand	SH8	Within the QEA and Study Area.
11	Regenerating stand	SH8	Outside of the Study Area. Similar historic clear-cut habitat exists within the Study Area.
12	Access road	SH8	Outside of the Study Area. Similar habitat exists within the Study Area.

[1] Vegetation Types:
SH5 - Red spruce – balsam fir / Schreber's moss
SH8 - Balsam fir / wood fern / Schreber's moss (Regenerating)
WC1 - Black spruce / cinnamon fern / sphagnum

In addition to covering a variety of habitats, the selected PC locations provide safe access for surveyors, good visibility/vantage points, and detectability of species drawn to edge habitats.

Following guidance provided by EC CWS (2007), surveys commenced within half an hour of sunrise and were completed by 10:00 a.m. Ten-minute PCs were completed at each survey location. Bird observations were recorded at four distance regimes: within a 50 m radius, 50 to 100 m radius, outside the 100 m radius, and flyovers. At each PC, a handheld Garmin GPS unit was used to geo-reference the location.

General observations including the temperature, visibility, wind speed, date, start and end time were recorded. Surveys were terminated if windy, noisy, or rainy conditions arose. Surveys were not conducted in wind speeds over 3 on the Beaufort scale (12-19 km/hr), when noise levels make it difficult to hear or

distinguish bird calls, or when it rains more than a light drizzle (EC CWS, 2007). While this Project involves expansion of an existing quarry; the quarry was not active during surveys so anthropogenic noise sources related to the Project were not present. Bearings were taken for priority species observed during dedicated survey periods and incidentally.

Incidental observations are those that occur outside of the allotted survey time, while walking to/from PC locations, or during other biophysical surveys. Incidental observations made while conducting avian surveys were recorded and included in field data collection, however, these observations were analyzed separately from non-incidental observations. Avian observations that occur during other biophysical surveys (i.e., wetland delineation, botany survey, etc.) were noted, but only SAR/SOCI observations were carried forward into analysis.

2.5.2.1.1 Spring Migration, Fall Migration

Three rounds of spring migration surveys (May 1, 14, and 26, 2021) and three rounds of fall migration surveys (September 12, 27, and October 12, 2020) were completed. Survey dates were selected to provide representative coverage of important stages of avifauna ecology; by spreading out survey dates, the widest variety of migrating birds were able to be observed. Spring migration and fall migration surveys have taken place at the 12 PC locations within and adjacent to the Study Area in a variety of habitats as outlined above.

2.5.2.1.2 Breeding

The goal of breeding bird surveys is to determine which species are using the area for nesting, raising young, and foraging during the breeding season in order to better understand the impact of the proposed quarry expansion on these species (EC CWS, 2007). The methodology for breeding bird surveys is identical to those described for spring and fall migration (Section 2.5.2.1), except for the addition of area searches. Area searches are recommended by CWS during the breeding season to visit more habitat types and/or search habitats more thoroughly for species use during the breeding season (EC CWS, 2007). Area searches were conducted by qualified MEL biologists, following meandering transects between PC locations, into the center of the Study Area, along the transmission line corridor, and in wetland habitat identified west of the Study Area. The areas targeted by Area Searches were both in and out of the Study Area and targeted areas not covered by PC locations (i.e., west of the Study Area). Area searches do not require standardized effort; however, effort was recorded (EC CWS, 2007). Approximate locations of meandering transects are shown in Figure 6 (Appendix A).

As biologists move along the meandering transects between PC locations, bird observations were recorded in a similar manner to PC location protocol. Bird observations were recorded at the same four distance regimes, and a handheld Garmin GPS unit was used to geo-reference the location of any SAR/SOCI. General observations were similar to those recorded at PCs. Area searches conducted along meandering transects between PC locations may result in the observation of the same individual multiple times from different transects.

As with migratory surveys, breeding bird surveys were conducted at the previously described 12 PC locations. In addition to the methods described above, the breeding status of the bird species observed during breeding bird surveys were also recorded. The surveyor recorded bird behavior observed, including distraction display, carrying food, and carrying nesting material. Furthermore, if the same species was observed on two subsequent breeding bird surveys at the same PC location, that is considered evidence of probable breeding as well. Table 2-2 outlines the types of breeding evidence and status that were recorded during the breeding bird surveys (MBBA, n.d.).

Table 2-2: Breeding Evidence Descriptions (MBBA, n.d.)

Breeding Status	Code	Breeding Evidence
Observed	X	Species observed in its breeding season (no breeding evidence).
Possible	H	Species observed in its breeding season in suitable nesting habitat.
	S	Singing male(s) present, or breeding calls hard, in suitable nesting habitat in breeding season.
Probable	P	Pair observed in suitable nesting habitat in nesting season.
	T	Permanent territory presumed through registration of territorial song, or the occurrence of an adult bird, at the same place, in breeding habitat, on at least two days a week or more apart, during its breeding season.
	D	Courtship or display, including interaction between a male and a female or two males, including courtship feeding or copulation.
	V	Visiting probable nest site.
	A	Agitated behaviour or anxiety calls of an adult.
	B	Brood patch on adult female or cloacal protuberance on adult male.
	N	Nest-building or excavation of nest hole by wrens and woodpeckers.
Confirmed	NB	Nest building or carrying nest materials, for all species except wrens and woodpeckers.
	DD	Distraction display or injury feigning.
	NU	Used nest or eggshells found (occupied or laid within the period of the survey).
	FY	Recently fledged young or downy young including incapable of sustained flight.
	AE	Adult leaving or entering nest sites in circumstances indicating occupied nest.
	FS	Adult carrying fecal sac.
	CF	Adult carrying food for young.
	NE	Nest containing eggs
	NY	Nest with young seen or heard.

Two surveys during the breeding season were conducted to obtain a representative snapshot of early and late breeders within and immediately adjacent the Study Area, while minimizing disturbance to nesting birds. Breeding bird surveys occurred on June 14 and 24, 2021. It should be noted that during migration surveys, breeding behavior will also be noted when observed as some individuals may breed earlier or later in the year. Surveys were spaced apart by 10 days to avoid/limit disturbance to nesting birds (EC CWS, 2007).

2.5.2.2 *Common Nighthawk*

Refer to Section 2.9.2.6.

2.5.2.3 *Nocturnal Owl Surveys*

Three owl species were reported by the ACCDC to have been observed within 100 km of the Study Area: the short-eared owl (*Asio flammeus*), the boreal owl (*Aegolius funereus*), and the long-eared owl (*Asio otus*). The short-eared owl is mainly found in open fields and grasslands (Cornell, 2019). The boreal owl is mainly found in northern Nova Scotia, in boreal-like forests or along the coast (Stewart, et al., 2015). The long-eared owl is mainly found roosting in dense vegetation and foraging in open grass or shrublands consisting of coniferous or deciduous forests; they typically use stick nests that have been abandoned by other bird species such as American crows, common ravens, and various hawk species (Cornell University, 2019). Of these three owl species, the short-eared owl (no breeding evidence) and long-eared owl (possible breeding evidence) were observed within the MBBA for the region. Additionally, great horned owl (*Bubo virginianus*), barred owl (*Strix varia*), and northern saw-whet owl (*Aegolius acadicus*) were identified within the MBBA for the region, all showing possible to probable breeding evidence. Habitat for the short-eared and boreal owl are unlikely to exist within the Study Area which, based on aerial imagery, does not have large areas of open fields or grasslands, and is in the Acadian Ecosite Group and not in boreal forest (Neily, Basquill, Quigley and Keys, 2017). Habitat may exist for long-eared owl, barred owl, great horned owl, and northern saw-whet owl within the Study Area, therefore nocturnal surveys were completed.

The methods for monitoring nocturnal owls followed the *Guideline for Nocturnal Owl Monitoring in North America* (Takats *et al*., 2001). Nocturnal owl surveys occurred when vocal activity of most owl species is greatest, as identified by Takats and colleagues (2001). Three surveys were conducted on April 15, 28 and May 4, 2021. PC survey stations were spaced at least 1.6 km apart to reduce the chances of detecting the same owl at multiple stations. Some of the louder owls, such as the barred owl, can be heard at distances of two kilometers (km) or more (Takats *et al*., 2001). However, most of the smaller owls cannot be heard as far or as clearly. Surveys were conducted between half an hour after sunset and midnight (Takats *et al*., 2001).

Four PC stations were surveyed: one is within the Study Area and the other three are outside the Study Area. As the QEA was not finalized at the time of designing this survey program, the PC within the Study Area was positioned to allow the surveyor to hear owls calling within the entire Study Area. From this location, there is a maximum distance of 525 m to the Study Area boundary. The three PC stations outside of the Study Area are situated to the west, north, and east, respectively. No PC station was located south of the Study Area because it would need to be south of Highway 103 to meet the 1.6 km separation distance (and highway noise would reduce its effectiveness of auditory identification). The four locations were selected for their safe access and suitable habitat (see Figure 6, Appendix A).

Prior to starting the survey, the selected broadcaster was tested to ensure that owl calls are audible and recognizable at 400 m. Ensuring that the broadcast cannot be heard beyond 400 m will minimize bias at the next survey station due to owls hearing the recording from the previous station (Takats *et al*., 2001).

The broadcaster test was carried out under weather and noise conditions similar to those that are likely to be encountered during the survey.

The *Bird Studies Canada (BSC) Nova Scotia Nocturnal Owl* Survey program broadcast were used, which consists of a 9.5-minute track that follows the following format and owl data recording method (Bird Studies Canada - Atlantic Region, 2019):

- Initiates with a beep to indicate the start of the first silent listening period, which lasts 1 minute. All owls heard or seen are recorded. Only if an owl is calling during this period, estimate a distance and bearing, then immediately proceed ~300 m along the road (toward the owl if possible) and record a second distance and bearing to permit triangulation of the owl and facilitate habitat association. Another beep marks the end of the first silent listening minute.
- A second silent listening minute will follow. All new owls seen or heard in the second minute are recorded, as well as any owls that continue to call from the first silent listening minute. As described above, if a new owl is heard during the second silent listening minute record a second distance and bearing was taken to permit triangulation of the owl and facilitate habitat association.
- During each of the following 20-second broadcasts, rotate the speakers fully.
- A 20-second boreal owl broadcast begins, which is followed by a one-minute silent listening period. All owls heard or seen during this period are to be recorded separately and it is important to keep track of whether the owls heard in the first two-minutes continue to call as well as any new owls.
- The boreal owl broadcast is repeated, which is again followed by a one-minute silent listening period. All owls heard or seen during this period continue to be recorded separately.
- A 20-second barred owl broadcast begins, which is followed by a two-minute silent listening period. All owls heard or seen during this period continue to be recorded separately.
- The barred owl broadcast is repeated, which is again followed by another two-minute silent listening period. All owls heard or seen during this period continue to be recorded separately.
- A beep marks the end of the broadcast track.

2.5.2.4 *Winter*

Based on low abundance and detection rates for birds in the winter, no targeted bird surveys were completed during this season. Rather, qualified MEL biologists recorded incidental observations of avifauna during mainland moose surveys (Section 2.9.2.2). Surveys took place on January 27 and February 12, 2021 (winter surveys) and March 23, May 6, and May 11, 2021 (PGI).

2.5.2.5 *Incidental Observations*

Incidental observations include (i) those individuals observed outside of dedicated point count survey locations or survey times (i.e., when walking between point count locations) and (ii) those individuals observed during non-bird related surveys (e.g., wetland assessments).

Birds recorded incidentally include novel species (i.e., those not yet recorded in standardized point counts) and priority species.

2.6 Wetlands

The Nova Scotia Environment Act (2006) defines wetlands as:

> *Land referred to as a marsh, swamp, fen, or bog that either periodically or permanently has water table at, near, or above the land surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation, and biological activities adapted to wet conditions.*

Wetland functions are the natural processes associated with wetlands and include, but are not limited to; water storage, pollutant removal, sediment retention and provision of nesting/breeding habitat. Functions may also include values and benefits associated with these natural processes such as aesthetics/recreation, cultural values, and subsistence production (NBDELG, 2008). The discussions of wetlands presented herein primarily uses terminology associated with the Canadian Wetlands Classification System (Warner and Rubec, 1997) or in line with the methodologies adapted by Nova Scotia for wetland delineation and functional assessment.

A desktop review and field survey were implemented during the wetland survey program and these methods are discussed below.

2.6.1 Desktop Review

A background desktop review of available topographic maps, appropriate provincial databases and aerial photography was completed to aid in determination of wetland habitat in the Aquatic Study Area. The Wet Areas database, the NSECC Wetlands database, and the NSECC WSS (July 2020, pers. comm, I. Bryson, NSECC Wetland Specialist) database were all reviewed. Desktop reviews were completed in order to identify anticipated potential wetland areas and prepare for field surveys.

2.6.2 Wetlands of Special Significance

The *Wetland Conservation Policy* was developed by Nova Scotia Environment (NSE) in 2011 (NSE, 2011). Its mandate is to provide a framework for the conservation of wetlands. Furthermore, it provides a framework for the identification of WSS. According to NSE (2011, p.11-12), the following criteria define WSS:

- All salt marshes;
- Wetlands that are within or partially within a designated Ramsar site, Provincial Wildlife Management Area (Crown and Provincial lands only), Provincial Park, Nature Reserve, Wilderness Areas or lands owned or legally protected by non-government charitable conservation land trusts;
- Intact or restored wetlands that are project sites under the North American Waterfowl Management Plan and secured for conservation through the NS-EHJV;
- Wetlands known to support at-risk species as designated under the federal *Species at Risk Act* or the *Nova Scotia Endangered Species Act*; and,

- Wetlands in designated protected water areas as described within Section 106 of the *Environment Act*.

Furthermore, the *Wetland Conservation Policy* (NSE, 2011) states that Government is in the process of developing a system for classifying additional wetlands or wetland types as WSS (NSE, 2017). Among the wetland characteristics, functions, and services to be considered during the process are whether the area:

- Supports a significant species or species assemblages (e.g. coastal plain flora);
- Supports high wildlife biodiversity;
- Has significant hydrologic value, or;
- Has high social or cultural importance.

Currently, a province-wide framework for determination of WSS using Wetland Ecosystem Services Protocol - Atlantic Canada (WESP-AC) has not been developed. It is MEL's understanding that the Province is in the process of identifying significance within the WESP-AC framework.

NSECC developed a WSS predictive GIS layer (July 2020, pers. comm., Ian Bryson, NSE Wetland Specialist), which overlies mapped wetlands with protected areas layers, and rare species observations from ACCDC, among other attributes. This predictive layer was consulted during the desktop evaluation for wetlands. This predictive layer incorporates all rare species observations, regardless of the species' ranking, accuracy of the data points, observation date, and mobility of species. As such, it is used as a predictive tool only to support WSS determination. Based on these desktop tools, and results of field surveys, preliminary conclusions relating to WSS are presented herein.

2.6.3 Field survey

Meandering transects were completed within the Aquatic Study Area to identify wetland habitat on April 9 and July 5, 2021. Wetland delineation was conducted by Emma Posluns, Jillian Saulnier, and Emma Halupka. Desktop analysis results showing topographic trends and habitat types helped to guide these transect locations. Wetland functional assessments were completed within the growing season (Section 2.6.3.4).

Wetland boundaries were determined as described by the United States Army Corps of Engineers, adapted for the Northcentral and Northeast Regions of the United States (United States Army Corp of Engineers, 2012) based on topography, soil, hydrology, and vegetation.

In keeping with the Army Corps of Engineers methodologies for wetland delineation, three criteria are required in order for a wetland determination to be made:

- Presence of hydrophytic vegetation;

- Presence of hydrologic conditions that result in periods of flooding, ponding, or saturation during the growing season; and
- Presence of hydric soils.

Wetland boundaries and watercourse routes were recorded on a Garmin GPSMAP 64s (capable of sub-5m accuracy). The delineated wetlands were flagged with pink flagging tape. Wetland Data Determination Forms were completed in and adjacent to wetlands identified within the Aquatic Study Area to confirm wetland/upland conditions to confirm boundaries and demonstrate that delineated wetlands met all three criteria.

2.6.3.1 *Hydrophytic Vegetation Methodology*

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

Dominant plant species observed at each data point location were classified according to their indicator status (probability of occurrence in wetlands), in accordance with the Nova Scotia Wetland Indicator Plant List. Further relevant information was reviewed in Flora of Nova Scotia (Zinck, 1998; Munro, Newell, and Hill, 2014).

If the majority (greater than 50%) of the dominant vegetation at a data point is classified as obligate (OBL), facultative wetland (FACW), or facultative (FAC) (excluding FAC-), then the location of the data point is considered to be dominated by hydrophytic vegetation. The prevalence index was used to calculate and determine positive hydrophytic vegetation indicators.

2.6.3.2 *Wetland Hydrology Methodology*

Wetland habitat, by definition, has a water table at, near, or above the land surface or that is saturated with water either periodically or permanently. To be classified as a wetland, a site should have at least one primary indicator or two secondary indicators of wetland hydrology. Examples of primary indicators of wetland hydrology include: water marks, drift lines, sediment deposition, and water stained leaves. Examples of secondary indicators of wetland hydrology include oxidized root channels, dry season water table, and stunted or stressed plants.

2.6.3.3 *Hydric Soils Methodology*

A hydric soil is defined as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (USDA-NRCS, 2003). Indicators that a hydric soil is present include the following: soil colour (gleyed soils and soils with bright mottles and/or low matrix chroma), aquic or preaquic moisture regime, reducing soil conditions, sulfidic material (odour), soils listed on the hydric soils list, iron and manganese concretions,

organic soils (histosols), histic epipedon, high organic content in surface layer in sandy soils, and organic streaking in sandy soils.

A soil pit was completed at each data point location. These pits were excavated to a maximum depth of 50 cm or refusal. The soil in each was then examined for hydric soil indicators. The matrix colour and mottle colour (if present) of the soil were determined using the Munsell Soil Colour Charts.

2.6.3.4 *Wetland Functional Assessment*

Wetland functional assessment was completed for each wetland identified within the Aquatic Study Area using the WESP-AC wetland evaluation technique. WESP-AC was completed by Jillian Saulnier and Emma Halupka on July 5, 2021.

The WESP-AC process involves the completion of three forms; a desktop review portion that examines the landscape level aerial conditions in which the wetland is situated, and two field forms identifying biophysical characteristics of the wetland (field form) and stressors within the wetland (stressors form). The process serves as a rapid method for assessing individual wetland functions and values. WESP-AC addresses 17 specific functions that wetlands may provide. The specific wetland functions are individually allocated into grouped wetland functions and measured for "function" and "benefit" scores. Wetland function relates to what a wetland does naturally (i.e., water storage), whereas wetland benefits are benefits of the function, whether it is ecological, social, or economic. The highest functioning wetlands are those that have both high function and benefit scores for a given function. WESP-AC enables a comparison to be made between individual wetlands within the Province to gain a sense of the importance each has in providing ecosystem services.

Table 2-3: WESP-AC Wetland Function Parameters

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

Grouped Wetland Function	Specific Wetland Functions
Terrestrial Habitat	Pollinator Habitat
	Native Plant Habitat

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

- Wetland Condition; and
- Wetland Risk.

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

- Public Use & Recognition;
- Wetland Sensitivity;
- Wetland Ecological Condition; and
- Wetland Stressors.

For each wetland evaluated, WESP-AC process calculates the overall score for the seven grouped wetland functions and the 17 specific wetland functions listed in Table 2-3 above. One score each is provided for function and benefit. Scores are ranked as 'Lower', 'Moderate', or 'Higher', allowing for analysis of the wetland as compared to baseline wetland scores in Nova Scotia. A 'Higher' WESP-AC score means that wetland has a greater capacity to support those processes as compared to other wetlands in the province. A 'Higher' WESP-AC score in both the function and benefits category means the wetland supports the natural ecosystem functions and provides services potentially important to society. For our analysis, MEL weighted the WESP-AC scores to quantitatively compare wetlands. The following weights were applied to scores for grouped wetland functions and specific wetland functions:

- Lower score = 1 point
- Moderate score = 2 points
- Higher score = 3 points

2.7 Surface Water

The Nova Scotia Environment Act (2006) defines a watercourse as:

> *"Any creek, brook, stream, river, lake, pond, spring, lagoon, or any other natural body of water, and includes all the water in it, and also the bed and the shore (whether there is actually any water in it or not)".*

The following desktop and field survey methodologies were implemented during the surface water survey program and are discussed below.

2.7.1 Desktop Review

The goal of the surface water desktop evaluation was to identify where watercourses, waterbodies, and drainage features may be located within or in proximity to the Aquatic Study Area based on mapped systems, topography, and satellite imagery, while also identifying where the Aquatic Study Area lies within primary and secondary watersheds. Prior to completing the field evaluation, MEL reviewed all Nova Scotia Topographic Database (NSTDB) mapped watercourses and waterbodies, provincial flow accumulation data, and depth to water table mapping to identify potential surface water features within the Aquatic Study Area.

2.7.2 Field Surveys

Watercourse delineation and site drainage characterizations were completed throughout the Study Area in conjunction with wetland delineation and evaluation, on April 9 and July 5, 2021.

During the field evaluations, MEL used NSECC guidance on watercourse determinations to identify watercourses (NSE, 2015a). The following parameters were used to define watercourses:

- Presence of a mineral soil channel;
- Presence of sand, gravel and/or cobbles evident in a continuous pattern over a continuous length with little to no vegetation;
- Indication that water has flowed in a path or channel for a length of time and rate sufficient to erode a channel or pathway;
- Presence of pools, riffles or rapids;
- Presence of aquatic animals, insects or fish; and,
- Presence of aquatic plants.

According to guidance provided by NSECC, any surface feature that meets two of the criteria above meets the definition of a provincially regulated watercourse. Using these criteria, regulated watercourses were mapped in the field using a Garmin GPSMAP 64s (capable of sub-5m accuracy). Watercourses were flagged using blue flagging tape, and a watercourse description form was completed for each homogenous reach.

2.7.2.1 *Water Quality Measurements*

Water quality parameters were measured in-situ by MEL personnel using a calibrated YSI Professional Plus Multi-Probe during low-flow on September 2, 2021. Parameters recorded include dissolved oxygen (DO), water temperature, pH, specific water conductivity (SPC), and total dissolved solids (TDS).

2.8 Fish and Fish Habitat

2.8.1 Desktop Review

The priority species list, as defined in Section 1.2.1, was used to identify priority fish species that may occur in the Study Area (Appendix C). Information on confirmed and potential fish presence within the Study Area and surrounding surface water features was collected from the following sources:

- ACCDC Report (as presented in Appendix D);
- NSDNRR Significant Species and Habitats database;
- Aquatic Species at Risk Map (Fisheries and Oceans Canada, 2019);
- Fisheries and Oceans Stock Status Reports (Gibson, Amiro, and Robichaud-LeBlanc, 2003);
- Description of Selected Lake Characteristics and Occurrence of Fish Species in 781 Nova Scotia Lakes (Alexander, Kerekes, and Sabean, 1986);
- Freshwater Fish Species Distribution Records (NSDFA, 2019); and
- Nova Scotia Department of Fisheries and Aquaculture (NSDFA) Lake Inventory Maps.

2.8.2 Field Surveys

The following subsections describe the components of the fish and fish habitat field surveys.

2.8.2.1 *Fish Habitat Characterization*

Fish habitat characterization was completed by MEL biologists, Olivia Butty and Jessica Lohnes, for all delineated watercourses in the Aquatic Study Area on August 27, 2021. The methods to complete habitat characterization were adopted from the Nova Scotia Fish Habitat Assessment Protocol (NSLC, 2017). Watercourse characterization included a visual assessment of substrate, cover, riparian habitat, and physical channel measurements (depth, wetted and bankfull widths). Observations were made on fish habitat quality for the life stages of each species confirmed or potentially present in the Study Area. Refer to Appendix E for the detailed fish habitat assessment data sheet.

The Aquatic Study Area (Figure 2, Appendix A) was established to identify watercourses (i.e., fish and fish habitat) that may be indirectly affected by the Project. The following surveys were completed in these watercourses: electrofishing surveys (discussed in Sections 2.8.2.2), water quality measurements (discussed in Section 2.7.2.1), and fish habitat characterization.

During the fish habitat characterisation, a determination of limitations for fish movement and access was also completed in part to evaluate each watercourse to determine whether it is considered a fisheries resource. According to Bourne et al. (2011), and Fullerton et al. (2010), the ability of fish to pass barriers can be difficult to define and measure, as it combines the physical characteristics of a barrier with fish physiology in a dynamic environment. Parameters such as the species of interest and their swimming capability, the variability in stream flow, length of the barrier, slope, drop height, and outflow pool are all to be taken into consideration when determining the potential for fish to pass a barrier. Throughout baseline watercourse mapping and fish habitat surveys, an assessment of potential limitations for fish movement and access was completed. When a potential limitation is encountered, biologists recorded the type of limitation, height and length of the limitation, depth of water, along with an estimate of slope

where relevant. The contiguity and spatial relationships of discontinuous pools are also described, when present, with the intent of understanding a fish's ability to move from one step-pool or isolated pool to another.

Hydrology indicators are used to identify evidence of flow if an initial assessment occurs during a period of low flow. Some examples of hydrology indicators used include water marks on trees, sediment deposits, drift deposits, algal mats, sparsely vegetated concave surface, water-stained leaves, surface soil cracks, drainage patterns, or moss trim lines. Vegetation communities can provide indication of flow (or absence thereof) as well. The presence of certain plant species provides evidence of flowing water, even if the water level has subsided. These include but are not limited to species such as bur-reed (*Sparganium spp.)*, royal fern (*Osmunda regalis*), and certain species within the genera *Glyceria, Juncus,* and *Carex*, to name a few. Guidance on vegetation species habits was provided by the Wetland indicator Plant List (Reed, 1988). Vegetative growth patterns, including growth and species composition of mosses, can provide evidence of water level fluctuations as well.

If a potential limitation for fish movement and access is anthropogenic in nature (i.e., improperly installed culverts), it was noted as such, but not considered a permanent due to its potential for being removed and reinstating fish passage.

2.8.2.2 *Fish Surveys: Electrofishing*

Electrofishing was conducted within one survey location in the Aquatic Study Area: WC1 (two reaches; Figure 9, Appendix A). Sampling reaches of approximately 100 m in length were selected as representative habitats with potential to support fish along a section of a watercourse. The goal of electrofishing surveys was to determine fish species presence within the Aquatic Study Area and within features that intercept surface water from the quarry. Fish collection was completed under Fisheries and Oceans Canada Fishing License # 341208.

Electrofishing was completed using guidance from a MEL Standard Operating Procedure (SOP) for Fish Collection (Appendix F). The methods and data collection forms outlined in the SOP were developed using the following sources:

- A review of fish sampling methods commonly used in Canadian freshwater habitats (Portt et al., 2006)
- New Brunswick (NB) Aquatic Resources Data Warehouse, the NB Department of Natural Resources and Energy, and the NB Wildlife Council - Fisheries Data Collection Forms Manual (2006)
- Fisheries and Oceans Canada's Interim Policy for the Use of Backpack Electrofishing Units (2003)

Fisheries and Oceans Canada's (DFO) Interim Policy for the Use of Backpack Electrofishing Units (2003) was reviewed and followed by all members of the electrofishing crew. This document provides a detailed list of standard equipment, safety, training, and emergency response procedure requirements for electrofishing. Each electrofishing crew consisted of two individuals, one of which (the crew lead) was a

qualified person as defined under the DFO Interim Electrofishing Policy. The crew lead was responsible for operating the backpack electrofisher according to their training and the Policy, and for communicating safety policies and electrofishing procedures to the second crew member.

Fish were sampled within open sites (i.e., without the use of barrier nets) using a Halltech Battery Backpack Electrofisher (HT-2000) with unpulsed direct current (DC) and a single pass – an open site was employed to ensure the greatest likelihood of capturing any fish present. The operator waded upstream to eliminate the effects of turbidity caused by bottom sediment and probed the anode into fish habitat within the site. A second crew member walked behind the operator to net any stunned fish using a D-frame landing net (1/8" mesh). If fish were captured, they were held in a live well containing ambient stream water and an aerator (i.e., bubbler), and the live well was kept out of the sun. Captured fish were checked regularly for signs of stress. At the conclusion of the pass, fish in the live well were identified to species and measured for length and weight. After recuperating, all fish were released back into the sampled reach.

Details of the August 2021 electrofishing surveys (locations and survey effort) are presented in Table 2-4 and shown on Figure 9 (Appendix A). Sampling reaches were selected based on potential fish presence, accessibility, habitat representation within the watercourse, and safety of personnel.

Table 2-4. Electrofishing Survey Details

Location	Survey Date	Reach Coordinates (UTM, NAD83)				Reach Length (m)	Survey Effort (sec)
		Upstream		Downstream			
		Easting	Northing	Easting	Northing		
WC1 R1	August 27, 2021	426440	4951722	426413	4951762	60[1]	341.2
WC1 R2	August 27, 2021	426355	4951856	426309	4951952	100	564.2

[1]reach length <100 m due to confinement between two subterranean sections of the watercourse

2.9 Priority Species

The following desktop and field survey methodologies were implemented during the priority species survey program and are discussed below.

2.9.1 Desktop Review

A desktop priority species list was created in accordance with the *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document* (NSE, 2009). This broad priority species list (provided in Appendix C) informed the biophysical field programs by identifying species that have the potential to be present within the Study Area. The desktop priority list was based on general species habitat requirements and the broad geographic area in which individual species are known to occur. See Section 1.2.1 for a definition of the following terms: priority species, SOCI, and SAR.

Databases provided by MTRI were assessed to identify the potential for priority lichen species including vole ears and boreal felt lichen. To determine the presence of any mapped SAR habitat, the NSDNRR significant species and habitats database was reviewed.

A desktop review for known bat hibernaculum nearby and within the Study Area was completed. The NSDNRR records of AMOs (NSDNR, 2017) were reviewed for the Study Area and within 5 km of the Study Area, as AMOs potentially provide bat hibernacula. The ACCDC report and the Recovery Strategy for the Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tri-colored Bat (*Perimyotis subflavus*) in Canada (Environment Canada, 2015) were consulted.

2.9.2 Field Surveys

Species specific field methods for SAR and SOCI are discussed in the following sections: Section 2.9.2.2 (mainland moose), Section 2.5.2.2 (common nighthawk). SAR and SOCI surveys were completed in conjunction with the other biophysical field surveys in 2020 and 2021. Where a SAR or SOCI was identified during surveys, additional effort was made in the field to understand the habitat at the sighting location and evaluate whether it was critical to the species' survival or life cycle requirements.

During all surveys within the Study Area, MEL personnel looked for signs of habitat that could support winter bat hibernation. Usage of the area by wood turtle (*Glyptemys insculpta*), snapping turtle (*Chelydra serpentina*), and eastern painted turtle (*Chrysemys picta picta*) was also considered, and MEL searched for incidental or opportunistic evidence of these species concurrently with watercourse and wetland surveys. Roadside surveys (e.g., avian surveys) were also completed at dawn and dusk during the turtle nesting season, suitable timing to detect nesting turtles along roadsides.

2.9.2.1 *Species at Risk Bats*

The ACCDC report identifies a bat hibernaculum as being located within 5 km of the Study Area (location sensitive) and notes that bat species (*Vespertilionidae sp.)* were identified within 4.4 km of the Study Area. NSDNRR confirmed that individual occurrences and monitoring occurrences of SAR bats were made under 5 km from the Study Area, but no known hibernacula are located within 5 km of the Study Area (August 2021, pers. comm., J. Laverty, Regional Biologist, NSDNRR). The ACCDC report also identifies little brown myotis (*Myotis lucifugus*), northern long-eared myotis (*Myotis septentrionalis*), and eastern pipistrelle (*Perimyotis subflavus*) within 11.6 km, 29.3 km, and 29.3 km from the Study Area, respectively (Appendix D). No other bat species were listed within the ACCDC report. The little brown myotis, northern long-eared myotis, and eastern pipistrelle are listed as Endangered by COSEWIC, SARA, and NSESA. AMOs can provide bat habitat, especially if they are open and unflooded. No AMOs are located within the Study Area; the closest is located 4.8 km southeast (NSDNR, 2017). Based on these findings, no targeted surveys were conducted for SAR bats, however, during all biophysical surveys, MEL biologists recorded any evidence of caves, open wells, cavities in mature trees, rock outcrops or other potential hibernacula or maternity roosting habitats, or any incidental observations of bats themselves. If a hibernaculum were observed, additional surveys (e.g., acoustic monitoring) would be completed.

2.9.2.2 *Mainland Moose*

The Study Area is located within a mainland moose concentration area and is also within mainland moose core habitat (NSDNRR, 2021b). Forest industry moose shelter patches are located approximately 750 m northeast (Figure 5, Appendix A); therefore, it was decided that moose-specific surveys were required. The goal of this survey program is to assess usage of the Study Area by mainland moose (*Alces americana*) through a combination of winter track surveys and pellet group inventory (PGI) surveys.

Moose generally use large areas with diverse habitat types throughout the year, however, during winter these areas become much smaller. Research shows that the winter range of moose may be approximately 2.6 km2 based on available forage and cover (Peek, Urich, & Mackie, 1976; Snaith & Beazley, 2002; Telfer, 1967a; Telfer, 1967b). During winter, early successional deciduous vegetation, which is often associated with open or disturbed areas, provides important forage for moose (Parker, 2003; Snaith & Beazley, 2002; Snaith, Beazley, MacKinnon, & Duinker, 2002). In Nova Scotia, the most important forage food species for moose are red maple (Acer rubrum), sugar maple (*Acer saccharum*), and mountain maple (*Acer spicatum*), and, in the winter, food availability is more important than shelter when it comes to habitat selection (Snaith & Beazley, 2002; Parker, 2003).

Cover from extreme weather via tree canopy will also help dictate important winter moose habitat. Mature conifer forests provide such shelter and protect from deep snow accumulation that may hinder moose movements (Peek, Urich, & Mackie, 1976; Parker, 2003; Telfer, 1967a). Moose tend to avoid traveling through areas of deep snow as it expends a lot of energy, especially in winter when food sources are scarce (Lundmark & Ball, 2008). Trails and unpaved forestry access roads, if not covered by deep snow, may provide easy travel routes for moose. According to the literature, the response of moose to roadways is highly variable, and depends on the size and traffic of the road. Laurian et al. (2008) found that moose generally avoid approaching within 500 m of roads, even if they are unpaved, forestry roads. Others have found that moose will use roads to access areas otherwise unreachable (Tinnerman & Racey, 1989; Van Ballenberghe & Peek, 1971).

Fourteen approximate 1-km long wildlife survey transects were established in lands within and surrounding the Study Area (Figure 5, Appendix A). The number and layout of the transects was designed following NSDNR Protocol for Mainland Moose Snow Tracking Survey and Pellet Group Inventory Data Collection (NSDNR, 2012). These guidance documents are aimed at wind power sites; however, MEL has adapted these methods for other types of development projects as appropriate. The number and length of transects were chosen as they adequately cover appropriate habitat within the Study Area and provides coverage of the areas directly surrounding it. The infrastructure layout will not be finalized by the time these surveys are completed; therefore, a variety of habitats were chosen in which to conduct surveys to have a broad understanding of moose usage across the landscape, both within and beyond the Study Area.

Transect placement reflects the general understanding of habitat usage by moose (Table 2-6). Transects were placed within a diversity of habitats including mixedwood forests, softwood forests, regenerating forests, wetlands, trails, harvested areas, and utility corridors. Due to their importance for foraging moose,

habitats with deciduous growth have been captured by the placement of transects within mixedwood forests. Habitat classifications are based on habitat mapping, aerial imagery, and available forestry GIS layers (Nova Scotia Department of Natural Resources, 2016).

The plan for the program was to complete three winter track surveys followed by one PGI survey on the same transects (T1-T14), however, acceptable winter conditions (i.e., snowfall) could not be met (note: snowfall was monitored throughout the winter to identify suitable days for surveying). Therefore, an additional PGI survey was implemented, as determined in consultation with NSDNRR (27 April 2021, pers. comm., M. McGarrigle, Species at Risk Biologist, NSDNRR). The additional PGI survey was completed on separate transects to avoid double counting pellet observations (T15-T28).

Table 2-5: Winter Moose Survey and PGI Transect Descriptions and Rationale

Survey #	Transect	Habitat	Rationale for Placement
Winter1, Winter 2, and PGI1	1	Mixedwood forest, wetland, trail, quarry, previously harvested forest, regenerating forest	Within Study Area
	2	Softwood, regenerating forest, quarry	Within Study Area
	3	Trail, mixedwood forest, wetland, open water	Outside Study Area. Similar mixedwood forest habitat.
	4	Softwood forest, trail, wetland	Outside Study Area. Similar softwood forest habitat.
	5	Trail within mixedwood forest	Outside Study Area. Similar mixedwood forest habitat.
	6	Softwood, harvested	Outside Study Area. Similar softwood habitat.
	7	Linear corridor, softwood, mixedwood	Outside Study Area. Similar softwood habitat.
	8	Mixedwood, softwood	Outside Study Area. Similar softwood habitat.
	9	Mixedwood, softwood, harvest	Outside Study Area. Similar softwood habitat.
	10	Mixedwood, softwood, harvest	Outside Study Area. Similar softwood habitat.
	11	Mixedwood, softwood	Outside Study Area. Similar softwood habitat.
	12	Softwood, harvested	Outside Study Area. Similar softwood habitat.
	13	Mixedwood, softwood	Outside Study Area. Similar softwood habitat.
	14	Softwood forest, regenerating forest	Outside Study Area. Similar softwood habitat.

Survey #	Transect	Habitat	Rationale for Placement
PGI2	15	Linear corridor, access road	Within Study Area
	16	Mixedwood, softwood, previously harvested forest, regenerating forest, trail	Within Study Area
	17	Mixedwood, previously harvested forest, regenerating forest	Outside Study Area. Similar mixedwood habitat.
	18	Wetland, previously harvested forest, regenerating forest, hardwood, mixedwood	Within Study Area, extends outside Study Area. Similar mixedwood habitat.
	19	Softwood, mixedwood, wetland	Outside Study Area. Similar softwood habitat
	20	Previously harvested forest, regenerating forest, softwood, hardwood	Outside Study Area. Similar softwood habitat.
	21	Access road	Outside Study Area. Potential high use area.
	22	Softwood, wetland, along road	Outside Study Area. Similar softwood habitat.
	23	Wetland, previously harvested forest, regenerating forest, mixedwood, softwood	Outside Study Area. Similar softwood habitat.
	24	Access road	Follows northeast Study Area boundary. Potential high use area.
	25	Softwood, access road	Outside Study Area. Similar softwood habitat.
	26	Access road and regenerating forest	Outside Study Area. Similar regenerating forest habitat and potential high use area.
	27	Access road	Outside Study Area. Potential high use area.
	28	Access road, linear corridor	Outside Study Area. Potential high use area.

Five transects bisect the Study Area and the remaining 23 transects are located outside of the Study Area (Figure 5, Appendix A), within a maximum distance of 2.6 km. These 23 transects encircle the Study Area so that if sign of moose are detected outside of the Study Area, MEL can determine actual proximity of moose to the site (NSDNR, 2012). Researchers in Minnesota found that moose tend to return to the same wintering areas, year after year, using similar travel routes to do so (Ballenberghe & Peek, 1971). The transects are positioned in a way that maximizes the chances of intercepting a moose moving through the landscape. Transect placement was constrained by the requirement to avoid particular parcels of private land; all transects are either on crown land or public roads.

Track surveys were completed on foot by two observers experienced in recognition of moose, deer, and other wildlife tracks, scat and browse. Transect selection was adjusted in the field, based on safety, accessibility, habitat, and conditions. Once the first round of surveys was complete, the same set of transects were used for future rounds.

Winter track surveys were completed within 3-7 days following a 10-cm snowfall, as long as there are no additional precipitation events in the intervening days. Surveys were not conducted during periods of rain, snowfall, or blowing snow. MEL used local weather forecasts, highway cameras, and direct observations of tracking conditions from on-site personnel (if available) prior to mobilizing, to ensure appropriate tracking conditions are present. MEL clearly documented weather conditions prior to, and during each survey; and surveys would be cancelled if tracking conditions degrade partway through a survey.

The winter track surveys were completed on January 27 and February 12, 2021. The PGI surveys were completed on March 23 (PGI #1) and May 6 and May 11, 2021 (PGI #2), prior to leaf-out when there is bare ground and good visibility.

During all surveys, locations of mainland moose tracks, browse, and scat were recorded using a handheld GPS unit. Survey tracks as well as incidental observations of other wildlife species, tracks, and scat were also recorded. If mainland moose signs were encountered during dedicated surveys or incidentally during other field programs, the surveyors would complete a mainland moose microhabitat assessment form. This form is used to collect data relating to the survey type, weather, and tracking conditions, type of sign observed, forest type, approximate stand age, and location of the sign in relation to nearest watercourse, wetland, and road. Photographs of mainland moose sign will also be taken. If any live moose were encountered, during this or any other type of survey, they would not be disturbed. No Species at Risk permit is necessary, as survey methods do not require MEL to harm, harass or approach live moose (February 2020, pers. comm., M. McGarrigle, Species at Risk Biologist, NSDNRR).

2.9.2.3 *Wood Turtle*

The wood turtle (*Glyptemys insculpta*) is listed as Threatened under the federal SARA and the NSESA. Their presence has been documented 17.9 km from the Study Area by the ACCDC report (Appendix D). Communication with NSDNRR in confirmed that there is no identified core habitat within or near the Study Area (11 February 2021, pers. comm., D. Hurlburt, Manager of Biodiversity, NSDNRR).

According to the Recovery Strategy (Environment and Climate Change Canada, 2020), wood turtles require water with sufficient flow and sufficient depth to provide them with ice-free, well-oxygenated water throughout the winter (Environment and Climate Change Canada, 2020). In Ontario, wood turtles hibernate in water with an average depth of 91 ± 34.8 cm, approximately 123.3 cm from the shore (Environment and Climate Change Canada, 2020). Wood turtles tend to hibernate wherever instream structures such as boulders or root-wads provide some cover, and rarely hibernate outside of the main channel of a watercourse, as they require well oxygenated water throughout the winter (18 January 2021, pers. comm., M. Pulsifer).

Wood turtles nest in well-drained gravelly soil on the banks of inhabited watercourses. While some may be attracted to gravelly roadsides for nesting, this habitat is considered unsuitable due to the danger presented to emerging hatchlings. To support egg incubation, soils need to be well-drained, with a southern aspect, and free of vegetation. This habitat is typically present as sand or gravel bars in depositional areas of dynamic, natural watercourses (Environment and Climate Change Canada, 2020).

No targeted wood turtle surveys were completed because no core habitat was present in the Aquatic Study Area, there were no ACCDC observataions in proximity to the Aquatic Study Area, and no watercourses were identidfied within the QEA. Opportunistic observations for all turtle species and their suitable habitat would be documented through all field programs, particularly wetland evaluations. All herpetofauna incidental observations were recorded during field surveys; observations may include animal sightings, vocalizations, amphibian egg masses, cast snake skins, turtle nest scrapes, or depredated nests.

If turtles were observed, a Nova Scotia turtle observation card would be completed, which includes the species, number of notches, turtle sex, date and time, note-worthy observations, habitat description, location, and weather. Any observed turtles would not be handled; instead, a photograph of the turtle would be taken, and its location marked with a handheld GPS. Therefore, a SAR permit through NSDNRR was not required.

2.9.2.4 *Snapping Turtle*

Snapping turtles are listed as Vulnerable under the NSESA and Special Concern under SARA and COSEWIC. Snapping turtles use a variety of habitats; however, the preferred habitat is slow-moving water with a soft mud bottom and dense aquatic vegetation. Nesting typically occurs in sand or gravel banks in proximity to water with sparse vegetative cover (ECCC, 2016). Hibernation sites are aquatic environments (e.g., lentic, lotic, and mud) where water will not freeze to the bottom, the substrate is a thick layer of mud, and other cover (e.g., large woody debris) is present (ECCC, 2016). No targeted surveys were completed because no watercourses are identified within the QEA. Per Section 2.9.2.3, all incidental observations would be recorded.

2.9.2.5 *Eastern Painted Turtle*

Eastern painted turtles are listed under COSEWIC as Special Concern. Eastern painted turtles can often be found in slow moving, relatively shallow watercourses, waterbodies, or wetlands. They require abundant basking sites and organic substrate with submergent aquatic plants that provide cover and food sources (COSEWIC, 2018). Their nesting habitats are open areas with south facing slopes that have a sandy loamy and/or gravel substrate; these habitats must be near (within 1.2 km) their preferred aquatic habitats. Overwintering habitats include areas with shallow water and deep substrate. Suitable habitat for the eastern painted turtle may be present within watercourse 1 (Aquatic Study Area), however, no targeted surveys were completed as no direct impacts are proposed to occur at this feature. Per Section 2.9.2.3, all incidental observations would be recorded.

2.9.2.6 *Common Nighthawk*

Common nighthawk (*Chordeiles minor*) is listed as Special Concern by COSEWIC and Threatened by the SARA and NSESA. The common nighthawk prefers to nest in gravelly substrates and is best detected while foraging for insects shortly after sunset (MBBA, 2008). Common nighthawks are documented by ACCDC and the MBBA as present in the vicinity of the Study Area, and suitable habitat may be available for this species within the Study Area based on desktop review (i.e., harvested areas and existing quarry footprint). The ACCDC report states this species has been identified within 4.1 ± 7 km of the Study Area (ACCDC, 2020). In addition, common nighthawk has been observed within the region displaying breeding evidence during both the first and second atlas survey (MBBA, n.d.).

Two dedicated evening surveys for the common nighthawk were conducted during their breeding season, on June 24 and July 7, 2021. The surveys were limited to two evening surveys to limit disturbance to breeding species. Targeted surveys for this species were selected because they are not reliably detected during the seasonal PC surveys due to their crepuscular nature (Saskatchewan Ministry of Environment, 2015). Four common nighthawk PCs (CONI PC) were surveyed by MEL biologists: CONI1, CONI2, CONI3, and CONI4 (Figure 6, Appendix A). Surveys commenced one hour before sunset and ended 30 minutes after sunset (Saskatchewan Ministry of Environment, 2015; MBBA, 2008).

One CONI PC is situated at the southern extent of the Study Area (CONI1), and the other three are on the road leading to and from the Study Area (CONI2, CONI3, and CONI4; Figure 6, Appendix A). CONI PC locations were chosen prior to the placement of the QEA; therefore, PC locations were chosen within and immediately adjacent the Study Area in order to provide coverage of the entire Study Area as common nighthawk can be heard from 800 m away (Saskatchewan Ministry of Environment, 2015). From CONI1 there is a maximum distance of 775 m to the Study Area boundary. CONI PC locations were selected because they are on gravel roads, with roadside gravel clearings or clear cuts (transmission line corridor) suitable for nesting and can safely be accessed from a vehicle during nocturnal surveys (MBBA, 2008). CONI PCs are distanced by 800 m to provide coverage, while avoiding overlapping observations (i.e., hearing the same individual at multiple locations) (Saskatchewan Ministry of Environment, 2015).

At each CONI PC location, surveys consisted of a three-minute passive surveying period, followed by three minutes of alternating 30-seconds call-playback of the conspecific common nighthawk call and 30-seconds of silence (passive surveying) as per survey protocol by Saskatchewan Ministry of Environment (2015). The MBBA *Species at Risk Atlassing Guide* states that common nighthawk are territorial, therefore using call-playback methods may increase the probability of observations (MBBA, 2008). Any observations of common nighthawk were recorded, including the number of individuals heard, sex, distance, bearing, dominant habitat that the bird is observed within, bird behaviour, and whether or not the bird is observed during the allotted survey time. Any other birds observed during the survey time were recorded.

3 BASELINE ENVIRONMENTAL CONDITIONS

3.1 General Spatial Setting for Project

The proposed Project is in the Western Ecoregion (700), as defined by the Nova Scotia Department of Natural Resources (Neily et al., 2017). The Western Ecoregion extends from Halifax south to Yarmouth and remains within 60 m of either the Atlantic Ocean or the Bay of Fundy. This ecoregion is characterized by a climate that is milder than the rest of the province. The total area of the Western Ecoregion is 16,870 km^2 or approximately 30.5% of the province (Neily et al., 2017).

Geology of the Western Ecoregion is comprised of folded Paleozoic slates and quartzites (greywacke) in the southwest, an arcing of granitic batholith from Yarmouth to Halifax, and areas of coarse, gravelly glacial tills (Neily et al., 2017). Soil classifications include Orthic Humo-Ferric and Ferro-Humic Podzols in well drained areas and Gleyed subgroups appear in appear in less well-drained areas. In course, granatic soils, Cemented (Ortstein) subgroups are also common (Neily et al., 2017).

Within the Western Ecoregion, white pine (*Pinus strobus*), hemlock (*Tsuga canadensis*) and red oak (*Quercus rubra*) are more prominent than in other parts of Nova Scotia. The Spruce Hemlock Forest Group occurs on fresh to fresh-moist sites and shade tolerant hardwood and mixedwood forests are found in richer sites (e.g., drumlins). Heathlands are also abundant in the western extent of this ecoregion (Neily et al., 2017).

3.1.1 Natural Subregion

The Western Ecoregion is further subdivided into ecodistricts. The Project exists in the St. Margaret's Bay Ecodistrict (780). This ecodistrict includes the majority of the Chebucto peninsula and encompasses land in western Halifax County, southern Hants County, and eastern Lunenburg County.

The soils within this ecodistrict are typically shallow, stony, well-drained sandy loams. The landscape also includes areas with large granite boulders. Elevations within the St. Margaret's Bay Ecodistrict rise from sea level to ~175 m. The predominant vegetation within the ecodistrict align with that of the ecoregion: red spruce forests on the slopes of hills, hemlock near watercourses, white pine in areas with drier soils and black spruce in areas with poorly drained soils (NSL&F, 2019; Neily et al., 2017).

3.1.2 Land Use and Habitat

Table 3-1 below displays the land use types and area (in hectares (ha)) within the Study Area. These estimations are based on google earth imagery from August 2020, the forest inventory GIS database (NSL&F, 2017), and field ground truthing.

Table 3-1. Calculations of Land Use within the Study Area

Land Use/Land Type	Area (ha)	% of Study Area
Wetland Habitat	0.86	2
Area with Existing Quarry and other Land Uses	6.71	21
Regenerating Stand	20.91	64

Land Use/Land Type	Area (ha)	% of Study Area
Softwood Forest Dominant	3.54	11
Roads	0.52	2
TOTAL STUDY AREA	32.54	100

Land use within the Study Area is dominated by regenerating stand (64%), followed by undisturbed softwood stand (11%) and wetlands (2%), totalling approximately 25.31 ha (77%). The remaining area, which totals 7.23 ha (23%), is comprised of the area with existing quarry and other land uses as well as roads.

Table 3-2 below displays the land use types and area (in hectares) within the QEA. These estimations were derived by the same tools used to estimate land use in the Study Area.

Table 3-2. Land Use within the QEA

Land Use/Land Type	Area (ha)	% of Study Area
Area with Existing Quarry and other Land Uses	5.64	23
Regenerating Stand	16.54	68
Softwood Forest Dominant	2.30	9
Roads	0.02	<1
TOTAL QEA	24.5	100

The majority of the land within the QEA is regenerating stand (68%) followed by the area with existing quarry and other land use (23%). Softwood forest habitat makes up the third most prominent land type (9%). The remaining area of the QEA consists of roads (<1%).

3.1.3 Site Sensitivities

The Study Area is not located in any protected or conservation areas within federal, provincial, or municipal jurisdiction. Figure 3 (Appendix A) shows the Study Area and surrounding significant habitats and conservation areas. The Nova Scotia Provincial Landscape Viewer (NSDNR, 2020) and desktop review identified the following:

- The closest NSECC predicted Wetland of Special Significance (WSS; ID# 16191) is located 1.5 km northwest of the Study Area;
- Island Lake Provincial Park is located approximately 1.5 km northwest of the Study Area;
- Old Annapolis Road Nature Reserve is located approximately 3.6 km north of the Study Area;
- Upper Tantallon Provincial Park is located approximately 5 km southeast of the Study Area;
- Jerry Lawrence Provincial Park is located approximately 5 km southeast of the Study Area;
- Five Bridge Lake Wilderness Area is located approximately 5.4 km southeast of the Study Area;
- Pockwock Wilderness Area is located approximately 7 km northeast of the Study Area;
- The Study Area is within an Endangered Mainland Moose Concentration Area;

- Predictive Boreal Felt Lichen (BFL) habitat is located approximately 200 m west and 500 m northwest of the Study Area. The habitat polygon to the west of the Study Area is located within the Aquatic Study Area.
- A mapped Significant Habitat for Species of Concern (common loon, *Gavia immer*) approximately 1.5 km southeast and 750 m northeast of the Study Area
- A mapped Significant Habitat for bald eagle (*Haliaeetus leucocephalus*) approximately 2.1 km east and 2.8 km south of the Study Area, and
- The Grassy Island Complex Important Bird Area (IBA; NS026) is located 10 km south of the Study Area

The majority of biophysical surveys occurred within the Study Area, except for wetland delineation and fish habitat assessment and collection, which also occurred within the Aquatic Survey Area.

3.2 Terrestrial Environment

This section describes the vegetation community, vascular plants, lichen, wildlife, and birds found within the Study Area.

3.2.1 Vegetation Community and Classification

The desktop review and field results for the vegetation community assessment completed within the Study Area are provided in the following sections.

3.2.1.1 *Desktop Results*

The Study Area is in St. Margarets Bay (780) ecodistrict within the Western Ecoregion (700) (Webb & Marshall, 1999). No Old Forest polygons (NSDNR, 2006) are present within the Study Area. NSDNRR forestry polygons (NSL&F, 2017) identified the Study Area and the QEA is composed of softwood and mixedwood forestry stands (Figure 4, Appendix A).

Refer to Section 3.1 for details on the vegetation associated with the aforementioned ecodistricts and ecoregions.

3.2.1.2 *Field Results*

The Study Area is primarily comprised of regenerative softwood stands, wetlands, and disturbed areas. Disturbed portions of the Study Area include the existing quarry footprint, gravel roads, and historic timber harvesting. The majority of the historic timber harvesting has occurred in the central portion of the Study Area. Within the Study Area, two upland vegetation types and two wetland vegetation types were present. The upland vegetation types belong to the Spruce Hemlock Forest Group (SH) and the wetland vegetation types belong to the Wet Coniferous Forest Group (WC) and the ‘cut-over’ group. See Table 3-3 and Figure 8 (Appendix A) for upland vegetation communities and section 3.3.1 for details on wetlands.

Table 3-3. Vegetation Community Groups and Vegetation Types within the Study Area

Community Type	Vegetation Group	Vegetation Type	Classification Source
Upland	Spruce Hemlock Forest Group	SH8 – Balsam fir / wood fern / Schreber's moss (Regenerating)	FEC (Neily et al. 2010)
		SH5 – Red spruce – balsam fir / Schreber's moss	FEC (Neily et al. 2010)
Wetlands	Wet Coniferous Forest Group	WC1 – Black spruce / cinnamon fern / sphagnum	FEC (Neily et al. 2010)
	Cut-over	Balsam fir – red maple / cotton sedge – three seeded sedge / sphagnum cut-over	MEL

The vegetation groups and vegetation types identified within the Study Area are described in detail within the following subsections.

3.2.1.2.1 Spruce Hemlock Forest Group (SH)

This vegetation group is widespread throughout Nova Scotia and consists of mid to late successional VTs (Neily et al., 2010). This vegetation group is dominated by a canopy consisting of shade tolerant softwoods such as balsam fir (*Abies balsamea*), red spruce (*Picea rubens*), and eastern hemlock (*Tsuga canadensis*). The shrub layer often consists of regenerating conifers and soils are often derived from glacial till (Neily et al., 2010). Two VTs belonging to this group, SH5 and SH8, were observed within the Study Area which were within intact and disturbed landscapes. This vegetation group was present across the Study Area and is situated within and outside of the QEA.

SH5 – Red Spruce – Balsam Fir / Schreber's Moss

The SH5 – Red Spruce – Balsam Fir / Shreber's Moss VT is a mid-successional community type dominated by red spruce and balsam fir. Fern species were either lacking or sparse within this VT, however if present, wood ferns (*Dryopteris spp*) and/or bracken fern (*Pteridium aquilinum*) were observed. Common woodland herbaceous species dominated the herbaceous layer primarily consisting of Canada bunchberry (*Cornus canadensis*) and goldthread (*Coptis trifolia*). The bryoid layer consists of stair-step moss, Schreber's moss while in low depressions, *Sphagnum* species such as *S. palustre* and *S. capillifolium* were present.

This VT was observed in the northwestern and west-central portions of the Study Area, in intact landscapes within and outside of the QEA. As described above, soils are nutrient poor and the closed canopy often associated with this VT prevents the developments of an extensive herbaceous layer. This VT provides more of a role for supporting wildlife such as grouse, woodpeckers, snowshoe hare (*Lepus americanus*), and American red squirrels (*Tamiasciurus hudsonicus*).

SH8 – Balsam Fir / Wood Fern / Schreber's Moss

The SH8 – Balsam Fir / Wood Fern / Schreber's Moss VT is an early to mid-successional community type which is dominated by balsam fir and often indicative of disturbances such as harvesting, insect infestation, and windthrow (Neily et al., 2010). The herbaceous layer is often variable within this VT and in some instances the canopy cover is so dense that very little herbaceous cover is present. Within the Study Area the herbaceous layer consisted of Canada bunchberry and bracken fern. The bryoid layer consisted of broom mosses (*Dicranum spp.*), hypnum mosses (*Hypnum spp.*) and *Bazzania spp.*

This VT was observed across the majority of the Study Area and falls within and outside of the QDA. Within the Study Area, this VT was primarily regenerating from historic clearing activities (~20 years ago). Like the SH5 VT, the SH8 VT supports wildlife such as grouse, woodpeckers, snowshoe hare, and American red squirrels.

3.2.1.2.2 Wet Coniferous Forest Group (WC)

This vegetation group is classified by having water at or near the surface for the majority of the year (Neily et al., 2010). This vegetation group is mainly dominated by a canopy of black spruce that varies from dense to sparse. Shrub layers are typically comprised of ericaceous species and the herbaceous layer is typically dominated by cinnamon fern, creeping snowberry, or sedges over Sphagnum moss (Neily et al., 2010). One VT belonging to this group, WC1, was observed in multiple wetlands (WL1 and 2) within the Study Area. These wetlands are located outside of the QEA.

WC1 – Black Spruce / Cinnamon Fern / Sphagnum

The WC1 – Black spruce / Cinnamon fern / Sphagnum VT is a common climax community found on wet, nutrient poor soils. The canopy of this vegetation type is predominantly black spruce and balsam fir with extensive cover of cinnamon fern and a variety of sphagnum species including *S. squarrosum*, *S. capillifolium* and *S. palustre*. Low to medium shrub cover is present within this VT which is often comprising of black spruce and balsam fir saplings. Bunch berry, cinnamon fern, three-seeded sedge (*Carex trisperma*). and goldthread (*Coptis trifolia*) dominate the herbaceous stratum.

3.2.1.2.3 Cut-over

Per Section 2.1.2, when MEL encounters a vegetative group that does not fit into a defined system (e.g., FEC), a new group is created with a VT based on dominant vegetation observed. The cut-over vegetative group was identified in WL3. This group, as its name implies, is characterized by historic clearing activities (~20 years ago).

Balsam Fir – Red Maple / Cotton Sedge – Three-seeded Sedge / Sphagnum

This VT is found in a weakly mineroptrophic setting with a high water table and extensive Sphagnum cover. The mat forming Sphagnums belonging to the *S. recurvum* group were the predominant bryophyte within the bryoid layer. The tree cover was very sparse consisting of balsam fir and red maple. Graminoid cover was moderate consisting predominately of cotton sedge (*Eriophorum vaginatum*) and three-seeded

sedge.

3.2.1.2.4 Vegetation Community and Classification Summary

The Study Area is comprises of VTs within the Spruce Hemlock Forest Group (SH), the Wet Coniferous Forest Group (WC) and the 'cut-over' group. None of the VTs observed are unique or uncommon in Nova Scotia. The vegetative communities identified within the Study Area do not have an elevated potential for priority species.

The entire treed extent of the Study Area is dominated by softwood communities, the majority of which are regenerating stands of balsam fir associated with historic timber harvesting. Additional disturbed portions of the Study Area include the existing quarry footprint and gravel roads.

3.2.2 Vascular Plants

The following sections outline the results from the desktop review and the field surveys completed within the Study Area.

3.2.2.1 *Desktop Results*

The ACCDC report documented seven vascular priority plant species within 5 km of the Study Area: whorled yellow loosestrife (*Lysimachia quadrifolia;* S1), Greene's rush (*Juncus greenei;* S1S2), Fernald's hay sedge (*Carex foenea;* S3), woods-rush (*Juncus subcaudatus;* S3), southern twayblade (*Neottia bifolia;* S3), Nova Scotia agalinis (*Agalinis neoscotica;* S3S4), and Loesel's twayblade (*Liparis loeselii;* S3S4). The Study Area is not within a black ash (*Fraxinus nigra*; S1S2; NSESA Threatened) 10 km by 10 km standardized grid square which core habitat is found (NSDNRR, 2021a).

3.2.2.2 *Field Results*

A total of 101 vascular plant species were observed within the Study Area, one of which was a SOCI: the Nova Scotia agalinis (S3S4; Figure 10, Appendix A). No priority vascular plant species were observed within the QEA. Within the Study Area, 6% of the observed vascular plant species (n=6) comprised of exotics, 94% (n=95) were native and of the native species less than 2.1% (n=2) belonged to the ACPF Group. A list of all observed plants can be found in Appendix G.

As discussed in Section 3.2.1, the Study Area consists primarily of intact and regenerating softwood forested communities and wetlands with disturbed sites consisting of the existing quarry footprint, gravel roads and historic timber harvesting.

The Study Area is highly disturbed and consists of regenerative softwood communities indicative of a low pH and nutrient poor regime. The locations that had the highest potential for rarities were linear disturbances such as trails and roads, and provided suitable habitat for Nova Scotia agalinis, which was observed within the Study Area.

The disturbed habitats (e.g., existing quarry footprint, gravel roads, and historic timber harvesting) consisted primarily of herbaceous pioneer species, with the majority of the exotic species being confined to the edges of the gravel roads running along the eastern and western Study Area boundary.

Many of the wetlands within the Study Area were disturbed and regenerative and did not provide habitat for many of the vascular plant rarities found in Nova Scotia.

One location of Nova Scotia agalinis was observed within the Study Area and outside the QEA, along the eastern Study Area boundary (see section 3.4.2 for details).

Two species identified within the Study Area, the Nova Scotia agalinis and bog fern (*Coryphopteris simulata*; ACCDC: S4), belong to the ACPF Group. The ACPF Group is a unique group of vascular plants which often inhabit the shoreline and wetlands of Nova Scotia. This group has a narrow range, starting from Florida and extending to Nova Scotia with a few disjunct populations within the Great Lakes. Many of the SAR within Nova Scotia belong to this group. Although many are common species and have no regulatory protection, they are a unique group which have a narrow range in North America.

3.2.3 Lichens

The following sections outline the results from the desktop review and the field surveys completed within the Study Area.

3.2.3.1 *Desktop Results*

Two priority lichen species were documented within 5 km of the Study Area in the ACCDC report, blue felt lichen (*Pectenia plumbea*; SARA & COSEWIC Special Concern; NSESA Vulnerable; ACCDC S3); and grizzled rocktripe lichen (*Umbilicaria vellea*; ACCDC S1). No predicted BFL polygons are present within the Study Area, however, one predicted polygon is present 200 m west of the Study Area. According to the MTRI databases, no extant BFL populations are within 19 km and no vole ears lichen are within 23 km of the Study Area.

3.2.3.2 *Field Results*

During the field surveys, 22 lichen species were observed within the Study Area. Two were determined to be priority species[1] (Figure 10, Appendix A):

- Frosted glass whiskers (*Sclerophora peronella*; Atlantic population; SARA & COSEWIC Special Concern; ACCDC S1?); and,
- Fringe lichen (*Heterodermia neglecta*; ACCDC S3S4).

[1] Blue felt lichen (*Pectenia plumbea*; SARA & COSEWIC Special Concern; NSESA Vulnerable; ACCDC S3) was incidentally identified 8 m north of the Study Area in wetland habitat contiguous with WL1. Since it was identified outside of the Study Area it is not discussed in more detail within this report.

Frosted glass whiskers were identified in two locations; both of which are east of WL1(i.e., in upland habitat) and north of the QEA. Per the NSDNRR At-Risk Lichens – Special Management Practices (NSDNR, 2018), a 100 m buffer will be maintained between the frosted glass whiskers and the QDA (). The fringe lichen is located in upland habitat within the north-central portion of the QEA. Additional information regarding the priority lichen species is provided in section 3.4.3.

As mentioned previously, the Study Area is disturbed and dominated by regenerative softwood stands. Many of the rare lichens in Nova Scotia have an association with mature forested communities, often associated with wetlands, lakes and watercourses. The habitat that provided the greatest potential to support lichen rarities was WL1, located in the northwestern extent of the Study Area. This wetland and adjacent upland habitat provided mature forested communities consisting of softwood and hardwood species. The appropriate tree maturity, bark texture, and pH provided habitat for a suite of rare cyanolichens and calicioids including blue felt lichen, frosted glass-whiskers, and fringe lichen which were observed within and immediately adjacent to the Study Area.

Table 3-4: Observed Lichen Species

Scientific Name	Common Name	SARA	COSEWIC	NSESA	SRank
Sclerophora peronella (Atlantic pop.)	**Frosted glass-whiskers (Atlantic population)**	**SC**	**SC**	**-**	**S1?**
Heterodermia neglecta	**Fringe lichen**	**-**	**-**	**-**	**S3S4**
Arctoparmelia centrifuga	Ripple ring lichen	-	-	-	S5
Cladonia crispata	Organpipe lichen	-	-	-	S5
Cladonia cristatella	British soldiers lichen	-	-	-	S5
Cladonia maxima	Giant cladonia lichen	-	-	-	S5
Cladonia multiformis	Sieve lichen	-	-	-	S5
Hypogymnia incurvoides	Lattice tube lichen	-	-	-	S4S5
Hypogymnia physodes	Monk's hood lichen	-	-	-	S5
Hypogymnia tubulosa	Powder-headed tube lichen	-	-	-	S5
Imshaugia aleurites	Salted starburst lichen	-	-	-	S4
Lichenomphalia umbellifera	Green-pea mushroom lichen	-	-	-	SU
Lobaria pulmonaria	Lungwort lichen	-	-	-	S5
Lobaria scrobiculata	Textured lungwort lichen	-	-	-	S5
Menegazzia terebrata	Magic flute lichen	-	-	-	S4
Nephroma helveticum	Fringed kidney lichen	-	-	-	S4S5
Pannaria conoplea	Mealy-rimmed shingle lichen	-	-	-	S4
Pannaria rubiginosa	Brown-eyed shingle lichen	-	-	-	S4
Platismatia glauca	Varied rag lichen	-	-	-	S5
Platismatia tuckermanii	Crumpled rag lichen	-	-	-	S5
Pseudocyphellaria perpetua	Gilded specklebelly lichen	-	-	-	SNA
Ropalospora chlorantha	Comet-spored lichen	-	-	-	-

Note: Scientific names used are in accordance with the latest ACCDC species list retrieved in August 2021. Scientific names may no longer be in use, however, for consistency in this report, species names in the ACCDC species list are used.

"-" indicates no common name and/or ranking currently available

Bolded species are SAR or SOCI; SC = Special Concern

Blue felt lichen is not included within the above table because it was not found within the Study Area.

3.2.4 Wildlife

The following sections outline the results from the desktop review and the field surveys completed within the Study Area.

3.2.4.1 *Desktop Results*

There are no documented NSDNRR significant habitats within the Study Area; the closest significant habitat is for common loon (*Gavia immer*; HX197) located at Sandy Lake, approximately 750 m northeast of the Study Area.

The Study Area is within a mainland moose concentration area (Figure 2, Appendix A). There are no known mainland moose shelter patches within the Study Area and the closest is located 750 m northeast of the Study Area, bordering Sandy Lake. The ACCDC report states that mainland moose have been observed 20.1 km from the Study Area. No priority mammal species were listed within 5 km of the Study Area by the ACCDC. The ACCDC report states that there are no observations of Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), snapping turtle (*Chelydra serpentina*), or eastern painted turtle (*Chrysemys picta picta*) within 5 km of the Study Area.

Although the ACCDC report identifies a bat hibernaculum as being located within 5 km, NSDNRR confirmed that no hibernaculum is located within 5 km of the Study Area. The record presented by the ACCDC is based on individual occurrences and monitoring occurrences of SAR bats which were made under 5 km from the Study Area (4 August 2021, pers. comm., J. Laverty, Regional Biologist, NSDNRR). No AMOs are located within the Study Area; the closest is located 4.8 km southeast (NSDNR, 2017). The closest critical bat habitat is approximately 23 km northwest of the Study Area, near Windsor, Nova Scotia (Environment Canada, 2015).

3.2.4.2 *Field Results*

3.2.4.2.1 Mammals

No sign of mainland moose was observed during winter transect surveys or during the PGI surveys (Section 3.4.4). Of the 28 transects surveyed, signs of deer (visual observation of tracks, scat, and/or browse) were observed on 12 transects surveyed during the two winter surveys and PGI1 (T1, T2, T3, T4, T6, T7, T8, T9, T10, T11, T12, and T14) and four of the transects surveyed during PGI2 (T3, T4, T5, and T12)[2] (Figure 5, Appendix A). These transects are located within and outside of the Study Area.

Wildlife species, including herpetofauna and mammal species, were assessed through incidental wildlife observations and recorded within the Study Area during all biophysical surveys. See Table 3-5 for all incidental mammal observations confirmed either visually or by sign (scat, tracks, etc.).

[2] Due to poor winter tracking conditions an additional PGI survey (PGI2) was completed on separate transects to avoid double counting pellet observations from PGI1.

Table 3-5. Confirmed Mammalian Species within the Study Area

Scientific Name	Common Name	SRank
Canis latrans	Eastern coyote	S5
Lepus americanus	Snowshoe hare	S5
Odocoileus virginianus	White tailed deer	S5
Tamiasciursus hudsonicus	American red squirrel	S5
Peromyscus leucopus	White-footed deermouse	S5
Erethizon dorsatum	North American porcupine	S5
Lynx rufus	Bobcat	S5

Other species not encountered during field surveys that have the potential to use the Study Area habitat include the following.

Table 3-6: Mammalian Species with Potential Habitat within the Study Area

Scientific Name	Common Name	SRank
Neovison vison	American mink	S5
Ursus americanus	American black bear	S5
Vulpes vulpes	Red fox	S5
Mustela erminea	Short-tailed weasel	S5
Tamias striatus	Eastern chipmunk	S5
Procyon lotor	Northern raccoon	S5
Mephitis	Striped skunk	S5

3.2.4.2.2 Herpetofauna

Spring peepers (*Pseudacris crucifer;* ACCDC: S5) were incidentally heard calling outside of the Study Area during nocturnal owl surveys and one green frog (*Lithobates clamitans*; ACCDC S5) was identified in the mapped waterbody at the southern extent of the Study Area.

Limited habitat is present for herpetofauna within the QEA as no wetlands, watercourses, or lakes are found within it. One mapped waterbody is found within the southernmost extent of the QEA (Section 3.3.2). This feature provides amphibian breeding habitat.

Within the Study Area and the Aquatic Study Area, habitat for herpetofauna is present within wetlands and in WC1. An assemblage of herpetofauna species may inhabit the areas where suitable habitat was observed. These species are listed in Table 3-7.

Table 3-7: Herpetofauna Species with Potential to Occupy the Aquatic Study Area.

Common Name	Scientific Name	ACCDC Prov. Rank
Wood turtle	*Glyptemys insculpta*	S2
Snapping turtle	*Chelydra serpentina*	S3

Common Name	Scientific Name	ACCDC Prov. Rank
Eastern painted turtle	*Chrysemys picta picta*	S4S5
Eastern smooth green snake	*Opheodrys vernalis*	S4
Eastern American toad	*Anaxyrus americanus*	S5
Pickerel frog	*Lithobates palustris*	S5
Northern leopard frog	*Lithobates pipiens*	S5
Mink frog	*Lithobates septentrionalis*	S5
Wood frog	*Lithobates sylvaticus*	S5
Eastern red-backed salamander	*Plethodon cinereus*	S5
Maritime garter snake	*Thamnophis sirtalis pallidulus*	S5

Refer to Section 3.4.5 for information on suitable habitat within the Study Area for wood turtle, snapping turtle, and eastern painted turtle.

3.2.5 Avifauna

The following sections outline the results from the desktop review and the field surveys completed within and immediately adjacent to the Study Area.

3.2.5.1 *Desktop Results*

There are no IBAs within 5 km of the Study Area (Bird Studies Canada, 2012). The closest IBA, Grassy Island Complex (NS026), is approximately 10.1 km south of the Study Area (Figure 2, Appendix A).

The Grassy Island Complex IBA includes three islands, Grassy Island (33 km from the Study Area) and Westhaver Island (43 km from the Study Area) in Mahone bay and Wedge Island (10 km from the Study Area), on the east side of St. Margarets Bay (IBA Canada, n.d.). All three islands are <10 ha in size and Wedge Island is the only one to be treed. Roseate terns (*Sterna dougallii*), common terns (*Sterna hirundo*), and arctic terns (*Sterna paradisaea*) nest on Wedge Island (IBA Canada, n.d.). Habitats within the Study Area are not representative of those found within the Grassy Island Complex IBA.

The closest Canada Wildlife Service MBS in Nova Scotia is the Kentville MBS, located approximately 60 km northwest of the Study Area (Figure 2, Appendix A). This MBS (200 ha) is located on the Cornwallis River in Kentville and contains flood plains and marshes (ECCC CWS 2019), habitat not found within the Study Area. American black duck *(Anas rubripes*), blue-winged teal (*Anas discors*), green-winged teal (*Anas carolinensis*), red-tailed hawk (*Buteo jamaicensis*), and northern harrier (*Circus hudsonius*) are the key bird species found in the Kentville MBS (ECCC CWS 2019).

The MBBA square 20MQ25 encompasses the entirety of the Study Area (results are provided in Appendix H). In the first MBBA Atlas, 155 species were observed within this square, in the second atlas 164 species were observed. The ACCDC database identified eight avian SAR within 5 km of the Study Area. These are discussed further in Section 3.4.6. The ACCDC results are in Appendix D.

3.2.5.2 *Avian Survey Results*

The following subsections outline the survey results of the point count surveys (spring migration, breeding season, fall migration, and common nighthawk surveys), winter surveys, and all incidental observations.

3.2.5.2.1 Spring Migration

Twelve point count locations (Figure 6 and 10, Appendix A) were surveyed on three separate dates during the spring migration period (May 1, May 14 and May 26, 2021). During spring migration surveys, a total of 349 individuals representing 34 species were observed. One individual of the order Passeriformes could not be identified at the species level and has been removed from the data in Table 4-13 below. There were no incidental observations (i.e., those outside of PC locations or survey times).

Four priority species were observed during the spring migration surveys. Two of these species are SAR; olive-sided flycatcher (*Contopus cooperi;* SARA and NSESA Threatened) and wood thrush (*Hylocichla mustelina;* SARA Threatened) and two are SOCI; Canada jay (*Perisoreus canadensis;* ACCDC S3) and turkey vulture (*Cathartes aura;* ACCDC S2S3B) (Figure 10, Appendix A; all avian priority species are discussed in Section 3.4.6).

Table 3-8: Spring Migration: Species and Abundance of Birds

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	#	Points Observed	Bird Group
Olive-sided Flycatcher	***Contopus cooperi***	**T**	**SC**	**T**	**S2B**	**1**	**6**	**6**
Wood Thrush	***Hylocichla mustelina***	**T**	**T**	-	**SUB**	**1**	**1**	**6**
Canada Jay	***Perisoreus canadensis***	-	-	-	**S3**	**5**	**8, 9, 12**	**6**
Turkey Vulture	***Cathartes aura***	-	-	-	**S2S3B**	**1**	**4**	**4**
American Crow	*Corvus brachyrhynchos*	-	-	-	S5	8	1, 6, 11, 12, 13	6
American Goldfinch	*Spinus tristis*	-	-	-	S5	11	1, 2, 8, 10, 12, 13	6
American Robin	*Turdus migratorius*	-	-	-	S5B,S3N	18	2, 3, 5, 8, 9, 10, 11, 12, 13	6
Black-and-White Warbler	*Mniotilta varia*	-	-	-	S5B	12	1, 5, 6, 8, 10, 11, 12, 13	6
Black-capped Chickadee	*Poecile atricapillus*	-	-	-	S5	11	1, 2, 3, 4, 10, 11, 12	6
Belted Kingfisher	*Megaceryle alcyon*	-	-	-	S5B	1	3	3
Blue-headed Vireo	*Vireo solitarius*	-	-	-	S5B	3	5, 9, 12	6
Blue Jay	*Cyanocitta cristata*	-	-	-	S5	8	3, 11, 12	6

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	#	Points Observed	Bird Group
Black-throated Green Warbler	*Setophaga virens*	-	-	-	S5B	7	1, 6, 8, 9, 11	6
Canada Goose	*Branta canadensis*	-	-	-	S4N	5	5, 6, 11	1
Common Raven	*Corvus corax*	-	-	-	S5	7	1, 3, 6, 9, 11, 13	6
Common Yellowthroat	*Geothlypis trichas*	-	-	-	S5B	16	1, 2, 3, 4, 5, 6, 8, 9, 11, 12, 13	6
Chestnut-sided Warbler	*Setophaga pensylvanica*	-	-	-	S5B	5	5, 8, 11, 13	6
Dark-eyed Junco	*Junco hyemalis*	-	-	-	S4S5	18	2, 3, 4, 5, 6, 8, 9, 10, 11, 12	6
Golden-crowned Kinglet	*Regulus satrapa*	-	-	-	S5	5	4, 5, 8	6
Hermit Thrush	*Catharus guttatus*	-	-	-	S5B	26	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13	6
Magnolia Warbler	*Setophaga magnolia*	-	-	-	S5B	5	3, 6, 8, 10	6
Mourning Dove	*Zenaida macroura*	-	-	-	S5	26	1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13	7
Nashville Warbler	*Oreothlypis ruficapilla*	-	-	-	S4S5B	3	1, 2, 3	6
Northern Cardinal	*Cardinalis*	-	-	-	S4	1	11	6
Northern Flicker	*Colaptes auratus*	-	-	-	S5B	17	1, 2, 3, 4, 6, 8, 9, 10, 11, 12	7
Palm Warbler	*Setophaga palmarum*	-	-	-	S5B	35	2, 4, 5, 6, 8, 9, 10, 11, 12, 13	6
Purple Finch	*Haemorhous purpureus*	-	-	-	S4S5B,S3S4N	3	4, 5	6
Ruffed Grouse	*Bonasa umbellus*	-	-	-	S5	2	12	7
Song Sparrow	*Melospiza melodia*	-	-	-	S5B	2	2, 12	6
Spruce Grouse	*Falcipennis canadensis*	-	-	-	S4	2	6, 12	7
Winter Wren	*Troglodytes hiemalis*	-	-	-	S5B	21	1, 2, 3, 4, 8, 9, 10, 11, 12, 13	6
White-throated Sparrow	*Zonotrichia albicollis*	-	-	-	S5B	53	1, 2, 3, 4, 5, 6, 8, 9,	6

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	#	Points Observed	Bird Group
							10, 11, 12, 13	
White-winged Crossbill	*Loxia leucoptera*	-	-	-	S4S5	1	11	6
Yellow-rumped Warbler	*Setophaga coronata*	-	-	-	S5B	9	2, 3, 4, 5, 8, 11, 13	6
Total Species: 34				**Total # Individuals: 349**				

Notes: Unknown birds and incidental observations are not included (those observed outside of point count locations). Bird group is coded as: 1 = waterfowl; 2 = shorebirds; 3 = other waterbirds (i.e., that are not waterfowl or shorebirds); 4 = diurnal raptors; 5 = nocturnal raptors; 6 = passerines (excluding dippers) and 7 = other landbirds. Bolded species are priority species. Underlined species are SAR. E = Endangered, T = Threatened, V = Vulnerable, SC = Special Concern. ACCDC rankings retrieved from: http://accdc.com/webranks/NSall.htm (July 2021).

The majority of species observed during dedicated spring migration surveys were of the order Passeriformes (79.4%), which also consisted of the highest percent of individual birds observed (84.5%). The second most abundant group were other landbirds (11.8%), followed by other waterbirds (2.9%), diurnal raptors (2.9%), and waterfowl (2.9%). White-throated sparrow (*Zonotrichia albicollis*; n=53) was the most abundant species observed, followed by palm warbler (Setophaga palmarum; n=35), mourning dove (*Zenaida macroura*; n=26) and hermit thrush (*Catharus guttatus*; n=26). No large flocks or obvious migration patterns were observed.

3.2.5.2.2 Breeding Season

The breeding bird survey consisted of 12 point count stations that were surveyed on June 14 and June 24, 2021 (Figure 6 and 10, Appendix A). A total of 266 individuals representing 35 species were observed. The species observed during dedicated surveys are included in the summary below. During dedicated breeding bird point count surveys, two SOCI were observed, bay-breasted warbler (*Setophaga castanea;* ACCDC S3S4B) and yellow-bellied flycatcher (*Empidonax flaviventris*; ACCDC S3S4B) (Figure 10, Appendix A). All avian priority species are discussed in Section 3.4.6. Novel species identified during area searches include Osprey (*Pandion haliaetus*), spruce grouse (*Falcipennis canadensis*), and song sparrow (*Melospiza melodia*). Additionally, two incidental species were observed during breeding bird surveys, a red-tailed hawk (*Buteo jamaicensis;* ACCDC S5) and a Swainson's thrush (*Catharus ustulatus*; ACCDC S3S4B). Incidentals are discussed in Section 3.2.5.2.7.

Table 3-9: Breeding Season Surveys: Species and Abundance of Birds

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	#	Points Observed	Breeding Status	Bird Group
Bay-breasted Warbler	***Setophaga castanea***	-	-	-	**S3S4B**	**1**	**9**	**S**	**6**
Yellow-bellied Flycatcher	***Empidonax flaviventris***	-	-	-	**S3S4B**	**1**	**4**	**S**	**6**
Alder Flycatcher	*Empidonax alnorum*	-	-	-	S5B	11	4, 5, 6, 7, 8, 10, 11, 12	S, T, H	6
American Crow	*Corvus brachyrhynchos*	-	-	-	S5	2	1, 11	S	6
American Goldfinch	*Spinus tristis*	-	-	-	S5	8	7, 8, 9	S, X	6
American Redstart	*Setophaga ruticilla*	-	-	-	S4S5B	4	2, 4, 5	S	6
American Robin	*Turdus migratorius*	-	-	-	S5B,S3N	6	1, 2, 6, 11, 12	S, T, H	6
Black-and-White Warbler	*Mniotilta varia*	-	-	-	S5B	6	1, 2, 3, 8, 10	S, T, H	6
Black-capped Chickadee	*Poecile atricapillus*	-	-	-	S5	2	12	S, T	6
Blue-headed Vireo	*Vireo solitarius*	-	-	-	S5B	5	3, 4, 5, 7, 12	S	6
Blue Jay	*Cyanocitta cristata*	-	-	-	S5	8	2, 4, 8, 10	S, T	6
Black-throated Green Warbler	*Setophaga virens*	-	-	-	S5B	8	3, 8, 9, 10, 11, 12	S, T	6

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	#	Points Observed	Breeding Status	Bird Group
Broad-winged Hawk	*Buteo platypterus*	-	-	-	S5B	1	2	H	4
Cedar Waxwing	*Bombycilla cedrorum*	-	-	-	S5B	1	7	S	6
Common Loon	*Gavia immer*	-	-	-	S4B,S4N	1	6	S	3
Common Yellowthroat	*Geothlypis trichas*	-	-	-	S5B	18	1, 2, 4, 7, 8, 9, 10, 11	S, T	6
Double-crested Cormorant	*Phalacrocorax auritus*	-	-	-	S4B	6	2	X	2
Dark-eyed Junco	*Junco hyemalis*	-	-	-	S4S5	20	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12	S, T, H	6
Golden-crowned Kinglet	*Regulus satrapa*	-	-	-	S5	2	1, 4	S	6
Herring Gull	*Larus argentatus*	-	-	-	S5	1	2	X	2
Hermit Thrush	*Catharus guttatus*	-	-	-	S5B	20	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	NY, S, T	6
Least Flycatcher	*Empidonax minimus*	-	-	-	S4S5B	3	2, 5, 8	S	6
Magnolia Warbler	*Setophaga magnolia*	-	-	-	S5B	7	1, 2, 3, 7, 9, 10	S, T	6
Mourning Dove	*Zenaida macroura*	-	-	-	S5	20	1, 2, 3, 4, 5, 6, 7, 8,	S, T, H	7

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	#	Points Observed	Breeding Status	Bird Group
							10, 11, 12		
Nashville Warbler	*Oreothlypis ruficapilla*	-	-	-	S4S5B	3	2, 5, 6	S	6
Northern Flicker	*Colaptes auratus*	-	-	-	S5B	4	4, 6, 11	S, H	7
Northern Parula	*Setophaga americana*	-	-	-	S5B	2	3, 12	S	6
Osprey	*Pandion haliaetus*	-	-	-	S4B	1	Area search	X	4
Palm Warbler	*Setophaga palmarum*	-	-	-	S5B	20	2, 4, 5, 6, 7, 8, 9, 10, 11	NB, T, A, S	6
Purple Finch	*Haemorhous purpureus*	-	-	-	S4S5B, S3S4N	5	5, 8, 9, 11, 12	S	6
Song Sparrow	*Melospiza melodia*	-	-	-	S5B	1	Area search	H	6
Spruce Grouse	*Falcipennis canadensis*	-	-	-	S4	10	Area search	NY, H	7
Winter Wren	*Troglodytes hiemalis*	-	-	-	S5B	5	1, 4, 5, 6, 11	S	6
White-throated Sparrow	*Zonotrichia albicollis*	-	-	-	S5B	42	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	S, T, P	6
Yellow-rumped Warbler	*Setophaga coronata*	-	-	-	S5B	11	1, 2, 4, 5, 8, 10, 11, 12	S, T, H	6
Total Species: 35				**Total # Individuals: 266**					

Notes: Unknown birds and incidental observations are not included (those observed outside of point count locations). Bird group is coded as: 1 = waterfowl; 2 = shorebirds; 3 = other waterbirds (i.e., that are not waterfowl

or shorebirds); 4 = diurnal raptors; 5 = nocturnal raptors; 6 = passerines (excluding dippers) and 7 = other landbirds. Bolded species are priority species. Underlined species are SAR. E = Endangered, T = Threatened, V = Vulnerable, SC = Special Concern. ACCDC rankings retrieved from: http://accdc.com/webranks/NSall.htm (July 2021). Breeding evidence codes: A = agitated behaviour or anxiety calls of an adult (probable); H = species observed in its breeding season in suitable nesting habitat (possible); P = pair observed in suitable nesting habitat in nesting season (probable); S = singing male(s) present, or breeding calls heard, in suitable nesting habitat in breeding season (possible); T = permanent territory presumed through registration of territorial song, or the occurrence of an adult bird, at the same place, in breeding habitat, on at least two days a week or more apart, during its breeding season (probable); X = species observed in its breeding season (no breeding evidence; observed); NB = Nest building or carrying nest materials, for all species except wrens and woodpeckers (confirmed); NY = Nest with young seen or heard (confirmed)

The majority of species observed during dedicated breeding bird surveys were of the order Passeriformes (77.1%), which also consisted of the highest percent of individual birds observed (83.5%). The second most abundant group of species were other landbirds (8.6%). The third and forth most abundant groups of species were shorebirds (5.7%) and diurnal raptors (5.7%). The fifth most abundant group of species were other waterbirds (2.9%). The five most common species observed during breeding bird surveys were the white-throated sparrow (n=42), dark-eyed junco (*Junco hyemalis*; n=20), hermit thrush (n=20), mourning dove (n=20), and palm warbler (n=20). No large flocks were observed.

Breeding evidence (e.g., nest, adult with chicks, or adult with nesting material) was confirmed for three species; hermit thrush, palm warbler, and spruce grouse (*Falcipennis canadensis*). The 29 species identified as possible or probable breeders were observed in suitable nesting habitat. It should be noted that it was not possible to confirm that all species identified as displaying breeding behaviour were actually breeding within the boundaries of the Study Area. For instance, an adult bird observed singing in suitable nesting habitat (possible breeding evidence) may be nesting on an adjacent parcel of land, outside of the Study Area.

The remaining three species were identified as observed in breeding season with no breeding evidence (e.g., osprey foraging in distance).

All the species identified are native species to Nova Scotia and were observed within the typical and common habitat associated with the Study Area and surrounding landscape.

3.2.5.2.3 Fall Migration

Twelve point count locations were surveyed on three separate dates during the fall migration period (September 12, September 27 and October 12, 2020; Figure 6, Appendix A). During fall migration, a total of 414 individuals representing 35 species were observed (see Table 3-10 below). No species were observed incidentally. Six unknown birds (four “warbler species” of the order Passeriformes and two from unknown bird groups) were also identified. These individuals could not be identified at the species level and have been removed from the data below in Table 4-15. Nine SOCI were observed during the dedicated fall bird migration point count surveys; blackpoll warbler (*Setophaga striata;* ACCDC S3S4B), boreal chickadee (*Poecile hudsonicus*; ACCDC S3), cape may warbler (*Setophaga tigrina*; ACCDC

S2B), Canada jay (*Perisoreus canadensis*; ACCDC S3), pine siskin (*Spinus pinus*; ACCDC S2S3), red crossbill (*Loxia curvirostra*; ACCDC S3S4), red-breasted nuthatch (*Sitta canadensis*; ACCDC S3), ruby-crowned kinglet (*Regulus calendula*; ACCDC S3S4B), and Swainson's thrush (*Catharus ustulatus*; ACCDC S3S4B) (Figure 10, Appendix A). All avian priority species are discussed in Section 3.4.6.

Table 3-10: Fall Migration Surveys: Species and Abundance of Birds

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	#	Points Observed	Bird Group
Blackpoll Warbler	***Setophaga striata***	-	-	-	**S3S4B**	**13**	**2, 4, 6, 7, 8, 10, 11, 12**	**6**
Boreal Chickadee	***Poecile hudsonicus***	-	-	-	**S3**	**1**	**11**	**6**
Cape May Warbler	***Setophaga tigrina***	-	-	-	**S2B**	**1**	**9**	**6**
Canada Jay	***Perisoreus canadensis***	-	-	-	**S3**	**1**	**5**	**6**
Pine Siskin	***Spinus pinus***	-	-	-	**S2S3**	**1**	**7**	**6**
Red Crossbill	***Loxia curvirostra***	-	-	-	**S3S4**	**1**	**4**	**6**
Red-breasted Nuthatch	***Sitta canadensis***	-	-	-	**S3**	**7**	**4, 6, 8, 11, 12**	**6**
Ruby-crowned Kinglet	***Regulus calendula***	-	-	-	**S3S4B**	**1**	**11**	**6**
Swainson's Thrush	***Catharus ustulatus***	-	-	-	**S3S4B**	**1**	**2**	**6**
American Crow	*Corvus brachyrhynchos*	-	-	-	S5	5	2, 3, 4, 8, 9	6
American Goldfinch	*Spinus tristis*	-	-	-	S5	22	3, 4, 5, 8, 9, 12	6
American Robin	*Turdus migratorius*	-	-	-	S5B,S3N	19	1, 2, 3, 4, 7, 8, 9, 11, 12	6
Black-and-White Warbler	*Mniotilta varia*	-	-	-	S5	1	7	6
Black-capped Chickadee	*Poecile atricapillus*	-	-	-	S5	49	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,	6

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	#	Points Observed	Bird Group
							12	
Blue-headed Vireo	*Vireo solitarius*	-	-	-	S5B	1	12	6
Blue Jay	*Cyanocitta cristata*	-	-	-	S5	15	1, 2, 3, 4, 5, 6, 8, 9, 11, 12	6
Brown Creeper	*Certhia americana*	-	-	-	S5	1	12	6
Canada Goose	*Branta canadensis*	-	-	-	S4N	1	7	1
Cedar Waxwing	*Bombycilla cedrorum*	-	-	-	S5B	6	12	6
Common Grackle	*Quiscalus quiscula*	-	-	-	S5B	125	3	6
Common Loon	*Gavia immer*	-	-	-	S4B,S4N	2	6, 11	3
Common Raven	*Corvus corax*	-	-	-	S5	12	1, 4, 6, 7, 8, 9, 11, 12	6
Common Yellowthroat	*Geothlypis trichas*	-	-	-	S5B	16	4, 6, 7, 8, 11	6
Dark-eyed Junco	*Junco hyemalis*	-	-	-	S4S5	11	3, 5, 7, 9, 12	6
Downy Woodpecker	*Dryobates pubescens*	-	-	-	S5	1	12	7
Golden-crowned Kinglet	*Regulus satrapa*	-	-	-	S5	24	3, 5, 7, 8, 9, 10, 12	6
Hermit Thrush	*Catharus guttatus*	-	-	-	S5B	4	9, 11, 12	6
Northern Flicker	*Colaptes auratus*	-	-	-	S5B	6	5, 7, 11, 12	7
Palm Warbler	*Setophaga palmarum*	-	-	-	S5B	13	2, 4, 6, 7, 8, 11, 12	6
Pileated Woodpecker	*Dryocopus pileatus*	-	-	-	S5	1	12	7
Purple Finch	*Haemorhous purpureus*	-	-	-	S4S5B,S3S4N	8	6, 8, 9, 11, 12	6
Red-tailed	*Buteo*	-	-	-	S5	2	6, 12	4

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	#	Points Observed	Bird Group
Hawk	*jamaicensis*							
Swamp Sparrow	*Melospiza georgiana*	-	-	-	S5B	1	6	6
White-throated Sparrow	*Zonotrichia albicollis*	-	-	-	S5B	8	3, 7, 11	6
Yellow-rumped Warbler	*Setophaga coronata*	-	-	-	S5B	33	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	6
Total Species: 35				**Total # Individuals: 414**				

Notes: Unknown birds and incidental observations are not included (those observed outside of point count locations). Bird group is coded as: 1 = waterfowl; 2 = shorebirds; 3 = other waterbirds (i.e., that are not waterfowl or shorebirds); 4 = diurnal raptors; 5 = nocturnal raptors; 6 = passerines (excluding dippers) and 7 = other landbirds. Bolded species are priority species. Underlined species are SAR. E = Endangered, T = Threatened, V = Vulnerable, SC = Special Concern. ACCDC rankings retrieved from: http://accdc.com/webranks/NSall.htm (July 2021).

The majority of species observed during dedicated fall bird migration surveys were of the order Passeriformes (82.9%), which was to be expected based on forest habitat. This group also consisted of the highest percent of individual birds observed (96.9%). The second most abundant group of species was other landbirds (8.6%). The next most abundant groups were waterfowl (2.9%), other waterbirds (2.9%) and diurnal raptors (2.9%). The most common species observed during fall migration were common grackle (*Quiscalus quiscula*; n=125) black-capped chickadee (*Poecile atricapillus*; n=49), yellow-rumped warbler (*Setophaga coronate;* n=33) and golden-crowned kinglet (*Regulus satrapa;* n=24). Two instances of large flocks of common grackles were recorded during two separate surveys (September 12 and September 27, 2021), both at PC3. The flock on September 12th consisted of 25 individuals and the flock on September 27th consisted of approximately 100 individuals. There were also smaller groups (10 individuals) of common yellowthroats (*Geothlypis trichas*) and American goldfinches (*Spinus tristis*) recorded on the September 12th.

3.2.5.2.4 Common Nighthawk Surveys

Common nighthawk surveys took place at four CONI PC locations on June 24 and July 7, 2021 (Figure 6, Appendix A). No common nighthawks were observed during either survey.

3.2.5.2.5 Nocturnal Owl Survey

Three surveys were conducted on April 15, 28 and May 4, 2021, at four point count locations (Figure 6, Appendix A). A total of 12 individuals representing two species, great horned owl (*Bubo virginianus*) and northern saw-whet owl (*Aegolius acadicus*), were observed (Table 3-11). Neither of the two species identified are considered priority species.

Table 3-11: Nocturnal Owl Surveys: Species and Abundance of Birds

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	#	Location	Bird Group
Great Horned Owl	*Bubo virginianus*	-	-	-	S4	2	Owl 1, 2	5
Northern Saw-whet Owl	*Aegolius acadicus*	-	-	-	S4B	10	Owl 1, 3, 4	5
Total Species: 2				**Total # Individuals: 12**				

Northern saw-whet owl were the most common owl species observed (n=10) followed by great horned owl (n=2).

3.2.5.2.6 Winter Survey

Winter surveys were completed to target mainland moose, however, bird observations were also recorded. The surveys included two with snow cover (Winter 1 and 2) and two PGI surveys (PGI 1 and 2) in the spring. Across all four winter surveys a total of 54 observations of 21 species were recorded. One SOCI, Canada jay, was observed during winter surveys (Figure 10, Appendix A). A second SOCI, boreal chickadee, was incidentally identified (i.e., not identified on a transect) and is not included in the below table. American robin (S5B, S3N) was identified during the PGI 2 survey (May 6 and 11, 2021), therefore, based on the timing of the observation is not considered a SOCI. Twenty non-priority avian species were observed during winter surveys (Table 3-12).

Three unknown species (grouse sp., sparrow sp., and woodpecker sp.) were also documented during winter surveys but are not presented in the following table.

Table 3-12: Winter Survey: Species and Abundance of Birds

Common Name	Scientific Name	SAR	COSEWIC	NSESA	SRank	#	Transects Observed	Survey Type	Bird Group
Canada Jay	***Perisoreus canadensis***	-	-	-	**S3**	**1**	**T13**	**PGI 1**	**6**
American Crow	*Corvus brachyrhynchos*	-	-	-	S5	5	T1, T5, T11, T15, T17	Winter 2, PGI 1 and PGI 2	6
American Robin	*Turdus migratorius*	-	-	-	S5B, S3N	1	T27	PGI 2	6
Black-and-White Warbler	*Mniotilta varia*	-	-	-	S5B	1	23	PGI 2	6
Black-capped Chickadee	*Poecile atricapilla*	-	-	-	S5	6	T6, T7, T13, T18, T19, T20	PGI 1 and PGI 2	6
Black-throated	*Setophaga virens*	-	-	-	S5B	1	T17	PGI 2	6

Common Name	Scientific Name	SAR	COSEWIC	NSESA	SRank	#	Transects Observed	Survey Type	Bird Group
Green Warbler									
Blue Jay	*Cyanocitta cristata*	-	-	-	S5	3	T7, T22, T28	PGI 1 and PGI 2	6
Common Raven	*Corvus corax*	-	-	-	S5	2	T8, T14	Winter 1 and PGI 1	6
Common Yellowthroat	*Geothlypis trichas*	-	-	-	S5B	2	T20, T25	PGI 2	6
Dark-eyed Junco	*Junco hyemalis*	-	-	-	S4S5	3	T2, T12, T23	PGI 1 and PGI 2	6
Downy Woodpecker	*Dryobates pubescens*	-	-	-	S5	3	T16, T20, T26	PGI 2	7
Great Horned Owl	*Bubo virginianus*	-	-	-	S4	1	T27	PGI 2	5
Golden-crowned Kinglet	*Regulus satrapa*	-	-	-	S5	2	T6, T7	Winter 1	6
Mourning Dove	*Zenaida macroura*	-	-	-	S5	3	T17, 20, 27	PGI 2	7
Northern Flicker	*Colaptes auratus*	-	-	-	S5B	2	T15, T17	PGI 2	7
Ruffed Grouse	*Bonasa umbellus*	-	-	-	S5	1	T7	Winter 1	7
White-throated Sparrow	*Zonotrichia albicollis*	-	-	-	S5B	6	T16, T17, T20, T23, T26, T27	PGI 2	6
White-breasted Nuthatch	*Sitta carolinensis*	-	-	-	S4	1	T28	PGI 2	6
Winter Wren	*Troglodytes troglodytes*	-	-	-	S5B	5	T15, T17, T20, T21, T26	PGI 2	6
Yellow-rumped Warbler	*Dendroica coronate*	-	-	-	S5B	3	T17, T20, T25	PGI 2	6
Yellow Warbler	*Setophaga petechia*	-	-	-	S5B	2	T17, T23	PGI 2	6
Total Species: 21				**Total # Individuals: 54**					

Notes: Unknown birds and incidental observations are not included (those observed outside of point count locations). Bird group is coded as: 1 = waterfowl; 2 = shorebirds; 3 = other waterbirds (i.e., that are not waterfowl or shorebirds); 4 = diurnal raptors; 5 = nocturnal raptors; 6 = passerines (excluding dippers) and 7 = other landbirds. Bolded species are priority species. Underlined species are SAR. E = Endangered, T = Threatened, V = Vulnerable, SC = Special Concern. ACCDC rankings retrieved from: http://accdc.com/webranks/NSall.htm (July 2021).

The majority of species observed during winter surveys were of the order Passeriformes (76.2%). This group also consisted of the highest percent of individual birds observed (81.5%). The next most abundant groups of birds were other landbirds (19.0%) followed by nocturnal raptors (4.8%). The most common species observed during winter surveys were black capped chickadee (n=6), white throated sparrow (n=6), American crow (*Corvus brachyrhynchos*; n=5), and winter wren (*Troglodytes troglodytes*; n=5).

3.2.5.2.7 Incidentals

Incidental observations include those made during dedicated bird surveys (i.e., observation outside of point count time or survey location) and those made during non-bird related surveys (e.g., wetland delineation). Incidental observations were recorded for novel species (i.e., those not yet recorded in standardized point counts) and priority species. Six individuals representing five species were identified incidentally (Table 3-13). Two of the five species are considered SOCI, Swainson's thrush, and boreal chickadee.

Incidental observations of avifauna were recorded during breeding bird surveys, winter surveys, owl surveys, and during wetland delineation.

Table 3-13: Avian Incidentals Recorded During Other Surveys

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	#	Survey Type	Location	Bird Group
Swainson's Thrush	***Catharus ustulatus***	-	-	-	**S3S4B**	**1**	**BBS**	-	**6**
Boreal chickadee	***Poecile hudsonicus***	-	-	-	**S3**	**1**	**Winter 1**	-	**6**
Red-tailed Hawk	*Buteo jamaicensis*	-	-	-	S5	1	BBS	-	4
Red-eyed Vireo	*Vireo olivaceus*	-	-	-	S5B	2	WL	WL 3	6
Red-winged Blackbird	*Agelaius phoeniceus*	-	-	-	S4B	1	Owl	Owl	6
Total Species: 5				**Total # Individuals: 6**					

Notes: Unknown birds and incidental observations are not included (those observed outside of point count locations). Bird group is coded as: 1 = waterfowl; 2 = shorebirds; 3 = other waterbirds (i.e., that are not waterfowl or shorebirds); 4 = diurnal raptors; 5 = nocturnal raptors; 6 = passerines (excluding dippers) and 7 = other landbirds. Bolded species are priority species. Underlined species are SAR. E = Endangered, T = Threatened, V = Vulnerable, SC = Special Concern. ACCDC rankings retrieved from: http://accdc.com/webranks/NSall.htm (July 2021).

All incidentals identified were of the order Passeriformes except for the red-tailed hawk. The most common species observed incidentally were hermit thrush (n=15), white throated sparrow (n=5), and dark-eyed junco (n=5).

3.2.5.3 *Summary of Bird Surveys*

Baseline point count surveys for birds (spring migration, breeding season, fall migration, common nighthawk surveys, and nocturnal owl surveys) were completed from September 2020 to July 2021, by

MEL biologists. A total of 1,122 minutes (18.7 hours) of surveys were completed over three seasons including time spent on common nighthawk surveys and nocturnal owl surveys. These surveys resulted in the observation of 1,041 individuals, representing 62 species. An additional 54 individuals representing 21 species were identified during winter surveys (winter surveys 1 and 2, as well as Moose PGI surveys 1 and 2).

Six individuals representing five species were recorded incidentally. Incidental observations include those individuals observed outside of dedicated point count survey locations or survey times (i.e., when walking between point count locations) or during non-bird related surveys. Novel species (i.e., those not yet recorded in standardized point counts) and priority species were recorded, if observed incidentally.

Across all survey seasons a total of fourteen priority species were observed. The species and the survey where they were observed are as follows;

- Bay-breasted warbler (*Dendroica castanea*; breeding);
- Blackpoll warbler (*Setophaga striata*; fall);
- Boreal chickadee (*Poecile hudsonica*; fall, vegetation/lichen);
- Cape May warbler *(Setophaga tigrina*; fall);
- Canada Jay (*Perisoreus canadensis*; fall, spring, Moose PGI 1);
- Olive-sided flycatcher (*Contopus cooperi*; spring);
- Pine siskin (*Spinus pinus*; fall);
- Red-breasted nuthatch (*Sitta canadensis*; fall, vegetation/lichen);
- Red crossbill (*Loxia curvirostra*; fall);
- Ruby-crowned kinglet (*Regulus calendula*; fall);
- Swainson's thrush (*Catharus ustulatus*; fall);
- Turkey vulture (*Cathartes aura*; spring);
- Wood thrush (*Hylocichla mustelina*; spring); and,
- Yellow-bellied flycatcher (*Empidonax flaviventris*; breeding).

These priority species are discussed in Section 3.4.6. Avian survey locations can be found on Figure 6 and 10 (Appendix A). Note: American robin (S5B, S3N) and purple finch (S4S5B, S3S4N) were identified in surveys during the breeding season, therefore, are not considered SOCI based on their SRank (Breeding Status Qualifier) during the season in which they were observed.

All species observed are native species in this region; they are typical species commonly found within the Study Area habitat and its surroundings. Except for the common grackle flocks observed, no obvious concentrations of one particular bird group were identified, nor was an identifiable migratory pathway noted.

3.3 Aquatic Environment

One watercourse, one waterbody, and four wetlands were identified within the Aquatic Study Area during field surveys (Figure 9, Appendix A). None of the wetlands or the watercourse are located within the

QEA, but the waterbody is partially located within it (Figure 9, Appendix A). The following sections provide details about the wetlands and surface water features identified, including the results from the wetland functional analysis (Appendix I) and fish and fish habitat evaluations.

The Aquatic Study Area lies within two unnamed tertiary watersheds, 1EH-3-P and 1EH-3-Q, both of which are contained within the Indian River Secondary Watershed (1EH-3) (Figure 2, Appendix A). The Indian River Secondary Watershed, which drains south to Indian River and empties into Head Harbour (Atlantic Ocean), is located within the East/Indian River Primary Watershed (1EH). The sizes of the tertiary, secondary, and primary watersheds are 734 ha (IEH-3-Q) and 1,721 ha (IEH-3-P), 18,530 ha, and 77,763 ha, respectively.

3.3.1 Wetlands

The following sections outline the wetland findings from the desktop review and field survey.

3.3.1.1 *Desktop Review*

A review of the NSECC Wetlands Inventory Database identified three mapped wetlands within the Aquatic Study Area (Figure 7, Appendix A). One mapped wetland straddles the northern Aquatic Study Area boundary. This wetland is 1.06 ha and the wetland type is listed as unknown. The second wetland, located within the western extent of the Aquatic Study Area, is 0.9 ha and is also listed as an unknown wetland type. The third wetland (0.74 ha) is located along the northwestern extension of the Aquatic Study Area along a mapped watercourse.

The Wet Areas Database identifies areas within the Aquatic Study Area that have moisture ranges varying from 0 to 0.5 m. At the northeastern extent of the Aquatic Study Area a moisture range of 0.11 to 0.5 m from the surface is present. The area immediately surrounding a mapped water body (Section 2.7.1) in the south of the Study Area includes two moisture ranges: 0.11 to 0.5 m and 0 to .01 m. An additional area with moisture closer to the surface (i.e., 0 – 0.10 m) commences along the western lobe of the Aquatic Study Area and runs south to north.

No predicted WSS are located within or immediately adjacent to the Aquatic Study Area (Figure 2, Appendix A). The closest predicted WSS (ID# 16191 and 16216), are located 1.5 km and 1.8 km northwest of the Aquatic Study Area on Island Lake. A third WSS (ID# 10799), a salt marsh north of Todds Island, is located 2.5 km south of the Aquatic Study Area.

3.3.1.2 *Field Surveys*

During field surveys completed across the Aquatic Study Area, four wetlands were identified (Figure 9, Appendix A). Wetland habitat was confirmed at the locations of the two mapped wetlands, although the boundaries were adjusted in the field. Refer to Appendix I for WESP results, and Appendix J for the wetland and watercourse photolog.

None of the four wetlands identified within the Aquatic Study Area fall within the QEA.

3.3.1.2.1 Wetland Characteristics

Three wetlands (WL) exist as swamps (WL1, 2 and 4) and the remaining wetland (WL3) exists as a fen. Of the four wetlands identified, three exist as isolated features (WL1, 2, and 3) and one exists as a headwater wetland (i.e., watercourse outflow; WL4).

Three wetlands are located in a terrene landscape position and the remaining wetland was identified as terrene headwater. The wetland in the terrene headwater position, WL4, is a watercourse outflow and the wetlands in a terrene landscape position are isolated. Refer to Section 3.3.3 for a discussion of fish habitat.

Saturation at surface was observed in all the wetlands within the Aquatic Study Area. Other hydrological indicators observed in the wetlands within the Study Area include: surface water, high water table, stunted or stressed plants, geomorphic position, micro topographical relief.

Table 3-14 provides the characteristics for delineated wetlands.

Table 3-14: Wetland Characteristics

Wetland	Wetland Type	Wetland Size (ha)[1]	Water Flow Path	Landform	Landscape Position	Hydric Soil Indicator	Hydrological Conditions	Dominant Vegetation
1	Softwood Treed Swamp	0.58	Isolated	Basin	Terrene	Histosol	Highwater table, saturation, stunted or stressed plants	**Herbs**: *Kalmia angustifolia, Osmundastrum cinnamomeum, Rhododendron groenlandicum, Vaccinium myrtilloides, Vaccinium oxycoccos* **Shrubs**: *Picea mariana* **Trees**: *Picea mariana, Acer rubrum*
2	Mixedwood Treed Swamp	0.03	Isolated	Basin	Terrene	Histosol	Saturation, stunted or stressed plants, geomorphic position	**Herbs**: *Rhododendron groenlandicum, Kalmia angustifolia, Osmundastrum cinnamomeum, Cornus canadensis, Carex trisperma* **Shrubs**: *Acer rubrum, Viburnum nudum* **Trees**: *Acer rubrum, Picea mariana*
3	Fen	0.25	Isolated	Flat	Terrene	Histosol	High water table, saturation, stunted or stressed plants, geomorphic position, micro topographical relief	**Herbs**: *Carex trisperma, Kalmia angustifolia, Osmundastrum cinnamomeum, Drosera rotundifolia, Eriophorum vaginatum* **Shrubs**: *Picea mariana, Acer rubrum* **Trees**: *Acer rubrum, Abies balsamea*
4	Mixedwood Treed Swamp	3.6	Outflow via WC	Basin	Headwater Terrene	Histosol	Surface water (2 cm, 5% of wetland), high water table, saturation, stunted or stressed plants, geomorphic position, micro topographical relief	**Herbs**: *Carex trisperma, Osmundastrum cinnamomeum, Rhododendron groenlandicum* **Shrubs**: *Picea mariana* **Trees**: *Picea mariana, Abies balsamea, Acer rubrum*

[1] All field delineated wetlands extend beyond the Study Area or Aquatic Study Area boundaries

3.3.1.2.1.1 *Swamps*

Swamps are wetlands that are characterized by the dominance of tall woody perennial vegetation that often exceeds 30% cover (National Wetlands Working Group, 1997). These wetland types are often forested (dominated by trees with a high canopy cover) and/or have extensive shrub cover and consist of soils which can either be mineral or organic (National Wetlands Working Group, 1997). This wetland type is common within Nova Scotia and can either be stand-alone or found within wetland complexes (often along the outer edges). Within the Aquatic Study Area, three of the wetlands encountered were swamps (75%). Two of the swamps (WL2 and 4) are mixedwood treed swamps dominated by both conifer and deciduous species in the tree layer and one swamp (WL1) was dominated by softwood trees. Wetland type classifications are guided by The Canadian Wetland Classification System (1997).

The vegetation community varied between swamps within the Study Area, but in general the dominant tree species in the overstory layer within the wetlands are balsam fir (*Abies balsamea*), red maple (*Acer rubrum*), and black spruce (*Picea mariana*). The dominant plants in the shrub stratum include the aforementioned tree species as well as wild raisin (*Viburnum nudum*). A variety of herbaceous species are found, depending on local hydrology, disturbance regime, and nutrient regime. Three-seeded sedge (*Carex trisperma*), cinnamon fern (*Osmundastrum cinnamomeum*), Labrador tea (*Rhododendron groenlandicum*), and lambkill (*Kalmia angustifolia*).

Soils within all swamps observed in the Study Area were histosols. Depths of histosol soils ranged from exceeded 50 cm, with no restrictive layer met.

3.3.1.2.1.2 *Fen*

One fen (WL3) exists within the Aquatic Study Area. Fens are characterized as peat landforms with fluctuating water levels via groundwater and/or surface water movement (National Wetlands Working Group, 1997). WL3 is present within a flat landform. Hydric soil indicators within WL3 were histosol to a depth of over 50 cm. Primary hydrology indicators within WL3 included a high water table and saturation at the surface.

WL3 had a sparse tree layer consisting of balsam fir and red maple. In general, the herbaceous layer was dominated by three-seeded sedge, cinnamon fern, lambkill, hare's tail cottongrass (*Eriophorum vaginatum*), and round-leaved sundew *(Drosera rotundifolia).*

3.3.1.2.2 Wetland Functional Analysis

The WESP-AC functional evaluation technique calculates the overall scores for seven wetland functional groups including a functional and benefit rating for five of the groups (Hydrologic, Water Purification, Aquatic Support, Aquatic Habitat and Terrestrial Habitat) and the benefit rating for the Wetland Condition and Wetland Risk groups. The WESP-AC calculator used the responses from desktop, field and stressor forms (included in the WESP-AC calculator) to determine whether the functions and benefits for each group are lower, moderate, or higher in comparison to baseline wetland scores in Nova Scotia.

To complete an effective, quantitative comparison of WESP-AC results for all wetlands within the Study Area, scores were weighted numerically as follows:

- LOWER: 1 point
- MODERATE: 2 points
- HIGHER: 3 Points

Table 1 (Appendix I) provides the overall numerically weighted scores for the evaluation of four wetlands completed across the Aquatic Study Area (Tables 3-6; Appendix I provides scores for WL1-4). It should be noted that function scores are not provided for the Wetland Condition and Wetland Risk Functional groups, as the WESP-AC calculator only considers these as benefits. Of the four wetlands evaluated, the average accumulated functional score per wetland was 2 (moderate). Based on the same analysis, the average accumulated benefit score per wetland was 2 (moderate). WESP-AC guidance states that the most valuable wetlands are those that possess both higher functions and benefits. Benefits relate to the perceived worth of the wetland function to societal needs (Adamus et al. 2016). Three wetlands scored higher for function and benefit: WL1 and WL2 for Water Storage and Delay, and WL4 for Songbird, Raptor and Mammal Habitat (see Table 1; Appendix I).

3.3.1.2.3 WESP-AC Grouped Wetland Function Results

Analysis was completed on the individual wetland functional groups being provided by the wetlands present within the Aquatic Study Area. The following sections provide results of this analysis on a per wetland functional group basis (see Table 2; Appendix I).

Hydrologic Group

The hydrological wetland service group evaluates the effectiveness of a wetland to store or delay the downslope movement of surface water. Wetlands that have the highest functions within this group include those that do not have surface water outlets, and instead are isolated from flowing surface water. The model does not account for wetland size, and in turn, does not account for larger wetlands having the ability to store more water than smaller wetlands.

Table 3-15. Hydrologic Function Group WESP-AC Results

Function	Benefit		
	Lower	Moderate	Higher
Lower	-	-	WL4
Moderate	-	-	WL3
Higher	-	-	WL1, WL2
Note: All wetlands are located outside of the QEA			

WL4 scored lower in hydrologic group function and higher in benefit, due to the connection with an outflowing watercourse (WC1). WL3 scored moderate in function and higher in benefit due to the isolation from flowing water and as a result of the stressor on the wetland (aberrant timing of water

inputs). The highest scoring wetlands (WL1 and WL2) are isolated and able to store water rather than allow it to drain off the landscape. High benefit scores indicate that these wetlands perform at a higher rate than others on the landscape when it comes to human related values.

Water Quality Group

This wetland functional group is compiled from four different functions: sediment retention and stabilization; phosphorus retention; nitrate removal; and carbon sequestration. The main function of this group is to evaluate each wetland's potential to intercept, retain, and filter sediments, particulates, and organic matter. Like the hydrologic group, the wetlands that have the highest functions in this regard include those that do not have a surface water outlet, and instead are isolated from flowing surface water.

Table 3-16. Water Quality Group WESP-AC Results

Function	Benefit		
	Lower	Moderate	Higher
Lower	-	-	-
Moderate	-	WL4	-
Higher	WL1, WL2, WL3	-	-
Note: All wetlands are located outside of the QEA			

Three of wetlands (WL1, WL2, and WL3) scored High in function for the Water Quality Group, demonstrating they are effective at intercepting, retaining, and filtering suspended sediments, particulates, and organic matter due to their lack of outlet and low topographic gradient. WL4 scored Moderate in function as a result of the outflow channel (WC1).

All of the wetlands scored lower-moderate in benefit, largely because of the isolation of the Project from developed areas and the small size of the wetlands compared to their catchment areas, which limits the potential benefits of the water purification function.

Aquatic Support Group

The aquatic support group comprises four individual functions: stream flow support; aquatic invertebrate habitat; organic nutrient export; and water cooling. The main function of this group is to determine the wetlands' ability to support ecological stream functions that promote habitat health. Therefore, wetlands lying adjacent to or containing flowing water score higher than those that do not (i.e., isolated wetlands). In addition, headwater wetlands are crucial for supporting stream flow during the dry season by contributing to water flow via groundwater input and storage capacity.

Table 3-17 Aquatic Support Group WESP-AC Results

Function	Benefit		
	Lower	Moderate	Higher
Lower	-	-	-
Moderate	WL1, WL3	-	-
Higher	WL2	WL4	-

Note: All wetlands are located outside of the QEA

Three of the wetlands either scored higher in function and lower in benefit (WL2) or moderate in function and lower in benefit (WL1 and WL3) within this group. These scores are due to the lack of wetland connectivity to watercourses and their ability to support habitat for aquatic invertebrates and ability to export organic nutrients. WL2 has a higher function than WL1 and WL3 because of its deeper organic layer which has more carbon available for export. WL4 scored higher for function and moderate for benefit because of its connectivity to a watercourse (WC1).

Aquatic Habitat Group

The aquatic habitat group comprises of five different functions: anadromous fish habitat; resident fish habitat; amphibian and turtle habitat; waterbird feeding habitat; and waterbird nesting habitat. Wetlands that have the highest functions within this group include those that are adjacent to or contain water.

Table 3-18 Aquatic Habitat Group

Function	Benefit		
	Lower	Moderate	Higher
Lower	WL2	WL1	WL3
Moderate	-	-	WL4
Higher	-	-	-
Note: All wetlands are located outside of the QEA			

Three of the wetlands (WL1, WL2, WL3) scored lower for function, as these wetlands do not have suitable conditions to support fish, herpetofauna, or waterbirds. WL4 has a moderate function due to its headwater position with WC1 and higher amounts of standing water that may provide habitat for fish, herpertofauna, or waterbirds. The higher benefit for WL3 and WL4 identifies that these wetlands perform at a higher rate to others on the landscape beyond the Study Area and throughout the province. This is due to these wetlands having greater levels of surface water.

Terrestrial Habitat Group

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

Table 3-19 Terrestrial Habitat Group WESP-AC Results

Function	Benefit		
	Lower	Moderate	Higher
Lower	-	-	-
Moderate	-	WL1, WL2,	-
Higher	-	WL3	WL4
Note: All wetlands are located outside of the QEA			

All wetlands scored at least moderate-moderate for function and benefit in the Terrestrial Habitat Group. In general, wetlands within the Aquatic Study Area provide ideal habitat, which includes downed wood, prevalent ground cover, varied microtopography, tree and shrub cover in and around the wetlands, and naturally vegetated buffer zones. The wetlands have a variety of woody heights and diverse forms, which allows for nesting habitat, perches, and feeding grounds. In addition, the wetlands provide a diverse range of herbaceous vegetation. As such, wetlands within the Aquatic Study Area generally provide habitat for songbirds, mammals, pollinators, and potentially rare plants. WL4 scored higher for the benefit score, indicating that this wetland performs at a higher rate to others in the landscape.

Wetland Condition

Wetland Condition refers to the integrity or health of a wetland as defined by its vegetative composition and richness of native species. Scores are derived from the similarity between the wetland being evaluated and reference wetlands of the same type and landscape setting (Adamus, 1996).

Wetland condition within the Aquatic Study Area included Moderate (WL1, WL2 and WL4) and Higher (WL3), indicating that these wetlands carry a relatively good range of vegetative community health levels. High scoring wetlands may have more microhabitats and species diversity, while low scoring wetlands may be more susceptible to changes in their surroundings.

Wetland Risk

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

All wetlands analyzed had moderate-higher risk scores for Wetland Risk benefit, due to their small size, lack of outlets (WL1, 2, and 3), stressors (WL3), and proximity to clearings and forestry roads.

Functional Assessment Summary

WESP-AC is a quantitative decision-making tool, but its results must be used qualitatively to form conclusions around wetland functions. As stated in Section 3.3.1.2.2, the highest functioning wetlands are those that have both higher function and higher benefit scores. It is also necessary to evaluate the wetlands that scored higher (function and benefit) across function groups. While higher benefit and function scores were calculated for various wetlands, no wetlands scored higher in all function groups. Three of the wetlands scored higher in both function and benefit for one group score: WL1 and WL2 in hydrologic group, and WL4 in terrestrial habitat group. WL1 and WL2 are hydrologically isolated and

have deep peat soils with high ability to store water. WL4 scored higher for terrestrial habitat group, likely due to the amount of downed wood present, wide range of woody heights and form diversity and diversity of shrub species. This results in a range of habitat types present in the wetland. Variable scores across the Aquatic Study Area for the majority of wetlands indicates that on average, these wetlands are very similar to those outside of the Aquatic Study Area.

Generally, the wetlands within the Aquatic Study Area have similar function and benefit scores within WESP-AC groups compared to the other wetlands across the Nova Scotia landscape.

3.3.1.2.4 WESP-AC Interpretation Tool

The results generated from the WESP-AC Interpretation tool are presented in Table 3-20.

Table 3-20 WESP-AC Interpretation Tool Results

Function-Benefit Product (FBP)	WL1		WL2		WL3		WL4	
	FBP Score	FBP Score Category	FBP Score	FBP Score Category	FBP Score	FBP Score Category	FBP Score	FBP Score Category
Support Supergroup – Hydrologic	76.28	High	74.30	High	46.09	Moderate	14.08	Low
Support Supergroup – Water Quality Support	17.91	Low	16.48	Low	26.58	Low	13.78	Low
Support Supergroup – Aquatic Support	2.17	Low	3.02	Low	5.32	Low	49.22	Low
Habitat Supergroup – Aquatic Habitat	0.85	Low	2.71	Low	13.06	Low	42.92	Low
Habitat Supergroup – Transition Habitat	58.47	Low	37.98	Low	51.28	Low	74.77	Low
Functional WSS Determination								
Habitat Rule Satisfied?	No		No		No		No	
Support Rule Satisfied?	No		No		No		No	

Function-Benefit Product (FBP)	WL1		WL2		WL3		WL4	
	FBP Score	FBP Score Category	FBP Score	FBP Score Category	FBP Score	FBP Score Category	FBP Score	FBP Score Category
Habitat/Support Hybrid Rule Satisfied?	No		No		No		No	
Conclusion	Site is not a WSS		Site is not a WSS		Site is not a WSS		Site is not a WSS	

WL1 and 2 received high Function – Benefit Product (FBP) scores for the hydraulic support supergroup. WL3 received a moderate FBP score for the same supergroup. All other scores for the remaining supergroups were low for all wetlands.

According to the functional WSS determination, a trigger for WSS was not met (Table 3-20).

3.3.1.2.5 Wetlands of Special Significance

Despite the WESP-AC Interpretation Tool indicating no WSS are present on site, one WSS was identified within the Aquatic Study Area. WL1 is a WSS due to the presence blue felt lichen (identified outside of the Aquatic Study Area), an at-risk species as designated under the federal *Species at Risk Act* and the *Nova Scotia Endangered Species Act*. One blue felt lichen thallus was observed 8 m north of the Aquatic Study Area along the edge of WL1. The thallus (15 cm^2) was fertile and was located approximately 60 cm above the ground on a red maple. WL1 will not be directly impacted by the proposed quarry (i.e., it is located outside of the QEA) and a 100 m setback will be maintained.

3.3.1.2.6 Groundwater Interactions

The determination of whether a wetland is functioning as a groundwater recharge or a groundwater discharge feature is not often possible by visual inspection alone. A wetland is a groundwater discharge area if groundwater moves upwards from underlying soils towards the land surface, whereas recharge wetlands exhibit groundwater that flows vertically downward from the wetland to underlying mineral soils. Groundwater discharge maintains high water tables and wetland habitat, whereas recharge sites replenish aquifers (Siegela, 1988).

It is likely that wetlands within the Aquatic Study Area exist as a combination of recharge and discharge features, although as presented in Table 3-14, WL1, 2, and 3 are isolated and lack restrictive soils that inhibit the downward movement of water. As such, these wetlands are expected to be serving as groundwater recharge wetlands. Conversely, WL4 has connectivity to an outflow watercourse, appears to have wetter hydrological surface characteristics, and is located in lower lying land, which makes it more likely to be functioning as a groundwater discharge wetland.

3.3.2 Surface Water

3.3.2.1 *Desktop Review*

A review of aerial imagery and NSTDB mapping identified one waterbody within the Aquatic Study Area. This waterbody is situated at the southern extent of the Aquatic Study Area, along the linear corridor, and immediately north of the access road that enters the existing quarry. One mapped watercourse was identified within the Aquatic Study Area, as indicated on Figure 7 (Appendix A). This watercourse is an unnamed first order stream that drains north into Island Lake. The mapped watercourse is not within the QEA; however, the mapped waterbody is partially encroached upon by the QEA.

Outside of the Aquatic Study Area, a second unnamed watercourse, which originates 430 m west of the Aquatic Study Area, drains northwest into the southern extent of Island Lake. One named watercourse, Indian River, is located ~1 km east of the Aquatic Study Area. Indian River flows north to south (parallel the Aquatic Study Area boundary) from Sandy Lake to the Atlantic Ocean, where it empties into Head Harbour.

3.3.2.2 *Field Results*

One field identified watercourse (WC1) was delineated and characterized within the Aquatic Study Area. This watercourse flows northwest within WL4 and ties into the only mapped watercourse within the Aquatic Study Area (Figure 9, Appendix A). The mapped waterbody was also confirmed in the field (Pond1). WC1 and Pond1 were surveyed for water quality (3.3.2.2.1). WC1 was surveyed for fish and fish habitat (Section 3.3.3). The physical characteristics of the water features within the Aquatic Study Area are summarized in Table 3-20. Refer to Appendix J for the wetland and watercourse photolog.

Table 3-21: Physical Characteristics of Watercourses within the Aquatic Study Area

WC ID	Reach	Reference UTMs (NAD 83)		Reach Length (m)	Stream Order	Flow Regime[1]	V[2]	Gradient	Bankfull Width (cm)	Depth Range (cm)	Bank Height (cm)	Substrate (%)	Cover (%)	Habitat (%)	Potential Limitations for Fish Movement and Access
		E	N												
1	1	Upstream		190	1	Intermittent	L	0%	10 - 50	5 - 20	0	Muck (100)	Submergent vegetation (70) Large woody debris (10)	Flat (100)	Subterranean sections downstream; 10 m, 35m, and 115 m in length.
		426755	4951445												
		Downstream													
		426644	4951587												
	2	Upstream		170	1	Perennial	L	0%	10 - 100	50 - 80	5	Muck (80) Boulder (20)	Emergent vegetation (40) Submergent vegetation (40)	Flat (100)	Portions of reach undefined.
		426352	4951855												
		Downstream													
		426266	4952010												

*Characteristics only reflect those within the length of watercourse assessed (watercourses continue outside of the Aquatic Study Area)
[1]Perennial = Year-round streams. Water is supplied from smaller upstream waters or groundwater while runoff from rainfall or other precipitation is supplemental.
Intermittent = Seasonal streams. Flow during certain times of the year, with runoff from rainfall or other precipitation supplementing flow.
Ephemeral = Rain-dependent streams that flow only after precipitation. Runoff from rainfall is the primary source of water.
[2] V=Velocity (L: Low flow rates (<0.15m/s). M: Moderate flow rates (0.15-0.3m/s). H: High flow rates (>0.3m/s))

Table 3-22: Physical Characteristics of the Waterbody within the Aquatic Study Area

Waterbody ID	Reference UTMs (NAD 83)		Waterbody length (m)	Waterbody width (m)	Depth Range (cm)	Substrate	Cover (%)	Potential Limitations for Fish Movement and Access
	E	N				(%)		
Pond1	426927	4951279	15	9	30	Clay (30) Sand (40) Gravel (30)	Non filamentous algae (20) Emergent vegetation (5)	• No downstream connectivity to a fisheries resource • Hung culvert drains into Pond1 • No upstream connectivity to a fisheries resource

3.3.2.2.1 *Water Quality Parameters*

Water quality parameters, as recorded *in-situ* with a calibrated YSI during the surface water sampling program, are presented in Table 3-22. Measurements were taken on September 2, 2021. Refer to Figure 9 (Appendix A) for water quality sample locations.

Table 3-23: In-situ Water Quality Profiles

Location	Watercourse ID		Temp (°C)	pH	DO (mg/L)	Sp. Con (µS/cm)	TDS (mg/L)
WQ1	WC1	Upstream ↓ Downstream	17.2	5.54	3.4	131.6	83.55
WQ2			15.5	4.95	0.7	81.4	53.30
WQ3			15.3	4.78	1.6	74.9	48.10
WQ4			15.3	4.79	4.0	65.3	43.26
WQ5			15.1	4.7	6.8	72.1	47.45
WQ6	Pond1		18.4	6.14	6.4	30.9	19.15

These results are discussed as they relate to fish habitat quality in Section 3.3.3.2.

3.3.3 Fish and Fish Habitat

3.3.3.1 *Desktop Review*

Per Section 3.3.2.1, one mapped watercourse and one mapped waterbody are located within the Aquatic Study Area. The mapped watercourse drains north into Island Lake which drains into east into Rafter Lake, south into Sandy Lake, and eventually south into Indian River, located east of the Aquatic Study Area.

The Nova Scotia freshwater fish species distribution records (NSDFA, 2019) were reviewed and no records were found for waterbodies surrounding the Aquatic Study Area. NSDFA were consulted and confirmed that there were no records of fish data on water features (Island Lake or surrounding area) in proximity to the Aquatic Study Area (August 27, 2021, pers. comm., J. LeBlanc, Manager of Resource Management, NSDFA). Within the secondary watershed records of fish are provided for Five Mile Lake and Uniacke Lake (NSDFA, 2019; note: observations were made between 1986 and 2004). These species identified in these two lakes are as follows:

- American eel (*Anguilla rostrata*; ACCDC S2; COSEWIC Threatened);
- Brook trout (*Salvelinus fontinalis*; ACCDC S3);
- Yellow perch (*Perca flavescens*; ACCDC S5);

- White sucker (*Catostomus commersonii*; ACCDC S5);
- Golden shiner (*Notemigonus crysoleucas*; ACCDC S4);
- Banded killifish (*Fundulus diaphanous*; ACCDC S5);
- Smallmouth bass (*Micropterus dolomieu*; ACCDC SNA); and,
- Nine spine stickleback (*Pungitius pungitius*; ACCDC S5).

Atlantic salmon (*Salmo salar* pop. 1) Inner Bay of Fundy Population (IBOF) and striped bass (*Morone saxatilis* pop. 2) Bay of Fundy Population were identified within the ACCDC report as being found within 9.1 km and 37.3 km of the Study Area, however, the Study Area is located within the Indian River Secondary Watershed (1EH-3; Section 3.3) which drains south into the Atlantic Ocean (not into the Bay of Fundy) and remains outside of the defined range of the IBOF population of Atlantic salmon (DFO, 2019a) and striped bass BOF population (Acadia University, 2019). The Aquatic Study Area is within the range of the Southern Upland Population of Atlantic salmon. This population is listed as Endangered by COSEWIC and ranked as S1 by the ACCDC. The Southern Upland Population of Atlantic salmon is not recorded within the ACCDC report nor do the water features surrounding the Aquatic Study Area support Atlantic salmon (The Salmon Atlas, 2021).

In addition to the IBOF population of Atlantic salmon, the ACCDC report lists brook trout (*Salvelinus fontinalis*), alewife (*Alosa pseudoharengus*), and American eel (*Anguilla rostrata*) as being found within 10 km of the Aquatic Study Area. The DFO aquatic SAR map does not identify any aquatic SAR within Indian Brook or Island Lake (DFO, 2019b).

Details relating to habitat requirements for priority species identified through the desktop review are discussed in Section 3.4.7. Fish habitat characterization provided herein is focused on habitat requirements for native fish species.

3.3.3.2 *Field Results*

Per Section 3.3.2.2, field surveys confirmed the presence of a small waterbody (Pond1) and one watercourse (WC1) within the Aquatic Study Area (Figure 9, Appendix A). WC1 is a first order stream sourced from WL4, a headwater wetland. Pond1, located within the linear corridor in the southern extent of the Aquatic Study Area.

As noted in Section 3.3.2, WC1 drains northwest for approximately 2 km to Island Lake. Island Lake flows into Rafter Lake, Sandy Lake, and eventually into Indian River, which flows north to south, east of the Aquatic Study Area. The flow path of this system circles the Aquatic Study Area (Figure 7, Appendix A).

Physical characteristics of WC1 and Pond1 are described in Table 3-20 and Table 3-21 (Section 3.3.1.2.1). Representative photos of watercourses are provided in Appendix J.

3.3.3.2.1 Fish Surveys

No fish were captured or observed during fishing efforts (electrofishing) completed in August 2021 within the Aquatic Study Area. Electrofishing was completed within two reaches of WC1 (Figure 9, Appendix A). Refer to Table 3-23 for electrofisher settings used during fish capture surveys (note: galvanotaxis was incidentally observed in frogs during electrofishing, indicating that the electrofisher was functioning appropriately).

Table 3-24: Electrofisher Settings

Location	Survey Date	Frequency (Hz)	Voltage (V)	Reach Length (m)	Survey Effort (sec)
WC1 R1	August 27, 2021	80	350	60[1]	341.2
WC1 R2	August 27, 2021	80	350	100	564.2
[1]reach length <100 m due to confinement between two subterranean sections of the watercourse					

3.3.3.2.2 Water Quality

Water quality results are reported and discussed as it relates to the chemical characteristics required for suitable fish habitat. Where applicable, water quality sampling results are measured against the CCME Guidelines for the Protection of Aquatic Life (FWALs). In-situ water quality measurements recorded at water quality sample locations in September 2021 are provided in Table 3-22, Section 3.3.2.3.

3.3.3.2.2.1 *Temperature*

Water temperature affects the metabolic rates and biological activity of aquatic organisms, thus influencing the use of habitat by aquatic biota. There are no CCME guidelines related to temperature and aquatic biota. Temperature preferences of fish vary between species, as well as with size, age, and season.

Trout and salmon are cold-water fish species, meaning they require cold water to live and reproduce. The optimal temperature range for brook trout growth and survival is 11-16 ℃, but can tolerate temperatures up to 20℃ (Raleigh, 1982). The optimum temperature for growth of juvenile salmon is in the range of 16 to 20ºC (Elliott and Elliott, 2010), but parr can thermoregulate up to 27℃ (Corey et al., 2019). American eel have a broader temperature range and can tolerate temperatures from 4 to 25 ºC (Fuller et al., 2019).

Average summer temperatures were not collected as part of baseline surveys completed within the Aquatic Study Area. Water temperatures recorded in early-September 2021, ranged from 15.1 to 17.2℃ in WC1. Water temperature decreased from upstream (17.2℃) to downstream (15.1℃) within WC1. Water temperatures in Pond1 were 18.4℃. Temperatures during the sampling period were suitable for cold-water species like salmon and trout as well as for American eel.

3.3.3.2.2.2 *pH*

The CCME water quality guidelines for the Protection of Aquatic Life establish that a range of pH from 6.5 to 9.0 is suitable within freshwater habitat (1999). Kalff (2002) indicates that the loss of fish populations is gradual and depends on fish species, but decline is evident when pH is <6.5. Kalff (2002) further states that a 10-20% species loss is apparent when pH <5.5. Brook trout tolerate acidic conditions particularly well, compared with other species. They have been known to survive at pH 3.5, though only in unusual circumstances. American eel are also more tolerant of low pH than are many other species, although densities and growth rates may be adversely affected by direct mortalities or declining abundance of prey as productivity declines at low pH (Jessop, 1995).

In September 2021, WC1 had pH measurements ranging from 4.70 to 5.54 (average = 4.95) and Pond1 had a pH that measured 6.14. pH in WC1 decreased from upstream to downstream. All pH measurements recorded were below the CCME water quality guidelines for the Protection of Aquatic Life (1999).

3.3.3.2.2.3 *Dissolved Oxygen*

The atmosphere and photosynthesis by aquatic vegetation are the major sources of DO in water (CCME 1999). However, the amount of oxygen available for aquatic life (i.e., the concentration of oxygen in water) is affected by several independent variables including water temperature, atmospheric and hydrostatic pressure, microbial respiration, and growth of aquatic vegetation; DO can vary daily and seasonally (CCME, 1999). The CCME guidelines for the Protection of Aquatic Life establish a minimum recommended concentration of DO of 9.5 mg/L for early life stages of cold-water biota and 6.5 mg/L for other life stages. For warm-water biota, the CCME guidelines recommend 6.0 mg/L for early life stages, and 5.5 mg/L for all other life stages.

DO levels recorded in September 2021 were extremely low in WC1 and ranged from 0.7 to 6.8 mg/L (average = 3.3 mg/L). The average of these levels is below the CCME guideline for Protection of Aquatic Life for both early and other life stages of both cold-water and warm-water biota. Low levels of DO are likely attributed to minimal instream vegetation, low flow conditions, and lengthy subterranean sections.

3.3.3.2.2.4 *Conductivity and Total Dissolved Solids*

Total Dissolved Solids (TDS) is a measurement of inorganic salts, organic matter and other dissolved materials in water. Conductivity, which is a measure of water's capacity to conduct an electrical current, is correlated to TDS as increases in the mineral and salt content of water will increase its capacity to carry a charge. Toxicity in fish can be achieved through large increases in salinity, changes in the ionic composition of the water and toxicity of individual ions. A study by Weber-Scannell & Duffy (2007) reported a variety of studies that evaluated the effect of elevated TDS on freshwater aquatic invertebrates. These studies reported the commencement of effect at 499 mg/L, with most effects not observed until >1,000 mg/L. With fish, research is limited, but preliminary studies reported in Weber-Scannell and Duffy demonstrated survival rates of salmonid embryos to elevated TDS (38% survival when exposed to 2,229 mg/L for brook trout, and 35% survival when exposed to 1,395 mg/L). Environment Canada has established a freshwater conductivity target of 500 µS/cm (conductivity must not exceed target) as part of its Environmental Performance Water Quality Index (Environment Canada, 2011).

Conductivity and TDS are often used as baseline for comparison with background measurements. Significant changes in these parameters could indicate that a discharge or some other source of pollution has entered the aquatic resource. Conductivity and TDS levels measured within the FHAA are considered acceptable for aquatic life.

3.3.3.2.3 Assessment of Fisheries Resources

The following paragraphs describe fish habitat within each water feature identified in the Aquatic Study Area and provides an assessment of the quality of the habitat in relation to fish species and their life stages. The results of fish habitat characterizations and fish surveys have been used to define which water features provide habitat for fish (i.e., "Fisheries Resources"), and which do not.

Fisheries resources are defined as those regulated watercourses which provide viable fish habitat and are accessible to fish at any time of the year. All delineated, linear watercourses are considered provincially regulated watercourses as defined by NSECC guidance (NSE, 2015a, but not all provincially regulated watercourses are considered fisheries resources. Provincially regulated watercourses may contain a bed and bank, but if inaccessible to fish based on certain features which would prevent fish from accessing the watercourse (e.g., presence of a permanent barrier, hydrological isolation from downgradient, fish-bearing systems) are not considered a fisheries resource.

Watercourse 1

WC1 is a first order, low gradient watercourse that originates from WL4, a headwater wetland (Figure 9, Appendix A). The upstream reach of WC1, as it originates within WL4, is intermittent. Within and downstream of WL4, WC1 flows through three subterranean sections that remain underground for 10 m, 35 m and 115 m, respectively. Portions of WC1 are also de-channelized. The downstream reach of WC1 within the Aquatic Study Area develops into a perennial watercourse.

WC1, when channelized, has a bankfull width that ranges from 10 to 100 cm and a maximum water depth of 80 cm. Substrate within the channel is muck (90%) and boulder (10%) and the habitat is classified as a flat (100%).

Electrofishing was completed in two reaches of WC1 and no fish were captured or observed (Section 3.3.3.2.1).

The subterranean portions of WC1 (Figure 9, Appendix A) are characterized by expanses of moss-covered boulders with no visible surface flow, flow is mostly audible beneath the boulders. These areas have been assessed as seasonal barriers to fish passage, as water levels are expected to rise between and above the level of the boulders during periods of high flow. Though not complete barriers, it is likely that these subterranean sections restrict passage by acting as navigational obstacles to upstream and downstream migration, especially during seasonal low flow conditions.

It is presumed, therefore, that fish may access the upper reaches of this watercourse, though only during periods of high flow or after heavy rain events. Fish habitat within the watercourse is limited by dry conditions, subterranean sections, and dechannelized surface flow through wetland habitat. Outside of the watercourse but within WL4, fish habitat is also limited. As a first order stream, WC1 does not provide passage to any upgradient aquatic features. Based on these characteristics, this watercourse may provide suitable habitat for juvenile American eel in the form of fine substrates and moderate cover (Scott and Crossman, 1973; Tesch, 1977) as they have the ability to travel terrestrially over wet substrates and as such, may be able to circumvent the subterranean reaches. The watercourse provides poor quality habitat for other fish species found in Nova Scotia including salmonids, suckers, and minnows due to the inconsistent flow, poor water quality, and subterranean sections acting as impediments to fish passage throughout the watercourse.

Pond1

Pond1 is located within the transmission line corridor in the southern extent of the Aquatic Study Area (Figure 9, Appendix A). Pond1 is approximately 135 m^2 and receives water from a hung culvert that is fed from a quarry road ditch line. No outflow from the pond was identified.

Pond1 appears to have been anthropogenically excavated but has since naturalized. Presently, it has emergent vegetation (5%) and non filamentous algae (20%). The pond edge is completely vegetated with graminoids (e.g., *carex* sp., common woolly bulrush), shrubs (e.g., speckled alder), and small trees (e.g., red maple). The substrate of the pond consists of sand (40%), clay (30%), and gravel (30%).

Due to its lack of connectivity to other water features both up and downstream, this waterbody is not considered a fisheries resource.

3.4 Priority Species

3.4.1 Desktop Review

A review of ACCDC report (Appendix D) confirms the presence of several priority species in proximity to the Study Area (Figure 10, Appendix A). The ACCDC identified the following records of SAR and SOCI within 5 km of the Study Area including:

- Eight records of seven vascular flora;
- Two records of nonvascular flora;
- 148 records of 36 vertebrates;
- Three records of two invertebrates; and
- One location sensitive occurrence of a bat hibernaculum.

The NSDNRR considers a number of species “location sensitive”. Concern about exploitation of location-sensitive species excludes the precise coordinates in an ACCDC report. Although the ACCDC report identifies a bat hibernaculum as being located within 5 km, NSDNRR confirmed that no hibernaculum is located within 5 km of the Study Area, but individual occurrences and monitoring occurrences of SAR

bats were made under 5 km from the Study Area (4 August 2021, pers. comm. J. Laverty, Regional Biologist, NSDNRR).

The following nine SAR have been identified within 5 km of the Study Area, two of which was observed during the field surveys (olive-sided flycatcher and blue felt lichen [outside of the Study Area]):

- Blue Felt Lichen (NSESA Vulnerable, SARA Special Concern, COSEWIC Special Concern)
- Chimney Swift (NSESA Endangered, SARA Threatened, COSEWIC Threatened)
- Bank Swallow (NSESA Endangered, SARA Threatened, COSEWIC Threatened)
- Barn Swallow (NSESA Endangered, SARA Threatened, COSEWIC Threatened)
- Canada Warbler (NSESA Endangered, SARA Threatened, COSEWIC Threatened)
- Rusty Blackbird (NSESA Endangered, SARA Special Concern, COSEWIC Special Concern)
- Common Nighthawk (NSESA Threatened, SARA Threatened, COSEWIC Special Concern)
- Olive-sided Flycatcher (NSESA Threatened, SARA Threatened, COSEWIC Special Concern)
- Eastern Wood-Pewee (NSESA Vulnerable, SARA Special Concern, COSEWIC Special Concern)

A summary of priority species identified by ACCDC within 10 km of the Study Area is provided below (Table 3-26). For avifaunal priority species, breeding status as documented for the second atlas in the Maritime Breeding Bird Atlas square summary (20MQ25) is also included. All species identified with 5 km are carried forward for discussion as similar landscapes to the Study Area are present, and therefore, species observed within 5 km are a good representation of what could occur within the Study Area. If the species was observed during atlas surveys, with no breeding evidence noted, this is indicated below as well.

Table 3-25. Summary of ACCDC observations of priority species within 10 km of the Study Area.

Scientific Name	Common Name	COSEWIC	SARA	NSESA	S Rank	Distance	MBBA
Vascular Plants							
Carex foenea	Fernald's Hay Sedge	-	-	-	S3	0.9 ± 0.0	-
Lysimachia quadrifolia	Whorled Yellow Loosestrife	-	-	-	S1	1.3 ± 0.0	-
Juncus subcaudatus	Woods-Rush	-	-	-	S3	1.3 ± 0.0	-
Liparis loeselii	Loesel's Twayblade	-	-	-	S3S4	1.6 ± 0.0	-
Neottia bifolia	Southern Twayblade	-	-	-	S3	1.7 ± 0.0	-
Agalinis neoscotica	Nova Scotia Agalinis	-	-	-	S3S4	2.3 ± 0.0	-
Juncus greenei	Greene's Rush	-	-	-	S1S2	2.9 ± 0.0	-
Lichens							
Umbilicaria vellea	Grizzled Rocktripe Lichen	-	-	-	S1	4.8 ± 5.0	-
Pectenia plumbea	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	4.9 ± 0.0	-
Mammals							
Vespertilionidae sp.	bat species	-	-	-	S1S2	4.4 ± 0.0	-
Avifauna							
Catharus ustulatus	Swainson's Thrush	-	-	-	S3S4B	1.2 ± 0.0	Confirmed
Regulus calendula	Ruby-crowned Kinglet	-	-	-	S3S4B	1.4 ± 0.0	Confirmed
Perisoreus canadensis	Canada Jay	-	-	-	S3	2.4 ± 0.0	Confirmed
Loxia curvirostra	Red Crossbill	-	-	-	S3S4	2.4 ± 0.0	Possible
Riparia riparia	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2.7 ± 1.0	Confirmed
Sitta canadensis	Red-breasted Nuthatch	-	-	-	S3	3.6 ± 0.0	Confirmed

Scientific Name	Common Name	COSEWIC	SARA	NSESA	S Rank	Distance	MBBA
Sterna paradisaea	Arctic Tern	-	-	-	S3B	3.6 ± 7.0	-
Euphagus carolinus	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	4.1 ± 7.0	Possible
Contopus virens	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	4.1 ± 7.0	Possible
Chaetura pelagica	Chimney Swift	Threatened	Threatened	Endangered	S2B,S1M	4.1 ± 7.0	Possible
Hirundo rustica	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	4.1 ± 7.0	Confirmed
Cardellina canadensis	Canada Warbler	Threatened	Threatened	Endangered	S3B	4.1 ± 7.0	-
Chordeiles minor	Common Nighthawk	Special Concern	Threatened	Threatened	S2B	4.1 ± 7.0	Probable
Contopus cooperi	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	4.1 ± 7.0	Confirmed
Sterna hirundo	Common Tern	-	-	-	S3B	4.1 ± 7.0	Probable
Accipiter gentilis	Northern Goshawk	-	-	-	S3S4	4.1 ± 7.0	Possible
Setophaga tigrina	Cape May Warbler	-	-	-	S2B	4.1 ± 7.0	Probable
Piranga olivacea	Scarlet Tanager	-	-	-	S2B	4.1 ± 7.0	Probable
Asio otus	Long-eared Owl	-	-	-	S2S3	4.1 ± 7.0	Possible
Spinus pinus	Pine Siskin	-	-	-	S2S3	4.1 ± 7.0	Probable
Pinicola enucleator	Pine Grosbeak	-	-	-	S2S3B,S5N	4.1 ± 7.0	Possible
Poecile hudsonicus	Boreal Chickadee	-	-	-	S3	4.1 ± 7.0	Confirmed
Falco sparverius	American Kestrel	-	-	-	S3B	4.1 ± 7.0	Confirmed
Gallinago delicata	Wilson's Snipe	-	-	-	S3B	4.1 ± 7.0	Possible
Cardellina pusilla	Wilson's Warbler	-	-	-	S3B	4.1 ± 7.0	Probable

Scientific Name	Common Name	COSEWIC	SARA	NSESA	S Rank	Distance	MBBA
Picoides arcticus	Black-backed Woodpecker	-	-	-	S3S4	4.1 ± 7.0	Probable
Actitis macularius	Spotted Sandpiper	-	-	-	S3S4B	4.1 ± 7.0	Confirmed
Empidonax flaviventris	Yellow-bellied Flycatcher	-	-	-	S3S4B	4.1 ± 7.0	Probable
Oreothlypis peregrina	Tennessee Warbler	-	-	-	S3S4B	4.1 ± 7.0	Possible
Setophaga castanea	Bay-breasted Warbler	-	-	-	S3S4B	4.1 ± 7.0	Confirmed
Setophaga striata	Blackpoll Warbler	-	-	-	S3S4B	4.1 ± 7.0	Confirmed
Charadrius vociferus	Killdeer	-	-	-	S3B	4.8 ± 0.0	-
Calidris minutilla	Least Sandpiper	-	-	-	S1B,S3M	5.0 ± 0.0	-
Tringa melanoleuca	Greater Yellowlegs	-	-	-	S3B,S3S4M	5.0 ± 0.0	-
Fish							
Salvelinus fontinalis	Brook Trout	-	-	-	S3	4.2 ± 0.0	-
Alosa pseudoharengus	Alewife	-	-	-	S3	4.8 ± 0.0	-
Invertebrates							
Ophiogomphus aspersus	Brook Snaketail	-	-	-	S2S3	4.4 ± 0.0	-
Erynnis juvenalis	Juvenal's Duskywing	-	-	-	S3S4	4.5 ± 1.0	-

3.4.2 Vascular Plants

Seven vascular priority plant species were documented within 5 km of the Study Area in the ACCDC report and include: whorled yellow loosestrife (*Lysimachia quadrifolia*, ACCDC: S1), Greene's rush (*Juncus greenei*, ACCDC: S1S2), Fernald's hay sedge (*Carex foenea*, ACCDC: S3), woods-rush (*Juncus subcaudatus*, ACCDC: S3), southern twayblade (*Neottia bifolia*, ACCDC: S3), Nova Scotia agalinis (*Agalinis neoscotica*, ACCDC: S3S4) and Lowsel's twayblade (*Liparis loeselii*, ACCDC: S3S4). The Study Area is not within a black ash 10 km by 10 km standardized grid square which core habitat is found (NSDNRR, 2021a).

One of the priority vascular plant species identified within 5 km by the ACCDC was observed in the Study Area: Nova Scotia agalinis (Figure 10, Appendix A). None of the other priority plant species were observed, either incidentally or during specified rare plant surveys. The habitat suitability within the Study Area and QEA for these species are described below:

Nova Scotia Agalinis

Typical habitats for the Nova Scotia agalinis are edge habitats of woods roads, as well as acidic soils in damp locations (Munro, Newell & Hill, 2014). One observations of Nova Scotia agalinis occurred on the edge of a road along the eastern Study Area boundary, but outside of the QEA.

Whorled Yellow Loosestrife

Whorled yellow loosestrife prefers habitats that are man-made or disturbed, as well as woodlands, grasslands, fens and moist prairies (Native Plant Trust, 2020). Suitable habitat for this species is found within the QEA and the Study Area, however, this species was not observed during field surveys.

Southern Twayblade

Southern twayblade are typically found in bogs and swamps (Native Plant Trust, 2020). Four wetlands were identified within the Aquatic Study Area (Section 3.3.1), however, no southern twayblade were observed. No wetlands are located within the QEA.

Greene's Rush

Sandy soils and dune hollows provide suitable habitat for Greene's rush (Munro et al. 2014). This habitat was not observed within the QEA or the Study Area, and Greene's rush was not observed.

Fernald's Hay Sedge

Dry, sandy rocky soils are the preferred substrate for Fernald's hay sedge (Native Plant Trust, 2020). This habitat is present within the Study Area and QEA; however, no Fernald's hay sedge was observed.

Woods-Rush

Woods-rush can be found in conifer woods and spruce swamps (Native Plant Trust, 2020). Woods-rush was not observed on site, however, spruce swamps (WL1, WL2, and WL4) are present within the Aquatic Study Area (but outside of the QEA) and conifer woods are present within both the Study Area and QEA.

Loesel's Twayblade

Loesel's twayblade often colonizes previously open and disturbed habitat during early and middle stages of reforestation (Flora of North America, 2020). This habitat type is present in much of the QEA and the Study Area, however, Loesel's twayblade was not identified.

3.4.3 Lichens

Two priority lichen species were documented within 5 km of the Study Area in the ACCDC report: blue felt lichen (*Pectenia plumbea*, ACCDC: S3), and grizzled rocktripe lichen (*Umbilicaria vellea*, ACCDC: S1). No predicted BFL polygons are present within the Study Area, however, one exists in the Aquatic Study Area (Figure 2, Appendix A). According to the MTRI databases, no known extant BFL populations are within 70 km and one known vole ears lichen is located within 24 km of the Study Area.

Overall, and as described in section 3.2.1.2 and 3.2.3.2, the lichen community within the QEA consisted of a community structure often associated with regenerating stands of balsam fir, such as the SH8 group. It is unlikely for the SH8 group to support SAR lichens as the majority of these species require more mature trees. This forest type is common throughout the Study Area, the surrounding landscape, and throughout Nova Scotia.

Two priority species were observed within the Study Area during the field surveys: fringe lichen (*Heterodermia neglecta*; ACCDC: S3S4), and frosted glass whiskers (*Sclerophora peronella*; ACCDC: S1?) (Figure 10, Appendix A). None of the priority lichen species identified within 5 km by the ACCDC were observed in the Study Area, however, blue felt lichen was incidentally identified 8 m north of the Study Area boundary (within WL1 and on crown land). The habitat suitability within the Study Area and QEA for these species and the ones identified are described below:

Blue Felt Lichen

Blue felt lichen is a foliose cyanolichen (a lichen with a cyanobacteria as a photobiont) which typically grows on mature red maple on the edge of swamps, lakes, and rivers. This species can also be found growing in upland habitat and on other hardwood species such as white ash, yellow birch, and sugar maple (COSEWIC, 2010). Blue felt lichen is fairly common in Nova Scotia, however, in North America the range is restricted to the northeast and only found in Nova Scotia, Newfoundland and Labrador, and New Brunswick (COSEWIC, 2010). Blue felt lichen is listed as Vulnerable (S3) by the ACCDC and special concern and vulnerable under SARA and NSESA, respectively.

Blue felt lichen was observed consisting of one thallus within WL1, but outside of the Study Area. The thallus (15 cm^2) was fertile and was located approximately 60 cm above the ground on a red maple. The QEA is situated >100 m from this observation, as per the recommendations within the *At Risk Lichen – Special Management Practices* (NSDNR, 2018).

Grizzled Rocktripe Lichen

Grizzled rocktripe lichen typically grows over vertical acid rock in open or somewhat sheltered inland areas (Klinkenberg 2020). Grizzled rocktripe lichen is not commonly found in Nova Scotia. It is listed as S1 by the ACCDC and is not listed under SARA or NSESA. This species was not observed in the Study Area or QEA.

Fringe lichen

The fringe lichen is a small foliose (but sometimes appears to be squamulose) lichen with a green/white upper surface, pale to dark brown cilia and an ecorticate lower surface. This species can be found on mature softwood and hardwood species in upland, wetland, and riparian habitats (Hinds & Hinds, 2007). According to Consortium of North American Lichen Herbarium (CNALH), this species has been collected in Lunenburg, Queens, Cumberland and Digby counties, however, as it appears to be the trend, and based on MELs experience, this is an underrepresentation of the distribution of this species within the province.

One observation consisting of three thalli was identified on a red maple (1.8 m above the ground, south facing). This specimen is located within the northern extent of the QEA (Figure 10, Appendix A).

Frosted Glass Whiskers

Frosted glass whiskers belong to a group of fungi known as "stubble" lichens due to their tiny spore-bearing structures. This species typically occurs on hardwoods, especially on exposed heartwood of living trunks, and more rarely on bark. In Canada, frosted glass whiskers are only known in British Columbia and Nova Scotia. They are listed as S1? By the ACCDC and special concern under SARA and COSEWIC (COSEWIC, 2005).

Two locations of frosted glass whiskers were observed: both locations were in upland habitat in the northern extent of the Study Area, immediately adjacent WL1. One location consisted of 100 stalks in the cavity of a red maple (~600 cm^2) and the second location was comprised of 20 stalks in a cavity of a red maple (~1 cm^2). (Figure 10, Appendix A). The QEA is situated >100 m from these observation, as per the recommendations within the *At Risk Lichen – Special Management Practices* (NSDNR, 2018).

3.4.4 Mammals

No priority mammal species were observed during field surveys. The ACCDC report identifies a bat hibernaculum as being located within 5 km of the Study Area (location sensitive) and notes that bat species (*Vespertilionidae sp.)* were identified within 4.4 km from the Study Area. NSDNRR confirmed that individual occurrences and monitoring occurrences of SAR bats were made under 5 km from the Study Area, but no known hibernacula are located within 5 km of the Study Area (August 2021, pers. comm., J. Laverty, Regional Biologist, NSDNRR). The ACCDC report also identifies little brown myotis (*Myotis lucifugus*), northern long-eared myotis (*Myotis septentrionalis*), and eastern pipistrelle (*Perimyotis subflavus*) within 30 km of the Study Area. Mainland moose were identified 20.1 km from the Study Area by the ACCDC.

Little Brown Myotis, Northern Long-eared Myotis, and Eastern Pipistrelle

Critical habitat for these three species, which is identified as a 100 km^2 grid square, is approximately 20 km northwest of the Study Area (Environment Canada, 2015). Critical habitat is defined by Environment Canada as the habitat necessary for the survival or recovery of the species and is considered location sensitive therefore, for protection and conservation, a 100 km^2 grid square is provided instead of a specific location (Environment Canada, 2015).

No provincial government records of AMOs were located within the Study Area (NSDNR, 2017). Four records of AMOs were identified within 8 km of the Study Area, with the closest AMO being approximately 4.8 km southeast. All AMOs are shafts and are associated with either woodlands or

residential properties. According to the provincial government records, these AMOs are plugged with rock and vegetation, and based on these descriptions, would not provide bat hibernacula habitat.

Within the Study Area, no caves, abandoned mines, or open wells which provide overwintering habitat (hibernacula) were observed for these bat species. Maternity roosting habitat is available in areas with more mature stands (SH5) and in wetlands with snags (Figure 8, Appendix A), however, the majority of the Study Area was cleared of vegetation in the past 20 years. Within the Study Area, foraging habitat is present in the wetlands and in proximity to the waterbody. Similar habitat to that within the Study Area and QEA is locally abundant and available outside the Study Area. No bats were observed during the suite of biophysical surveys conducted.

Mainland Moose

The Study Area is within a mainland moose concentration area but no moose or evidence of moose were observed during the winter surveys or PGI surveys. There are no moose shelter patches within the Study Area.

The ACCDC report recorded 16 observations of mainland moose, with the closest recorded observation occurring 20.1 km from the Study Area. Mainland moose require a diverse and heterogenous landscape consisting of both early and late successional vegetation communities (Snaith et al. 2002). Mature forested stands are critical in providing refuge from snow, wind, and cold temperatures as well as providing shade in the summer (Snaith et al. 2002). Regenerative forests, particularly consisting of red maple, striped maple, yellow birch, and balsam fir provide a food source for moose. Aquatic feeding areas are also important for moose survival and habitat is usually provided in cool water lakes and medium sized rivers. In these habitats, moose will primarily feed on pondweeds (*Potamogeton spp*.) and pond lilies (*Nuphar and Nymphae spp*.).

Within the Study Area, the SH5 forest group provides suitable refuge habitat for moose. This habitat is present in the northeastern and west-central portions of the Study Area. Regenerative stands, particularly those belonging to the Spruce-Hemlock forest group (SH8), provide foraging for moose and are found within the Study Area and the QEA.

Three small wetlands are present along the northern Study Area boundary, however, none of the wetlands provide aquatic feeding habitat. Within the Aquatic Study Area, WL4 contains larger amounts of standing water and WC1, but no suitable aquatic feeding habitat was identified. Aquatic feeding habitat may be present outside of the Study Area in Island Lake (1 km west) and Sandy Lake (750 m northeast).

3.4.5 Herpetofauna

No priority herpetofauna species were observed during field surveys. According to the ACCDC, no SAR were observed within 5 km of the Study Area, however, snapping turtle, eastern painted turtle, and wood turtle were noted within 8.5 km, 13.5 km, and 17.9 km of the Study Area, respectively. No wood turtle SMP buffers exist within the Study Area, the closest buffer is over 15 km to the east. Additionally, no identified wood turtle core habitat is located within or near the Study Area (11 February 2021, pers. comm., D. Hurlburt, Manager of Biodiversity, NSDNRR).

The closest observation of a Blanding's turtle was 72 km from the Study Area. The Study Area is outside of the range of Blanding's turtle critical habitat (ECCC 2019), therefore, the species is not discussed in more detail within this section.

The preferred habitat for wood turtle, snapping turtle, and eastern painted turtle, as well as the availability of such habitat within the Study Area, is outlined below:

Wood Turtle

Wood turtles are listed as Threatened under SARA, COSEWIC and NSESA. The species live along permanent streams but may roam overland during summer and can be found in a variety of terrestrial habitats. Wood turtles nest on sand or gravel-sand beaches and banks. This species prefers clear rivers, streams or creeks with moderate current and sandy or gravelly substrate. They overwinter in numerous microhabitat types, which include burrowing in mud, under overhanging banks, or in the bottoms of stream pools (Environment Canada, 2016).

One watercourse, WC1, (Section 3.3.2) was identified within the Aquatic Study Area, but no suitable nest beaches were present within it. Suitable habitat for overwintering is present in the mapped wetland at the northern finger of the Aquatic Study Area, as the depths in WC1 increase. Potential nesting habitat exists on the edges of access roads that delineate the Study Area and within the existing quarry floor (e.g., stockpiles). No alder thickets are present within the Study Area, however, other areas offer suitable forage habitat for wood turtle, such as wetland habitat and mixed wood forests, located in the north of the Study Area.

No wood turtles or evidence of wood turtles were observed during the surveys and aside from gravel stockpiles generated from quarrying, no suitable wood turtle habitat is present within the QEA.

Snapping Turtle

Snapping turtles are listed as Vulnerable under the NSESA and Special Concern under SARA and COSEWIC. Snapping turtles use a variety of habitats; however, the preferred habitat is slow-moving water with a soft mud bottom and dense aquatic vegetation. Nesting typically occurs in sand or gravel banks in proximity to water with sparse vegetative cover (ECCC, 2016). Hibernation sites are aquatic environments (e.g., lentic, lotic, and mud) where water will not freeze to the bottom, the substrate is a thick layer of mud, and other cover (e.g., large woody debris) is present (ECCC, 2016).

WC1 provides suitable substrate for overwintering, however, water depths are not sufficient in the upstream portions of WC1. Suitable overwintering habitat is present in the northern finger of the Aquatic Study Area within the mapped wetland. No suitable nest sites were identified along WC1, however, gravel is present along roadsides (in and around the Study Area) and within the existing quarry.

No snapping turtles or evidence of snapping turtles were observed during the biophysical surveys.

Eastern Painted Turtle

Eastern painted turtles are listed under COSEWIC as Special Concern. Eastern painted turtles can often be found in slow moving, relatively shallow watercourses, waterbodies, or wetlands. They require abundant basking sites and organic substrate with submergent aquatic plants that provide cover and food sources (COSEWIC, 2018). Their nesting habitats are open areas with south facing slopes that have a

sandy loamy and/or gravel substrate; these habitats must be near (within 1.2 km) their preferred aquatic habitats. Overwintering habitats include areas with shallow water and deep substrate. Suitable nesting habitat for the eastern painted turtle is present along roadsides (in and around the Study Area) and within the existing quarry. Potential overwintering habitat is present in WC1, within the Aquatic Study Area.

No eastern painted turtles were identified during the biophysical surveys.

3.4.6 Avian

Fourteen priority avifauna species were observed within the Study Area during all field surveys, including incidentals (Table 3-27; Figure 10, Appendix A). Two SAR (olive-sided flycatcher and wood-thrush) and 12 SOCI species were observed. See below for observations of all bird species broken down by survey type and PC location.

Table 3-26. SAR and SOCI observed during all survey periods and incidentally

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	Survey type[1]	Location	Total #
Olive-sided Flycatcher	***Contopus cooperi***	**Special Concern**	**Threatened**	**Threatened**	**S2B**	**Spring**	**6**	**1**
Wood Thrush	***Hylocichla mustelina***	**Threatened**	**Threatened**	**-**	**SUB**	**Spring**	**1**	**1**
Cape May Warbler	*Setophaga tigrina*	-	-	-	S2B	Fall	9	1
Pine Siskin	*Spinus pinus*	-	-	-	S2S3	Fall	7	1
Turkey Vulture	*Cathartes aura*	-	-	-	S2S3B	Spring	4	1
Canada Jay	*Perisoreus canadensis*	-	-	-	S3	Spring	8, 9, 12	5
						Fall	5	1
						Winter	T13	1
Boreal Chickadee	*Poecile hudsonicus*	-	-	-	S3	Fall	11	1
						Incidental	-	1
Red-breasted Nuthatch	*Sitta canadensis*	-	-	-	S3	Fall	4, 6, 8, 11, 12	7
Red Crossbill	*Loxia curvirostra*	-	-	-	S3S4	Fall	4	1
Bay-breasted Warbler	*Setophaga castanea*	-	-	-	S3S4B	BBS	9	1
Yellow-bellied Flycatcher	*Empidonax flaviventris*	-	-	-	S3S4B	BBS	4	1
Blackpoll Warbler	*Setophaga striata*	-	-	-	S3S4B	Fall	2, 4, 6, 7, 8, 10, 11, 12	13
Ruby-crowned Kinglet	*Regulus calendula*	-	-	-	S3S4B	Fall	11	1
Swainson's Thrush	*Catharus ustulatus*	-	-	-	S3S4B	Fall	2	1
						Incidental	-	1
TOTAL								**40**

[1]Survey Type: Spring = spring migration survey; BBS = breeding bird survey, Fall = fall migration survey;

Bold denotes SAR designation

The observation location and preferred habitat of the priority avifauna species identified are described in the following paragraphs:

Olive-sided Flycatcher
This species inhabits open coniferous or mixed coniferous forests, often near water or wetlands that contain tall snags or trees (NSL&F, 2021). Suitable habitat is present in and around the QEA and the Study Area. This species was observed in one location (PC6) during the spring migration survey to the north of the Study Area (Figure 10, Appendix A). PC6 is in upland mixed age mixedwood forest.

Wood Thrush
Wood thrush are typically found in the shaded understory of mature deciduous forests (Sibley, 2017). No mature deciduous forests are present within the Study Area. This species was observed in one location (PC1) during the spring migration survey (Figure 10, Appendix A). PC1 is located within the current quarry footprint of the QEA but the observation was noted from 50-100 m southeast of the point count location, in a forested area that was historically cleared (south of the Study Area).

Cape May Warbler
Cape May warblers can be found in spruce forests throughout the year, and other trees during migration. This species generally breeds in open spruce forests and near forest edges (Cornell University, 2019). Suitable habitat is present in and around the QEA and Study Area. One Cape May warbler was observed during fall migration surveys to the east of the Study Area in a regenerating stand (PC9; Figure 10, Appendix A).

Pine Siskin
This species can be found in conifers, mixed woods, alders, and weedy areas. During migration and winter, pine siskins can be found in semi-open areas and woodland edges (Cornell University, 2019). Suitable habitat is present within the QEA and Study Area. This species was observed during fall migration surveys to the northeast of the Study Area in a regenerating stand (PC7; Figure 10, Appendix A).

Turkey Vulture
Turkey vultures can be found in open and semi-open country, as well as along roadsides (Cornell University, 2019). Suitable habitat is present within the QEA and Study Area, particularly within the previously forested areas. One turkey vulture was observed as a fly by during spring migration surveys at PC4, in the northwest extent of the QEA (Figure 10, Appendix A).

Canada Jay
Canada jay is a boreal and subalpine forest species (Cornell University, 2019) often found nesting and foraging with a forested community consisting of spruce, pine, and hardwood tree species. Suitable habitat is primarily present within the northwestern and central-west portions of the Study Area. Canada jay was identified in several locations during spring migration surveys (PC8, 9, 12), fall migration

surveys (PC5), and winter surveys (T13) within regenerating and intact stands in and around the QEA and Study Area (Figure 10, Appendix A).

Boreal Chickadee

This passerine inhabits mostly mature coniferous forests dominated generally by spruce and balsam fir in the tree stratum (Cornell University, 2019). This species was observed during fall migration surveys (PC11) in a regenerating stand outside of the Study Area (Figure 10, Appendix A), as well as incidentally during winter surveys.

Red-breasted Nuthatch

Red-breasted nuthatches preferred habitat is coniferous forests of spruce, fir, pine, hemlock, and larch (Cornell University, 2019). Potential habitat is primarily present within the northwestern and central-west portions of the Study Area. Red-breasted nuthatch were identified in several locations during fall migration surveys (PC4, 6, 8, 11, and 12) within and around the QEA and the Study Area (Figure 10, Appendix A).

Red Crossbill

Red Crossbills are typically found in conifer forests and groves (Cornell University, 2019). Suitable habitat is found within the northwestern and central-west portions of the Study Area, and a red crossbill was identified at PC4 during fall migration surveys (Figure 10, Appendix A). PC4 is a regenerating stand located within the QEA.

Bay-breasted Warbler

This species breeds in coniferous forests both mature and regenerative. Typically, nests are usually present in dense balsam fir or spruce stands (Cornell University 2019). Suitable habitat is found within the northwestern and central-west portions of the Study Area. The species was identified during a breeding bird survey at PC9, east of the Study Area in a regenerating stand (Figure 10, Appendix A).

Yellow-bellied Flycatcher

Yellow-bellied Flycatchers build their nest on or near the ground in moist coniferous forests, bogs, swamps, and peatlands (Cornell University, 2019). Suitable habitat is found in the northern portion of the Study Area where three wetlands are present. A Yellow-bellied Flycatcher was observed during a breeding bird survey (PC4) in the northwest portion of the QEA (Figure 10, Appendix A).

Blackpoll Warbler

This species can be found in conifers, forests, shrubby thickets and mature evergreen and deciduous forests (Cornell University, 2019). The northwestern and central-west portions of the Study Area contain this habitat. Blackpoll warbler were the most identified priority avian species (n=13). Several individuals were identified during the fall migration surveys at 8 of 12 point count locations (PC2, 4, 6, 7, 8, 10, 11, 12). These locations were within and around the QEA and Study Area (Figure 10, Appendix A).

Ruby-crowned Kinglet

Ruby-crowned Kinglets build their nests high on conifer trees within conifer dominant or mixed wood forests. They also use isolated trees in meadows and floodplain forests (Cornell University, 2019). Suitable habitat is primarily in the northwestern and central-west portions of the Study Area. Ruby-crowned kinglet were identified during the fall migration survey, in a regenerating stand east of the Study Area (PC11; Figure 10, Appendix A).

Swainson's Thrush

The Swainson's thrush generally prefers balsam fir and spruce forests with a variety of ages and disturbance levels. This species is most abundant in high elevations (MBBA, 2008). Suitable habitat is scattered throughout the Study Area and the QEA. This species was identified in the fall migration survey in the western portion of the QEA in disturbed habitat at PC2 (Figure 10, Appendix A). Swainson's thrush was also identified incidentally during breeding bird surveys and botany surveys.

Note: Although noted during the winter survey (Section 3.2.5.2.6), American robin (S5B, S3N) were identified during the PGI survey (May 6 and 11, 2021), therefore, based on the timing of the observation is not considered a SOCI.

3.4.7 Fish

No fish were captured or observed during fish surveys within the Aquatic Study Area (i.e., WC1). The ACCDC report identified Brook trout and alewife within 5 km of the Study Area as well as American eel and Atlantic salmon (IBoF) within 10 km. Per section 3.3.3.1, the Aquatic Study Area is outside of the range of the IBoF population of Atlantic salmon (Fisheries and Oceans Canada, 2019a).

WC1 provides poor quality habitat for salmonids, suckers, and minnows due to the inconsistent flow, poor water quality, and subterranean sections acting as impediments to fish passage throughout watercourse (Section 3.3.3.2.3). Suitable habitat may be provided to American eel, as described below:

American Eel

American eel are found in the Atlantic Ocean from Iceland to the Caribbean Sea. They spawn in the Sargasso Sea, situated on the west side of the Atlantic Ocean, southeast of Nova Scotia (COSEWIC, 2012). American Eel can be found in all waters that are connected to the Atlantic Ocean, including both lotic and lentic environments (DFO, 2016). American eel prefer benthic environments with ample cover such as; mud, rocks, woody debris, and submergent vegetation (Scott and Crossman, 1973; Tesch, 1977).

No American eel were captured or observed during fish surveys in WC1, however, WC1 may provide suitable habitat for juvenile American eel in the form of fine substrates and moderate cover as they have the ability to travel terrestrially over wet substrates and as such, may be able to circumvent the subterranean reaches.

Habitat provisions within the Aquatic Study Area for American eel would be limited to juvenile and adult life stages, as American eel spawn at sea (COSEWIC, 2012).

4 CONCLUSIONS

Scotian Materials Limited are proposing the expansion of an existing quarry (the Project) located on PID 41457821 in the community of Head of St. Margarets Bay, Halifax County, Nova Scotia (Figure 1, Appendix A).

In support of the submission of a provincial EARD with NSECC, this Study has been completed to identify the biophysical conditions existing within, and in proximity to the proposed site (the Study Area). This was achieved by completing a review of background desktop resources in combination with field studies to identify potential environmental constraints and sensitivities.

In September of 2020, field components of the biophysical EA were initiated. These field components continued through until August 2021 complying with the requirements for a *Class I* undertaking under Section 9(1) of the *Nova Scotia Environmental Assessment Regulations*. The field studies were focused on highlighting the ecological linkages within the Study Area, as well as with the habitats surrounding the Study Area. The field components included:

8. Vascular plant surveys (June 15, 2021 [early botany] and September 12, 2020 [late botany]);
9. Lichen surveys (September 12, 2020);
10. Vegetation community classification (April 9, 2021);
11. Avian surveys
    g) Nocturnal owl (April 15, 28 and May 4, 2021);
    h) Spring migration (May 1, 14 and 26, 2021);
    i) Breeding bird (June 14 and 24, 2021);
    j) Common nighthawk (June 24 and July 7, 2021);
    k) Fall migration (September 12, 27, October 12, 2020);
    l) Winter birds (January 27 and February 12, 2021)
12. Wetland and watercourse evaluations (April 9 and July 5, 2021);
13. Fish and fish habitat assessment (August 27, 2021); and,
14. Species at Risk (SAR) surveys;
    c) Mainland moose (Winter Tracking – January 27 and February 12, 2021; pellet group inventory – March 23, May 6, and May 11, 2021)
    d) Incidental SAR (all seasons).

Implementation of the above surveys was completed within the Study Area and the Aquatic Study Area (wetland, watercourse, fish and fish habitat surveys). These Study Areas encompass the full extent of the QEA.

<u>Vegetative Community, Vascular Plants, and Lichens</u>

The Study Area is primarily comprised of regenerative softwood stands, wetlands, and disturbed areas. Disturbed portions of the Study Area include the existing quarry footprint, gravel roads, and historic timber harvesting. The majority of the historic timber harvesting has occurred in the central portion of the Study Area. Within the Study Area, two upland vegetation types and two wetland vegetation types were present. The upland vegetation types belong to the Spruce Hemlock Forest Group (SH) and the wetland vegetation types belong to the Wet Coniferous Forest Group (WC) and the 'cut-over' group.

A total of 101 vascular plant species were observed within the Study Area, one of which was a SOCI: the Nova Scotia agalinis (*Agalinis neoscotica*; ACCDC S3S4). No priority vascular plant species were observed within the QEA. Within the Study Area, 6% of the observed vascular plant species (n=6) comprised of exotics, 94% (n=95) were native and of the native species less than 2.1% (n=2) belonged to the Atlantic Coastal Plain Flora Group.

A total of 22 lichen species were observed within the Study Area. Two were determined to be priority species, the frosted glass whiskers (*Sclerophora peronella*; Atlantic population; SARA & COSEWIC Special Concern; ACCDC S1?) and fringe lichen (*Heterodermia neglecta*; ACCDC S3S4). The frosted glass whiskers is located outside of the QEA, however, the fringe lichen is located within the QEA. One additional priority lichen species, Blue felt lichen (*Pectenia plumbea*; SARA & COSEWIC Special Concern; NSESA Vulnerable; ACCDC S3), was identified 8 m north of the Study Area.

Fauna

Winter and pellet group inventory (PGI) surveys found signs of eastern coyote (*Canis latrans*), snowshoe hare (*Lepus americanus*), white-tailed deer (*Odocoileus virginianus*), American red squirrel (*Tamiasciursus hudsonicus*), white-footed deermouse (*Peromyscus leucopus*), North American porcupine (*Erethizon dorsatum*), and bobcat (*Lynx rufus*).

The Study Area is within a mainland moose concentration area but there are no mainland moose shelter patches within the Study Area. The ACCDC report states that mainland moose have been observed 20.1 km from the Study Area. No sign of mainland moose was observed during winter transect surveys or during the (PGI) surveys.

The ACCDC report identifies a bat hibernaculum as being located within 5 km of the Study Area (location sensitive) and notes that bat species (*Vespertilionidae sp.)* were identified within 4.4 km from the Study Area. The NSDNRR confirmed that individual occurrences and monitoring occurrences of Species at Risk bats were made under 5 km from the Study Area, but no known hibernacula are located within 5 km of the Study Area. No bats or potential hibernacula were identified during field surveys.

No priority herpetofauna species were observed during field surveys. According to the ACCDC, no Species at Risk herpetofauna were observed within 5 km of the Study Area, however, snapping turtle, eastern painted turtle, and wood turtle were noted within 8.5 km, 13.5 km, and 17.9 km of the Study Area, respectively. No wood turtle Special Management Practices buffers exist within the Study Area, the closest stream buffer is over 15 km to the east. Additionally, no identified wood turtle core habitat is

located within or near the Study Area (11 February 2021, pers. comm., D. Hurlburt, Manager of Biodiversity, NSDNRR).

Avifauna

Baseline point count surveys for birds (spring migration, breeding season, fall migration, common nighthawk surveys, and nocturnal owl surveys) resulted in the observation of 1,041 individuals, representing 62 species. An additional 54 individuals representing 21 species were identified during winter surveys (winter surveys 1 and 2, as well as Moose PGI surveys 1 and 2) and 42 individuals representing 14 species were recorded incidentally.

Across all survey seasons a total of fourteen priority species were observed, as follows:

- Bay-breasted warbler (*Dendroica castanea*; ACCDC S3S4B);
- Blackpoll warbler (*Setophaga striata*; ACCDC S3S4B);
- Boreal chickadee (*Poecile hudsonica*; ACCDC S3);
- Cape May warbler *(Setophaga tigrina*; ACCDC S2B);
- Canada Jay (*Perisoreus canadensis*; ACCDC S3);
- Olive-sided flycatcher (*Contopus cooperi*; SARA Special Concern, NSESA Threatened; ACCDC S2B);
- Pine siskin (*Spinus pinus*; ACCDC S2S3);
- Red-breasted nuthatch (*Sitta canadensis*; ACCDC S3);
- Red crossbill (*Loxia curvirostra*; ACCDC S3S4);
- Ruby-crowned kinglet (*Regulus calendula*; ACCDC S3S4B);
- Swainson's thrush (*Catharus ustulatus*; ACCDC S3S4B);
- Turkey vulture (*Cathartes aura*; ACCDC S2S3B);
- Wood thrush (*Hylocichla mustelina*; SARA Threatened; ACCDC SUB); and,
- Yellow-bellied flycatcher (*Empidonax flaviventris*; ACCDC S3S4B).

All species observed are native species in this region; they are typical species commonly found within the Study Area habitat and its surroundings. Except for a flock of common grackle observed, no obvious concentrations of one particular bird group were identified, nor was an identifiable migratory pathway noted.

Wetlands

Four wetlands were identified within the Aquatic Study Area, none of which are within the QEA. Three wetlands exist as swamps (WL1, 2 and 4) and the remaining wetland (WL3) exists as a fen. Of the four wetlands identified, three exist as isolated features (WL1, 2, and 3) and one exists as a headwater wetland (i.e., watercourse outflow; WL4).

Functional assessment of the wetlands was completed using the Wetland Ecosystem Services Protocol – Atlantic Canada (WESP-AC). This quantitative decision-making tool did not identify any wetland as scoring significantly higher than any others: wetlands within the Aquatic Study Area function similarly to others on the landscape.

One wetland of special significance (WSS) was identified within the Study Area: WL1 is categorized as a WSS due to the presence of blue felt lichen (*Pectenia plumbea;* SARA & COSEWIC Special Concern; NSESA Vulnerable; ACCDC S3). Blue felt lichen was observed outside of the Study Area, in the northern extent of WL1. This wetland and the 100 m buffer from the blue felt lichen will not be directly impacted by the proposed quarry expansion.

Surface Water and Fish Habitat

One watercourse (WC1) and one waterbody (Pond1) were identified within the Aquatic Study Area during field surveys. WC1, which drains south to north into Island Lake, is first order stream sourced from a headwater wetland (WL4). Pond1 is an anthropogenically developed pond that has since naturalized. Pond1 is sourced from roadside ditching and has no outlet or connectivity to a fisheries resource.

Fish habitat surveys were completed in WC1 which included electrofishing (two reaches). No fish were captured or observed. Fish may access this the upper reaches of this watercourse, though only during periods of high flow or after heavy rain events. Fish habitat within the watercourse is limited by dry conditions, subterranean sections, and dechannelized surface flow through wetland habitat. As a first order stream, the watercourse does not provide passage to any upgradient aquatic features. Based on these characteristics, this watercourse may provide suitable habitat for juvenile American eel in the form of fine substrates and moderate cover as they have the ability to travel terrestrially over wet substrates and as such, may be able to circumvent the subterranean reaches. The watercourse provides poor quality habitat for other fish species found in Nova Scotia including salmonids, suckers and minnows due to the inconsistent flow, poor water quality, and subterranean sections acting as impediments to fish passage throughout watercourse. Outside of the watercourse but within WL4, fish habitat is also limited.

5 LIMITATIONS

Constraints Analysis

- On some maps, land use or land cover is defined everywhere to form a complete mosaic of polygons. On topographic maps landuse/landcover is depicted only in certain areas. The source data in some cases may need to be conditioned to allow the second type of depiction if it is a mosaic, and certain constraints will operate differently in each case, and,
- Conflicts that might exist between objects in a database are typically of a logical nature, such as topological inconsistencies or duplicate identifiers. We attempted to ensure that our database has addressed any potential inconsistencies, however inconsistencies may still occur. In map generalization, the vast majority of conflicts are physical, spatial consequences of reducing map scale. The greater the degree of scale change, the more cluttered an un-generalized map will be, and this signals the extents of potential conflicts in presentation of the data.

Limitations incurred at the time of the assessment include:

- MEL has relied in good faith upon the evaluation and conclusions in all third-party assessments. MEL relies upon these representations and information provided but can make no warranty as to the accuracy of information provided;
- This report provides an inventory based on acceptable industry methodologies. A single assessment may not define the absolute status of site conditions;

General Limitations incurred include:

- Classification and identification of soils, vegetation, wildlife, and general environmental characteristics (i.e., vegetation concentrations, and wildlife usage) have been based upon commonly accepted practices in environmental consulting. Classification and identification of these factors are judgmental and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may not identify all factors; and
- All reasonable assessment programs will involve an inherent risk that some conditions will not be detected and all reports summarizing such investigations will be based on assumptions of what characteristics may exist between the sample points.

6 CERTIFICATION

This Report has considered relevant factors and influences pertinent within the scope of the assessment and has completed and provided relevant information in accordance with the methodologies described.

The undersigned has considered relevant factors and influences pertinent within the scope of the assessment and written, combined, and referenced the report accordingly.

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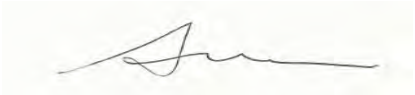

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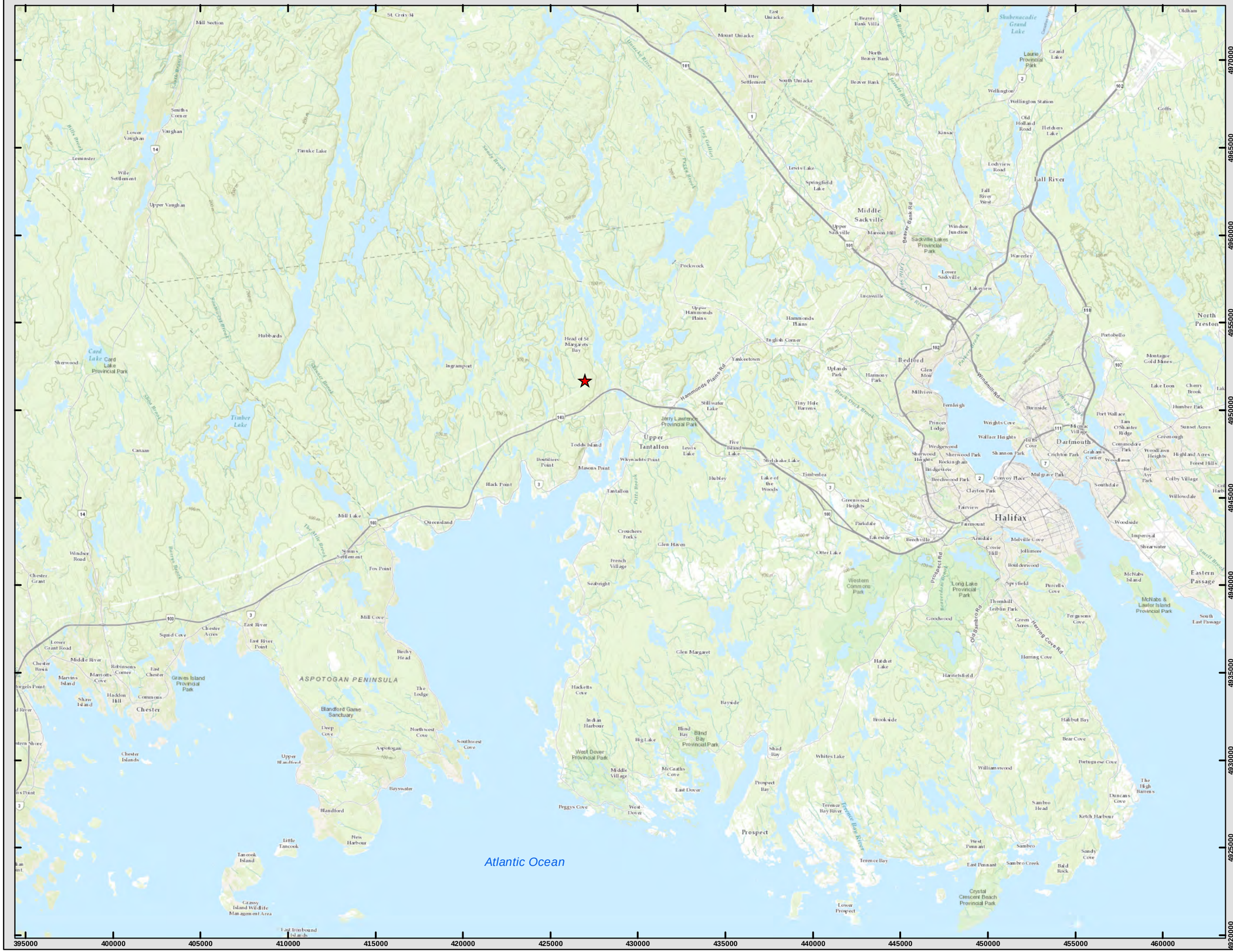
APPENDIX A. FIGURES



GHD

FIGURE 1

Project Location

Tote Road Quarry Expansion Project
Head of St. Margarets Bay, NS

★ Project Location

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1.25 2.5 5 Kilometers

1:200,000 Scale when printed @ 11" x 17"

Drawn By: J. Bonazza
Reviewed By: MMD
Date: 2021-09-08

McCallum Environmental Ltd.

Document Name: 210824_Figure1

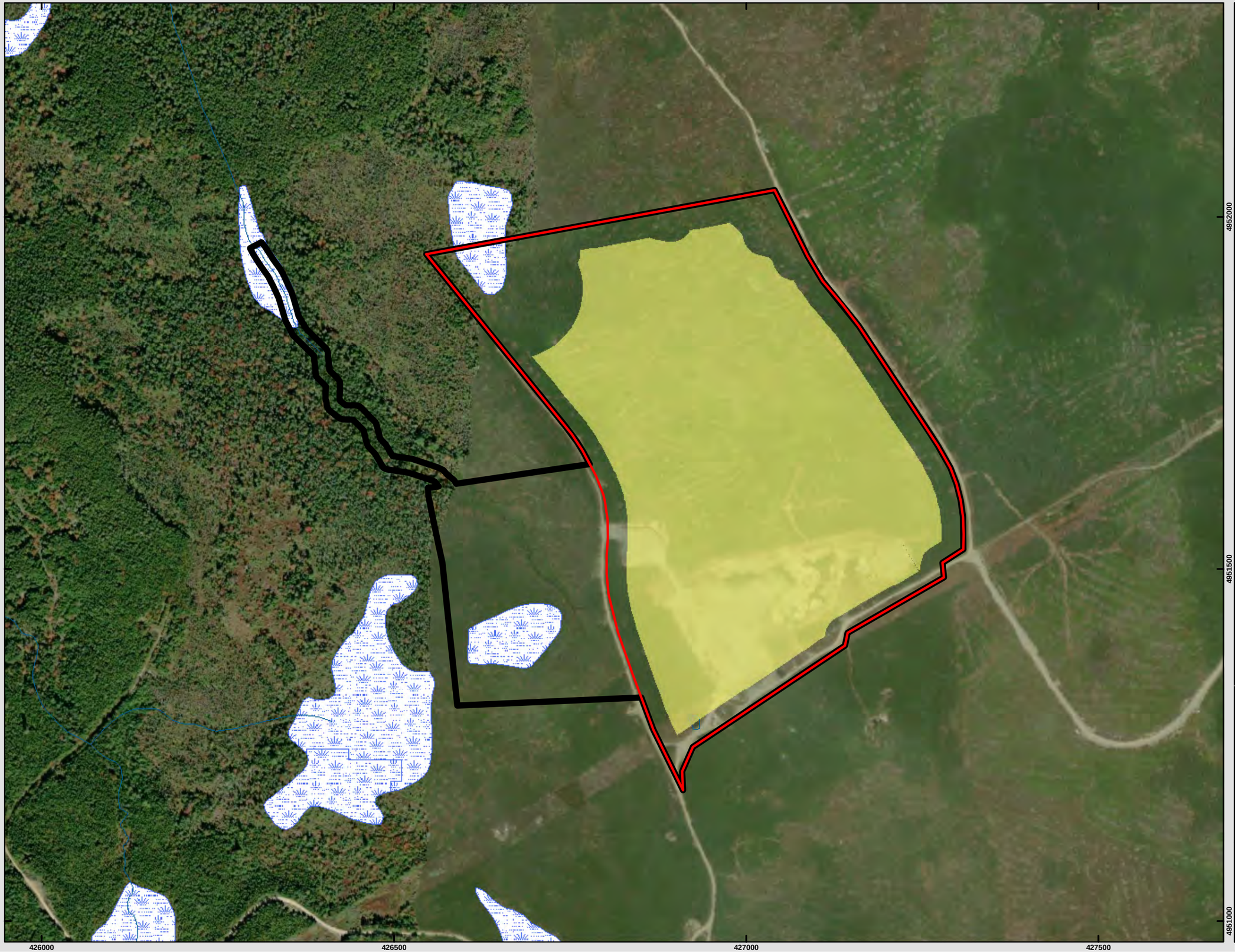


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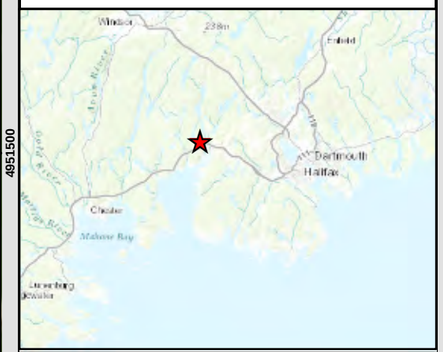
FIGURE 2

Assessment Areas

Tote Road Quarry Expansion Project
Head of St. Margarets Bay, NS

- Study Area (PID 41457821)
- Aquatic Study Area
- Quarry Expansion Area (QEA)
- Mapped Watercourse (NSECC)
- Mapped Wetlands (NSECC)



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Units: Meter

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1:5,000 Scale when printed @ 11" x 17"

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Date: 2022-02-11

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Document Name: 210824_Figure2_SA_ASA_QEA

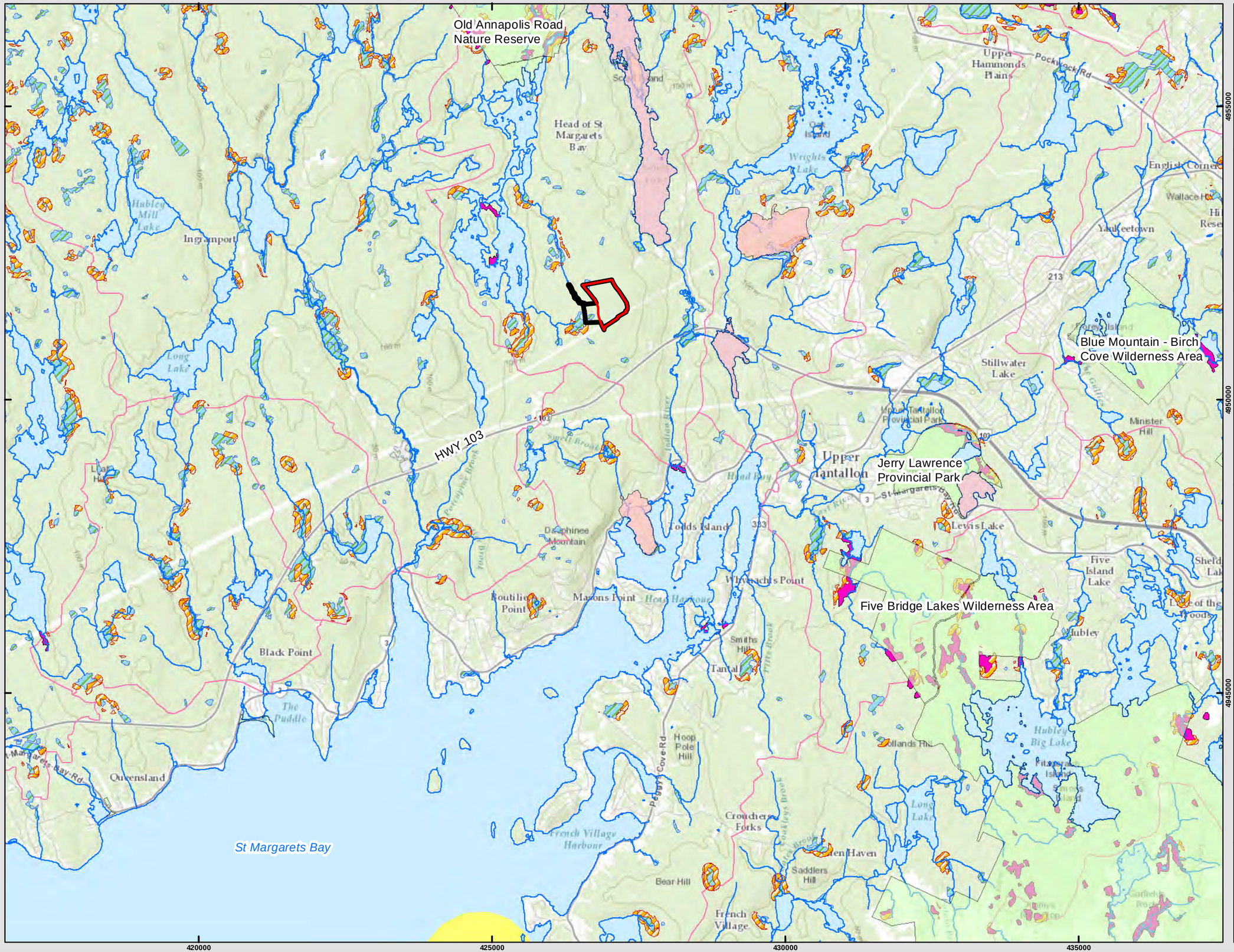

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FIGURE 3

Site Sensitivities

Tote Road Quarry Expansion Project
Head of St. Margarets Bay, NS

- Study Area
- Aquatic Study Area
- Parks and Protected Areas
- Significant Habitat
- Important Bird Area (IBA)
- Boreal Felt Lichen Predicted Habitat
- Mapped Wetlands (NSECC)
- Wetlands of Special Significance
- Secondary Watershed Boundary
- Mapped Watercourses (NSECC)

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:60,000 Scale when printed @ 11" x 17"

Drawn By: MQ
Reviewed By: MMD

Date: 2021-10-08

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Document Name: 210824_Figure3_Site_Sensitivities

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FIGURE 4

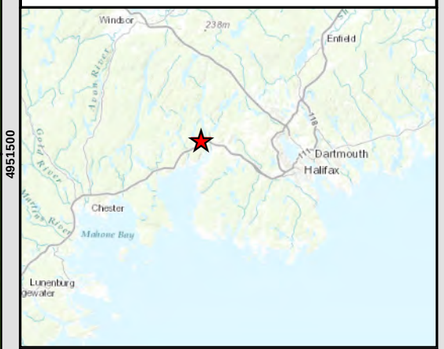
Desktop Review - Forest Cover

Tote Road Quarry Expansion Project
Head of St. Margarets Bay, NS

Study Area
Mapped Watercourses (NSECC)
Mapped Wetlands (NSECC)

Forestry Cover

Treed Bogs
Inland Waters
Powerline Corridor
Natural Stand
Treed Forested Land
Clearcut



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Datum: North American 1983 CSRS
Units: Meter

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1:4,000 Scale when printed @ 11" x 17"

Drawn By: MQ
Reviewed By: JB

Date: 2021-09-08

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Document Name: 210824_Figure4

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FIGURE 5

Mainland Moose Transect Locations

Tote Road Quarry Expansion Project
Head of St. Margarets Bay, NS

- Study Area
- Winter1, Winter2, PGI1
- PGI2
- Roads
- Mapped Wetlands (NSECC)
- Moose Patches
- Crown Land

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:18,000 Scale when printed @ 11" x 17"

Drawn By: J. Bonazza
Reviewed By: AW

Date: 2021-10-08

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Document Name: 210824_Figure5_moose

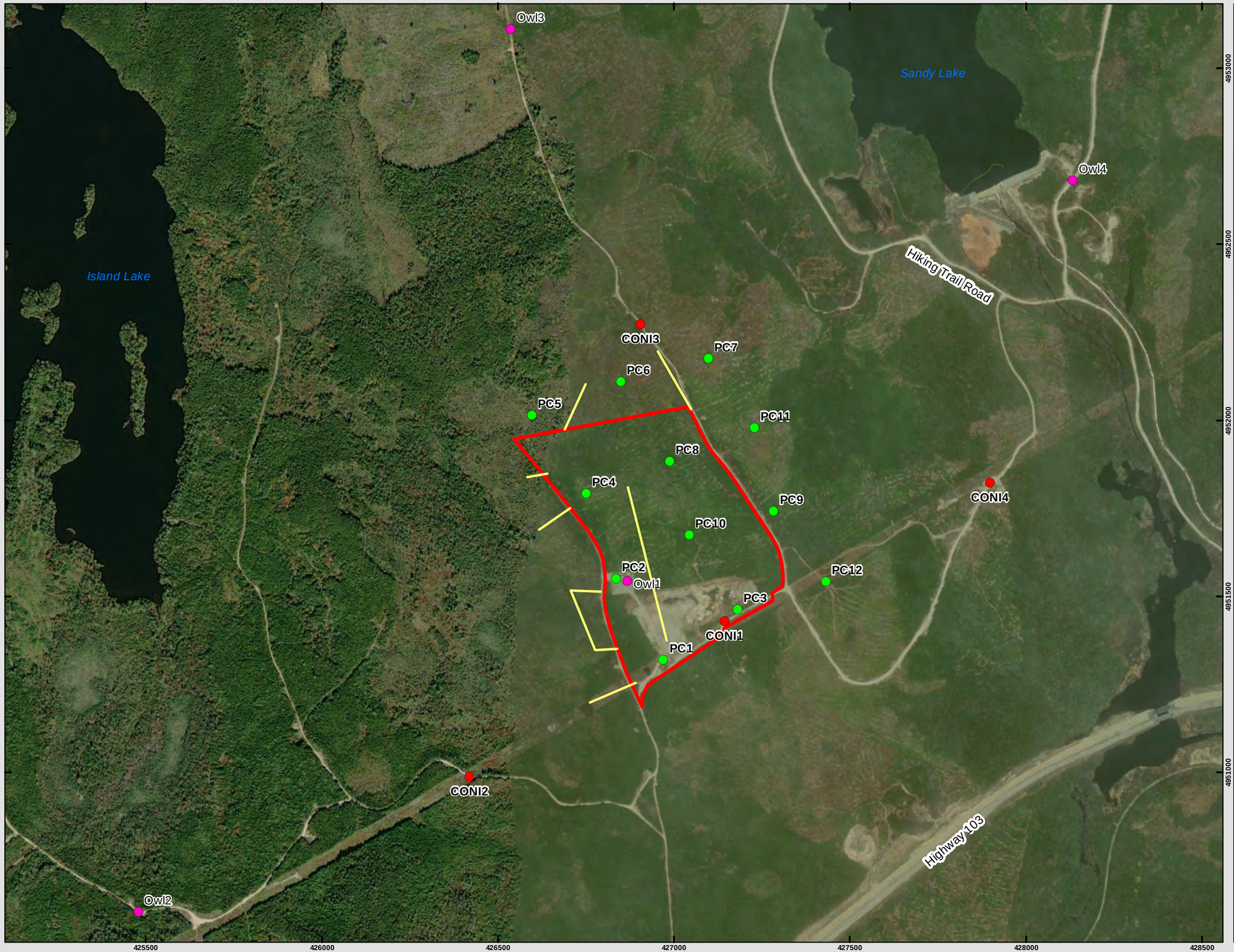

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FIGURE 6

Avian Survey Locations

Tote Road Quarry Expansion Project
Head of St. Margarets Bay, NS

- Study Area
- Point Count Location
- Nocturnal Owl Survey Location
- Common Nighthawk Survey Location
- Breeding Bird Area Seach Transects

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:10,000 Scale when printed @ 11" x 17"

Drawn By: MQ
Reviewed By: JB

Date: 2021-09-08

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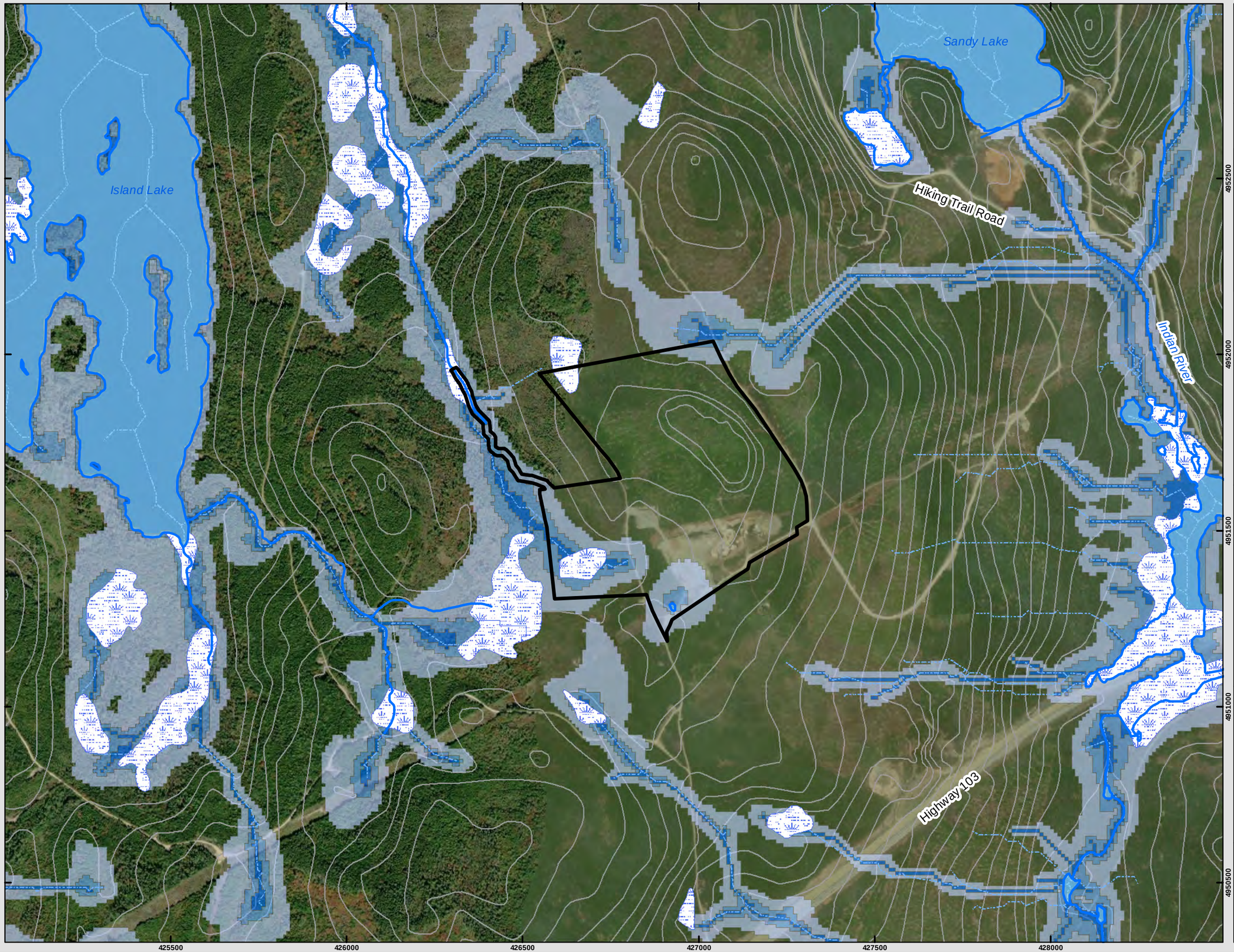
Document Name: 210824_Figure6_avian



GHD

FIGURE 7

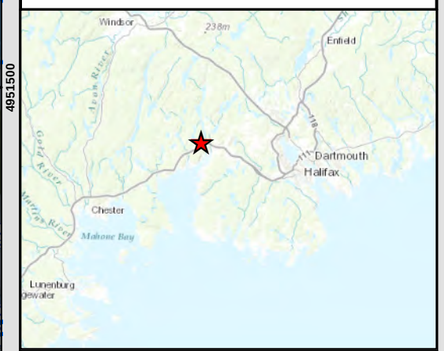
Aquatic Desktop Review

Tote Road Quarry Expansion Project
Head of St. Margarets Bay, NS

- Aquatic Study Area
- Mapped Watercourses (NSECC)
- Mapped Wetlands (NSECC)
- Mapped Waterbodies (NSECC)
- Flow Accumulation
- Topographic Contours (5 m)

Wet Areas Mapping

- 0 - 0.10m
- 0.11 - 0.50m
- 0.51 - 2.00m



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Units: Meter

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1:10,000 Scale when printed @ 11" x 17"

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Reviewed By: AW

Date: 2021-09-08

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Document Name: 210824_Figure7

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FIGURE 8

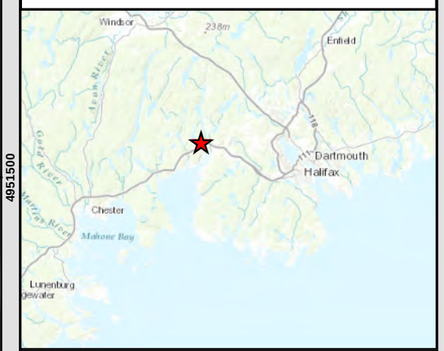
Vegetation Community Classification

Tote Road Quarry Expansion Project
Head of St. Margarets Bay, NS

Study Area

Vegetation Type

- SH5
- SH8 (Regenerating)
- WC1
- Cutover Wetland
- Existing Quarry
- Road



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Units: Meter

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1:5,000 Scale when printed @ 11" x 17"

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Reviewed By:MMD

Date: 2021-09-08

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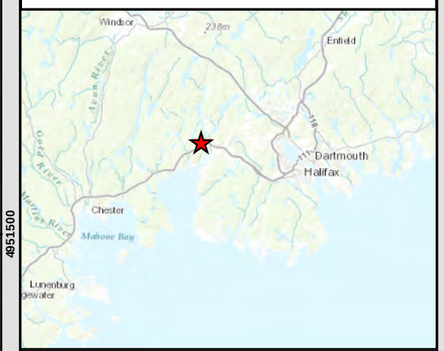
Document Name: 210824_Figure8_habitatresults

FIGURE 9

Aquatic Field Results

Tote Road Quarry Expansion Project
Head of St. Margarets Bay, NS

- Aquatic Study Area
- Study Area
- Field Delineated Wetland
- Field Delineated Waterbody
- Mapped Wetlands (NSECC)
- Field Delineated Watercourse
- Mapped Watercourses (NSECC)
- Subterranean Portion
- Electrofished Reach
- Wetland Continues Beyond Study Area
- Water Quality Sample Location



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 50 100 200 m

1:4,000 Scale when printed @ 11" x 17"

Drawn By: J. Bonazza
Reviewed By: MMD

Date: 2021-09-08

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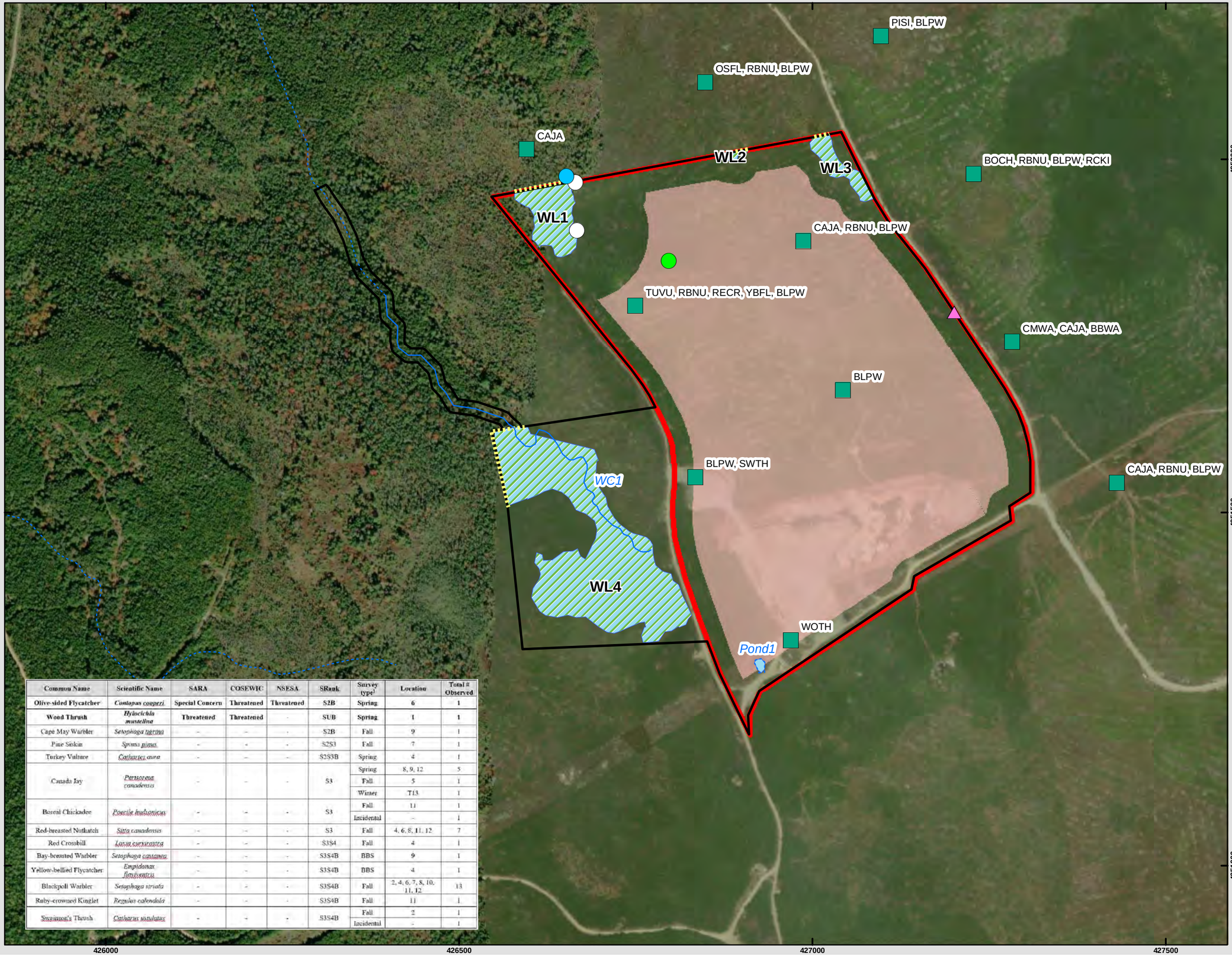
Document Name: 210824_Figure9_aquaticresults



Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	Survey type[1]	Location	Total # Observed
Olive-sided Flycatcher	***Contopus cooperi***	**Special Concern**	**Threatened**	**Threatened**	**S2B**	**Spring**	**6**	**1**
Wood Thrush	***Hylocichla mustelina***	**Threatened**	**Threatened**	-	**SUB**	**Spring**	**1**	**1**
Cape May Warbler	*Setophaga tigrina*	-	-	-	S2B	Fall	9	1
Pine Siskin	*Spinus pinus*	-	-	-	S2S3	Fall	7	1
Turkey Vulture	*Cathartes aura*	-	-	-	S2S3B	Spring	4	1
Canada Jay	*Perisoreus canadensis*	-	-	-	S3	Spring	8, 9, 12	5
						Fall	5	1
						Winter	T13	1
Boreal Chickadee	*Poecile hudsonicus*	-	-	-	S3	Fall	11	1
						Incidental	-	1
Red-breasted Nuthatch	*Sitta canadensis*	-	-	-	S3	Fall	4, 6, 8, 11, 12	7
Red Crossbill	*Loxia curvirostra*	-	-	-	S3S4	Fall	4	1
Bay-breasted Warbler	*Setophaga castanea*	-	-	-	S3S4B	BBS	9	1
Yellow-bellied Flycatcher	*Empidonax flaviventris*	-	-	-	S3S4B	BBS	4	1
Blackpoll Warbler	*Setophaga striata*	-	-	-	S3S4B	Fall	2, 4, 6, 7, 8, 10, 11, 12	13
Ruby-crowned Kinglet	*Regulus calendula*	-	-	-	S3S4B	Fall	11	1
Swainson's Thrush	*Catharus ustulatus*	-	-	-	S3S4B	Fall	2	1
						Incidental	-	1

GHD

FIGURE 10

Priority Species Results

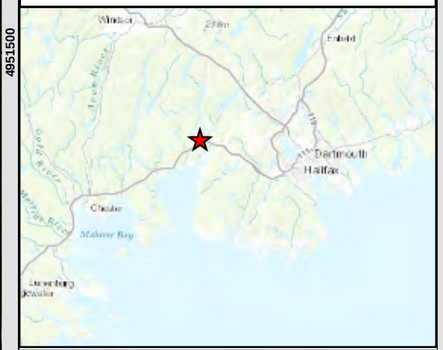
Tote Road Quarry Expansion Project

Head of St. Margarets Bay, NS

- Study Area
- Aquatic Study Area
- Quarry Expansion Area
- Field Delineated Waterbody
- Field Delineated Wetland
- Wetland Continues Beyond Study Area
- Field Delineated Watercourse
- Mapped Watercourses (NSECC)

Field Identified SAR/SOCI

- Agalinis neoscotica
- Heterodermia neglecta
- Sclerophora peronella
- Pectenia plumbea
- Priority Avifauna



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Units: Meter

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1:5,000 Scale when printed @ 11" x 17"

Drawn By: J. Bonazza
Reviewed By: MMD

Date: 2022-02-11

McCallum Environmental Ltd.

Document Name: 210824_Figure10_SARSOCI results_mmd

APPENDIX B. PROJECT TEAM MEMBERS' *CURRICULUM VITAE*

Andy Walter, BSc. (Hort)
andy@mccallumenvironmental.com
Senior Project Manager

Years in Practice
13 years

Certifications
Nova Scotia Advanced Wetlands Delineator and Evaluator

Memberships
Nova Scotia Wetlands Delineation, Maritime College of Forest Technology

Education
- BSc. (Horticulture), Essex University (UK), 2003-2005

Training
- Wetland Functional Assessment Training Workshop, NSE 2013
- Urban Wetland Restoration: A Watershed Approach, 2012
- Nova Scotia Advanced Wetlands Delineation and Evaluation Course, 2010;
- Water Management and Wetland Restoration Training Course, 2014;
- Identifying and Delineating Wetlands for Nova Scotia, 2009
- Watercourse Alteration Certification (Nova Scotia Environment) (2008)
- Wetland Ecosystem Services Protocols (Freshwater, Tidal) – Nova Scotia / New Brunswick, 2016
- Saint John Ambulance Emergency First Aid, AED, CPR(C). 2016

Summary
Mr. Walter is a trained biologist and wetland specialist, and has extensive experience managing technical biophysical projects within Atlantic Canada. Mr. Walter is knowledgeable in federal, provincial, and municipal environmental regulations and guidelines applicable to Atlantic Canada, and works closely with all necessary regulatory agencies to facilitate project implementation. As senior project manager, Mr. Walter ensures biophysical field programs are tailored to the needs of the client and project, while meeting regulatory standards. Mr. Walter has provided environmental support to the planning process in a wide range of project types including residential development, industrial projects (mining, pit and quarry), transmission line and hydro dam infrastructure and highway construction to name a few. Mr. Walter has managed the environmental processes associated with multiple wind energy developments in Nova Scotia, including compilation of provincial environmental assessment (EA) documents, public and First Nation engagement and consultation and implementation of associated EA biophysical field surveys required to support regulatory permitting.

As a trained field biologist, Mr. Walter utilizes his extensive experience completing technical field programs to lead a team of biologists in support of his ongoing project portfolio. Mr. Walter's previous technical experience includes completion of terrestrial and aquatic habitat assessments including desktop reviews and characterization of biophysical environments. Mr. Walter also completes numerous fish habitat/watercourse assessments for effects monitoring, watercourse alteration, and HADD authorization projects. As a qualified wetland delineator and wetland function evaluator for Atlantic Canada, Andy has completed delineation of hundreds of wetlands. Projects often involve the completion of species at risk assessments, functions assessments, and detailed wetland characterization in support of provincial wetland alteration applications. Mr. Walter has designed and implemented multiple large and small-scale wetland monitoring programs throughout Atlantic Canada.

Mr. Walter is a wetland restoration professional and manages the identification and implementation of wetland restoration, enhancement, expansion and creation projects. This includes reviewing of databases, mapping, and aerial imagery, ground truthing and consultation with local environmental groups and government to identify potential restoration opportunities. Mr. Walter engages with landowners to secure land for restoration projects and manages the construction and monitoring of these initiatives to meet regulatory requirements.

Project Experience
- Management and implementation of wetland restoration projects including a 20 hectare and 12-hectare agricultural wetland restoration project in NS.
- Planning and feasibility studies for a floodplain and a shrub/treed swamp wetland restoration project in NS (2020-ongoing).
- Managing, and currently in the process of implementing a new wetland functional assessment tool for use in Nova Scotia. This Project included the collection of baseline wetland information across Nova Scotia by completing 125 wetland functional assessments using the Wetland Ecosystem Services Protocol (WESP). This project was completed in collaboration with Nova scotia Environment and Dr. Paul Adamus (developer of the WESP-AC).
- Managing four Provincial Environmental Assessments (baseline surveys, effects assessment and mitigation) for quarry expansion projects, NS (2018 - 2020).

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Andy Walter, BSc. (Hort)
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Senior Project Manager

- Managing a Provincial Environmental Assessment (baseline surveys, effects assessment and mitigation) for new quarry development in Coclchester County, NS (2019-ongoing).
- Design and implementation of extensive wetland post-construction monitoring projects associated with mine and highway development (2016-ongoing).
- Managing environmental CEAA screening and associated wetland and watercourse alteration permits for the Paqtnkek Interchange Project for NSTIR (2014-2018).
- Managing a Provincial Environmental Impact Assessment for a proposed 20MW wind Project in New Brunswick.
- Managing an environmental screening and associated wetland and watercourse alteration permits for the NSTIR Highway 102/103 Interchange project (2016-2018.
- Management and completion of terrestrial habitat mapping, wetland delineation and vegetation surveys in support of EA and regulatory permitting for the South Canoe Wind Project (80MW wind Project in Nova Scotia) 2011-2014.
- Management of a multi-faceted avian study in support of a provincial EA at Aulds Cove, NS.
- Project management, regulatory consultation and associated environmental considerations related to multiple proposed development projects throughout NS.
- Completion of six provincial environmental assessments and baseline surveys for community wind projects in Nova Scotia in 2012-2014.
- Terrestrial habitat mapping, wetland delineation and vegetation surveys in support of a 65km distribution transmission line in central Nova Scotia.
- Utilization of the WESP-AC wetland functional assessment tool in > 100 wetlands across Nova Scotia in support of regulatory wetland alteration permitting, provincial and federal environmental assessment and wetland monitoring. (2016 – 2021).
- Wetland delineation, species at risk, watercourses and flora surveys at the site of a proposed quarry in Nova Scotia. Subsequent facilitation of wetland alteration permit to alter in excess of 20 hectares of wetland.
- Implemented the passive wetland restoration strategy at a disturbed wetland on NSDNR property. Completed regular monitoring of vegetation, soil, and hydrology conditions and developed project recommendations accordingly (2009-2011).
- Wetland delineation, species at risk, watercourses and flora surveys at the site of a proposed 22km railway line and shipping container terminal in eastern Nova Scotia (2012-2014).
- Completion of wetland delineation and watercourse identification and associated regulatory permitting at multiple developments in Nova Scotia (2009-2016)

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Andy Walter, BSc. (Hort)
andy@mccallumenvironmental.com
Senior Project Manager

Work Experience

Strum Environmental Services Ltd., Nova Scotia 2008-2015

Environmental Specialist/Project Manager- provided project management expertise for development clients across Atlantic Canada. Projects included environmental assessment, large scale commercial, residential and wind power developments, wetland and watercourse alteration projects, wetland compensation planning and implementation, wetland restoration and creation projects, avian studies, and regulatory consultation.

Melanie MacDonald, BSc. (ISAR & Bio), MREM
melanie@mccallumenvironmental.com

Years in Practice
16

Education
Masters of Resource and Environmental Management, Dalhousie University, 2009-2011

B.Sc. Advanced Major in Biology & Interdisciplinary Studies in Aquatic Resources, St. Francis Xavier University, 2001-2005

Training
- Avian Nest Sweeps & Monitoring, 2021
- Fish Habitat Restoration, In-stream Techniques, 2021
- Technical Writing Workshop, 2019
- Fish Habitat Assessments, 2019
- eDNA Methods, 2019
- Freshwater & Diadromous Fishes of New England, 2019
- Saint John Ambulance Standard First Aid, AED, CPR(C), 2019
- Field Hike Leader Certification, Basic and Winter modules, Outdoor Council of Canada, 2015 & 2018
- Wetland Ecosystem Services Protocol (WESP-AC) training, 2017
- WHMIS, 2017
- Electrofishing Crew Leader, 2015
- Wetland Delineation Certification, 2013
- Small Vessel Operator Proficiency & Marine Emergency Duties A3 certified, 2006

Summary
Ms. MacDonald has been in the environmental consulting profession since 2005. She has worked on both project and research related field assessments primarily in Nova Scotia and Alberta. She is responsible for completing biophysical assessments and ecological inventories, including flora and fauna surveys, avian surveys, and species at risk evaluations, primarily for clients in the energy, mining, and commercial development sectors.

Ms. MacDonald is a senior ecologist, highly skilled at completing ecological habitat assessments via geo-spatial desktop review (GIS), and implementation of field studies. During the past nine years of her career, Ms. MacDonald has gained extensive experience completing habitat and ecological integrity studies across the Nova Scotia landscape. Her in-depth knowledge of Nova Scotia flora and fauna has provided her with the tools to effectively determine habitat uniqueness, and ecological sensitivity.

Ms. MacDonald coordinates all McCallum field biologists required to complete all environmental baseline and ecological inventory programs for Provincial and Federal Environmental Assessment registration. Ms. MacDonald has been responsible for the implementation of more than ten environmental baseline programs for mining, quarry development and energy sector development projects in Nova Scotia in advance of environmental assessment registration. In addition, Ms. MacDonald has been largely responsible for communicating the results of baseline environmental conditions to industry and project related stakeholders. Her effective communication skills, broad technical knowledge and personable demeanor has furthered her involvement in multiple community liaison committees, and other community organizations.

Selected Project Experience
- Completion of environmental baseline surveys for the federal environmental assessment process for proposed development of four separate gold mines in eastern Nova Scotia from 2015-2020.
- Completion of avian surveys, including baseline studies, post-construction studies and pre-construction nest searches for over ten projects, such as mines, quarries, wind power projects and residential development.
- Completed baseline fish and fish habitat survey study design and analysis for four proposed gold mines in eastern Nova Scotia. Three of these projects have triggered the federal EIS process, and three will require authorization for Harmful Alteration, Disruption and Destruction of fish habitat under the *Fisheries Act*, and associated offsetting. The evaluations completed at each of these sites involved detailed evaluations of fish passage barriers, and detailed evaluation of the Projects potential direct and indirect effects on fish and fish habitat.
- Completed baseline studies on 125 wetlands across the province to implement a new wetland functional assessment technique (WESP-AC) to the Nova Scotian regulatory landscape.

McCallum Environmental Ltd.

Melanie MacDonald, BSc. (ISAR & Bio), MREM
melanie@mccallumenvironmental.com

Experience

McCallum Environmental Ltd., Halifax, Nova Scotia

Senior Ecologist & Field Coordinator
May 2011-Present

- Completing biophysical assessments, including flora and fauna surveys, with emphasis on species at risk.
- Leading a team to complete wetland and watercourse delineations and functions assessments.
- Extensive fish and fish habitat assessments to support *Fisheries Act* authorization applications and associated offsetting programs.
- Communicating field survey results and effects assessments for Environmental Assessments and other Provincial regulatory applications.
- Instructed Wetland Delineation course with Fern Hills Institute, Summer 2016-2019.

Amec Colt, Shell/Albian Sands Expansion 1 - Fort McMurray, Alberta.

Environmental Specialist and Area Environmental Lead
July 2008 – October 2009.

- Proactively monitored construction activities via inspections, audits and Environmental Work Permits & Protection Plans to ensure compliance with regulatory approvals, the projects' Environmental Control Plan, and best management practices. Investigated and reported incidents, and liaised between contractors and project owners. Implemented Environmental Awareness training programs and communicated issues via weekly newsletters.

Canadian Natural Resources Ltd. - Fort McMurray, Alberta

Regulatory and Environmental Specialist October 2005 – July 2008

- Conducted extensive field work in various fish and wildlife programs. Communicated issues with government agencies, contractors and external stakeholders. Performed on-call duties, spill response, and non-compliance reporting and response. Expanded upon site wide procedures for protection of water, wildlife and waterbirds.
- Chaired the regional 'Oil Sands Bird and Wildlife Protection Committee'.
- Acted as the clients' field lead in planning & completion of a fish salvage of 38 km of the Tar River, and in construction of a 77 hectare fish habitat compensation lake (Horizon Lake). Horizon Lake earned the CAPP Steward of Excellence Award for Environmental Performance (2009).

Jeff Bonazza, BSc., M.Env.Sci
Jeffb@mccallumenvironmental.com

Years in Practice
6

Education
Master of Environmental Science, *Memorial University of Newfoundland,* 2015

B.Sc. Major in Biology, *St. Francis Xavier University,* 2010

Certifications
- Wetland Plants and Delineation, Fern Hill Institute
- Backpack Electrofishing, Canadian Rivers Institute
- Project Management Planning Course, Environmental Project Management & Sustainability Solutions

Training
- Brook Floater Virtual Workshop, Fisheries and Oceans Canada Species at Risk Program, Jan. 19-20, 2021
- Land Bird Species at Risk in Forested Wetlands Workshop, Jan. 2018
- Technical Writing for Professionals, Natural Resource Training Group, July 2019
- Fish and Fish Habitat Characterization,

Experience

Mr. Jeff Bonazza has been in the environmental consulting professions since 2015, after completing a master's degree in environmental science. He has managed projects, authored reports, and conducted regulatory and First Nations consultation. Mr. Bonazza has worked as a field biologist on projects throughout Atlantic Canada as well as in western Canada and Ontario. In this role Mr. Bonazza has conducted surveys including; bird surveys, wildlife surveys, evaluation for Species at Risk, herpetofaunal and reptile evaluations, wetland functional assessment, wetland delineation, fish habitat characterization and electrofishing.

McCallum Environmental Ltd., Halifax, NS
Project Coordinator
Dec. 2016 - Present
- Project management
- Report writing
  - Federal Environmental Impact Statements, Provincial Environmental Assessments, Species at Risk permitting, wetland alteration applications etc.
- Regulatory and First Nations consultation
- Design and lead field programs
  - Flora and fauna surveys, Species at Risk assessments, wetland delineation, wetland functional assessment (WESP-AC completed on >50 wetlands in NS), etc.
- Create maps using ArcGIS
- Projects:
  - NextBridge Infrastructure LP.
    - Species at Risk permitting.
  - Atlantic Mining Nova Scotia
    - EIS reporting, wetland alteration applications, field surveys.
  - Zutphen Resources
    - Environmental Protection Plan, reporting and permitting requirements.
  - Bio Design Earth Products
    - Environmental Assessment registration.

McCallum Environmental Ltd., Halifax, NS
Environmental Coordinator
Sept. 2015 – Dec. 2016
- Environmental monitoring
  - Regulatory advising, spill response, erosion/sediment control, wildlife monitoring, water quality monitoring, and reporting on construction activity.
- Provided field support for flora and fauna surveys, Species at Risk assessments, and wetland delineation/functional assessment.
- Report writing (monitoring reports, wetland alteration applications).
- Created maps using ArcGIS
- Projects

Jeff Bonazza, BSc., M.Env.Sci
Jeffb@mccallumenvironmental.com

Natural Resource Training Group, July 2019
- Standard First Aid AED CPR "A", St. John Ambulance, Dec. 2017
- Geographic Information System (GIS) Training, ESRI, Feb. 2015
- WHMIS, CCOHS, March 2018
- PADI Open Water certified scuba diver, Nov. 2010
- MED A1, Canadian Sailing Expeditions Inc. and Transport Canada, May 2008

- Valard Construction
  - Environmental coordinator for Muskrat Falls Transmission Line in Newfoundland and Labrador.
- Terra Firma Development Corp
  - Reporting and permitting requirements.

Memorial University of Newfoundland, St. John's, NL
Research Assistant
2014- 2015
- Conducted a literature review investigating the role of predator/prey interactions of freshwater fish in Ontario.
- Developed a food web of piscivorous fish species in Ontario.

Agriculture and Agri-Food Canada, Truro, NS
Research Technician
2011- 2014
- Entered and analyzed scientific data
- Conducted quadrat sampling and botanical separation
- Prepared samples for analysis
- Operated specialized laboratory instruments
- Supervised and trained laboratory visitors and volunteers
- Assisted research scientists and graduate students in their research

McCallum Environmental Ltd.

John R. Gallop, B.Sc., P. Biol
john@mccallumenvironmental.com

Years in Practice
6

Education
B.Sc. (Honours, Biology), Waterloo University, 2008-2011.

Designations
A professional Biologist (P.Biol) with the Alberta Society of Professional Biologists (ASPB)

Training
- Old Growth Lichens with a Focus on Calicioids
- Common Lichens of North East North America
- Alberta Wetlands: From Classification to Policy by Aquality Environmental Consulting
- Saint John Ambulance Standard First Aid, AED, CPR(C), 2018
- Electrofishing Online Training Course and Field Practicum by Canadian River Institute and College of Extended Learning at University of New Brunswick.

Summary

Mr. Gallop has been in the environmental consulting profession since 2014. He has worked on both project and research related field assessments in Nova Scotia, Alberta and Saskatchewan and is a well-rounded ecologist with strengths in vascular flora, lichens, avian and aquatic ecology.

Mr. Gallop is responsible for survey design/implementation, and project management of biophysical assessments/reporting, including flora and fauna surveys, aquatic surveys (wetlands, watercourses and fish surveys), avian surveys, and Species at Risk evaluations, primarily for clients in the energy, mining, and commercial development sectors.

Selected Project Experience

- 6 years of experience delineating wetlands throughout Atlantic Canada and Western Canada.
- Lead Ecologist and report writer for several proposed wind and solar projects in Alberta and Saskatchewan. Responsible of survey design, Environmental Assessment writing and project management.
- Completion of ungulate and other wildlife surveys for a variety of projects.
- Four years experience surveying rare lichens and lichen diversity for industry and not for profit organizations.
- Completion of environmental baseline surveys for the federal environmental assessment process for proposed development of several gold mine projects in eastern Nova Scotia in 2016 - 2020 in Nova Scotia
    - Lichen surveys
    - Rare vascular plant surveys
    - Wetland delineation and functional assessment
    - Fish habitat surveys and electrofishing
    - Wildlife surveys
    - Avian surveys
- Completion of wetland delineation, watercourse identification and vegetation assessments of several large-scale developments (wind and mining) in Saskatchewan and Nova Scotia in 2015 - present.

Experience

McCallum Environmental Ltd., Halifax, Nova Scotia
Intermediate Environmental Scientist:
April 2016-Present
- Completing biophysical assessments, including flora (vascular plants and lichens) and fauna surveys, with emphasis on species at risk. Completing wetland and watercourse delineations and assessments and coordinating migratory bird monitoring.

John R. Gallop, B.Sc., P. Biol
john@mccallumenvironmental.com

- Communicating field survey results and methodologies for Environmental Assessments and other Provincial regulatory applications.
- Project Coordination and responsible of survey design for a variety of projects throughout Canada. Responsible for authoring Environmental Assessment documents, Technical Proposals, Wetland Alteration Applications and project budgeting.

Basin Environmental LTD., - Edmonton, Alberta.
Environmental Technologist

September 2014 – February 2016.

- Utilized the Alberta Wetland Classification system to assess wetlands and the Wetland Rapid Evaluation Tool to determine compensation required for impacts to classified wetlands.
- Aerially interpreted and delineated wetlands.
- Conducted species at risk background searches and field visits.
- Conducted pre-disturbance assessments for oil and gas activities, road improvements and residential developments, including: watercourses/waterbodies, soil profiling, vegetation, wildlife, eco-sites and timber volumes.
- Prepared reports for a variety of assessments, including: wetlands, pre-disturbance, bio-physicals, fish habitats for access road watercourse crossings, EAP/EFR supplements and applications.
- Monitored the water quality of horizontal directional drilling on fish bearing permanent watercourses.
- Assisted surveyors and construction engineers on-site in the design of oil and gas well leases and facilities, pipelines and access roads to ensure compliance with EAP Standards and Guidelines.

Emma Posluns, MSc.
emma@mccallumenvironmental.com

Years in Practice
6

Education

B.Sc. (Geography), University of Victoria, 2005-2009.

M.Sc. (Environmental Science), Memorial University of Newfoundland and Labrador, 2010-2013.

Training

- Gender Based Analysis+ Training, 2020
- Watercourse Identification, 2019
- Technical Writing, 2019
- Backpack Electrofishing Certification, 2018
- At-Risk Landbird Identification Workshop, 2018
- Saint John Ambulance Standard First Aid, AED, CPR(C), 2017
- Wildlife Awareness training – 2015
- W.H.M.I.S – 2015
- Geographic Information System (GIS) Training, ESRI – 2013
- Facilitation Skills for Technical Professionals, Dalhousie University – 2017

Summary

Ms. Posluns has been in the environmental consulting profession since 2015. She has worked on both project related and research related field assessments in Nova Scotia.

Ms. Posluns is responsible for completing biophysical assessments, including wetland delineation, characterization, and functional assessment, flora and fauna surveys, avian surveys, aquatic surveys, wetland monitoring and species at risk evaluations, primarily for clients in the energy sector, mining sector, and commercial development sector. Ms. Posluns has been responsible for the management of field data for multiple, large-scale initiatives in Nova Scotia, including a provincial infrastructure project and a mining development.

Selected Project Experience

- Utilization of the Wetland Ecosystem Services Protocol – Atlantic Canada (WESP-AC) wetland functional assessment tool in > 250 wetlands across Nova Scotia in support of regulatory wetland alteration permitting, provincial and federal environmental assessment and wetland monitoring (2016 - 2021).
- Responsible for technical writing for multiple federal and provincial level Environmental Assessments.
- Conducted migratory bird surveys, winter wildlife assessments, and species at risk searches for federal and provincial infrastructure projects.
- Lead wetland delineation programs, conducted functional wetland assessments, completed watercourse identification and vegetation assessments for multiple large-scale developments in Nova Scotia.
- Trained incoming staff in the use of provincially recognized wetland functional assessment tool, WESP-AC.
- Coordinated spatial data organization, performed GIS analysis, and created dynamic maps for a variety of projects.

Experience

McCallum Environmental Ltd., Halifax, Nova Scotia

Environmental Scientist:
June 2017-Present

- Completing avian surveys and other biophysical assessments, with emphasis on species at risk.
- Leading wetland and watercourse delineations and functional assessments and coordinating data management and Geographical Information Systems (GIS).

Emma Posluns, MSc.
emma@mccallumenvironmental.com

- Communicating field survey results and methodologies for federal and provincial Environmental Assessments and provincial regulatory applications.
- Preparing Phase 1 Environmental Site Assessments.

CBCL LTD., Halifax, Nova Scotia
Environmental Scientist
September 2015 – April 2017.

- Completed migratory bird point count surveys and nocturnal owl surveys, while efficiently and effectively following protocols.
- Created GIS maps for over 20 projects, including six 100-page map books, effectively visualizing contaminated sites, ecologically sensitive habitats, and urban development.
- Aerially interpreted and delineated wetlands.
- Conducted species at risk background searches and field visits.
- Prepared reports for a variety of assessments, including permit applications and Environmental Management Plans.
- Assisted with marine water quality sampling.

OceanCanada Partnership, Halifax, Nova Scotia
Environmental Scientist
September 2015 – April 2017.

- Facilitated community meetings and provided expertise to help a group with local area development planning.
- Conducted interviews and community-wide surveys of a rural fishing village to create a database of local assets.
- Summarized findings of community assets into an accessible written document.
- Lead a marine-monitoring program in an ecologically sensitive bay, coordinating 15 volunteers in fieldwork, identifying and assessing eelgrass health and distribution, sample collection, and data entry.
- Investigated social, ecological, and economic changes within coastal communities to make suggestions on future development.

Saint Mary's University, Halifax, Nova Scotia
Professor of Geography
August 2015 – April 2016.

- Explained technical environmental information clearly and concisely to Canadian and International students, ensuring all students had a supportive learning atmosphere.
- Designed new course material that engaged students and enhanced their learning experience.
- Worked with students one-on-one to solve conflicts.

Regional District of North Okanagan, Vernon, British Columbia
Water Sustainability Coordinator
2013 – 2014.

Emma Posluns, MSc.
emma@mccallumenvironmental.com

- Worked under the BC Water Act and maintained a comprehensive understanding of provincial and local policy, regulations, and bylaws.
- Compiled and analysed large datasets, assessing trends, and informing local policy.
- Effectively communicated with team members.

Meaghan Quanz, B.Sc. M. Env. Studies
meaghan.q@mccallumenvironmental.com

Years in Practice
2

Education
Master of Environmental Studies, *Dalhousie University,* 2019

B.Sc. Major in Ecology, *University of Waterloo,* 2016

Diploma in Ecological Restoration and Rehabilitation *University of Waterloo,* 2016

Training
- Standard First Aid AED CPR "C", Red Cross, Jan. 2020
- WHMIS, CCOHS, Jan. 2020
- Pleasure Craft Operator, Jan. 2014

Experience

Ms. Meaghan Quanz has been in the environmental consulting profession since January 2020, after completing a master's degree in Environmental Studies in 2019. She primarily performs environmental monitoring for a variety of large and small-scale development, construction and exploration initiatives, as well as project related field assessments across Nova Scotia, Canada.

Ms. Quanz has worked as a research assistant on projects throughout Ontario and Alberta. Ms. Quanz has conducted surveys including; wetland flora surveys, groundwater and surface water chemistry, aquatic macroinvertebrate surveys, and carbon flux monitoring.

McCallum Environmental Ltd., Halifax, NS
Junior Environmental Scientist
January 2020 - Present
- Environmental monitoring of resource exploration programs and construction projects
  - Regulatory advising, spill response, erosion/sediment control, wildlife monitoring, water quality monitoring, and reporting on construction activity.
- Report writing
  - Monitoring reports, Crown Land use applications, wetland alteration applications, water withdrawal applications
- Conducted fauna surveys, winter wildlife surveys, water quality sampling and surface water flow sampling
- Delineated wetlands, conducted functional wetland assessments, completed watercourse identification and vegetation assessments for multiple developments in Nova Scotia
- Utilization of the WESP-AC wetland functional assessment tool in 5 wetlands across Nova Scotia in support of regulatory wetland alteration permitting, provincial and federal environmental assessment and wetland monitoring (2020 – 2021)

Dalhousie University, Halifax, NS
Thesis Research
2017-2019
- Collected sediment, surface water and dragonfly larvae tissue from wetlands surrounding a wastewater treatment facility for analysis of select contaminants

- Followed the CABIN Wetland protocol to analyze wetland macroinvertebrate communities
- Analyzed data in Minitab® and RStudio® and created graphs of the data in SigmaPlot®

University of Waterloo, Waterloo, ON
Research Assistant
2013- 2015

- Involved in projects centered around wetland restoration and creation in the oil sands regions of Fort McMurray, Alberta, and river geochemistry in Waterloo Region, Ontario
- Completed upland vegetation surveys, natural saline fen vegetation surveys, groundwater chemistry and transect vegetation surveys
- Conducted daily transect data collection on soil moisture, ground temperature, frost depth and water table height, as well as monthly leaf area index collection at the Suncor fen creation site and surrounding reference wetlands
- Collected and tested surface water and groundwater samples for parameters such as phosphorus, nitrate, and dissolved gases, and studying changes due to anthropogenic influences

Exp, Brampton, ON
Environmental Scientist
2015

- Sampled various media, including water and sediment, for Phase I and II environmental assessment projects in the Greater Toronto Area
- Input data and completed writing for sections of final reports

Jillian Saulnier, M.Sc.
jillian@mccallumenvironmental.com

Years in Practice
11

Education
Master of Science (MSc), Department of Plant, Food, and Environmental Science, *Dalhousie University*, 2019

Ecosystem Management Technician, *Fleming College*, 2009

Bachelor of Science (Agr), *Nova Scotia Agriculture College*, 2007

Training
- Emergency First Aid AED CPR "C", Red Cross
- WHMIS
- Introduction to OH&S
- Wilderness and Remote First Aid
- Electrofishing
- Swiftwater Recuse
- Watercourse Alternation Sizer Certification
- Culvert Assessment Training
- Stream Restoration Techniques Training

Experience

Mrs. Jillian Saulnier has been in the environmental profession for over 10 years. Her experience ranges from developing and implementing species-at-risk and stream restoration projects, project management, conducting environmental farm assessments, facilitating environmental educational programs, and Indigenous engagement and consultation.

Mrs. Saulnier started with McCallum Environmental since May 2021. She primarily performs environmental monitoring such as water quality sampling, wetland delineation, watercourse assessments, fish and fish habitat assessments, and construction monitoring for a variety of large and small-scale development, construction and exploration initiatives across Nova Scotia, Canada.

McCallum Environmental Ltd., Halifax, NS
Jr. Biologist
May 2021 - Present

- Environmental monitoring of transmission line construction project
  - Regulatory advising, spill response, erosion/sediment control, wildlife monitoring, water quality monitoring, and reporting on construction activity.
- Report writing
  - Monitoring reports, Crown Land use applications, wetland alteration applications, water withdrawal applications.
- Conducted fauna surveys, water quality sampling and surface water flow sampling.
- Conducted watercourse assessments.
- Conducted fish and fish habitat assessments including electrofishing and fish rescue during construction.
- Completion of wetland boundary determination and characterizations for regulatory wetland alteration permitting.

Confederacy of Mainland Mi'kmaw, Mi'kmaw Conservation Group, Truro, NS
Species at Risk Project Lead, Gulf Region
May 2020 – April 2021

Jillian Saulnier, M.Sc.
jillian@mccallumenvironmental.com

- Stormwater Management
- Wet-Pro Certification, CURA H2O
- Project Wild, Canada Wildlife Federation

- Develop creative and effective ways to present and share research findings to Mi'kmaw youth, community members, and stakeholders in a clear and concise manner,
- Liaise and develop working relationships with researchers, non-government organizations, government, and educators in aquatic resource and oceans management,
- Develop and conduct Mi'kmaw Ecological Knowledge interviews with community members at Pictou Landing First Nation,
- Conduct literature reviews on Atlantic salmon habitat requirements and population status in the Southern Gulf of Saint Lawrence,
- Install water temperature tools in streams to later collect and analyze,
- Collect water quality parameters according to prescribed procedures, processes, and standards,
- Conduct habitat assessments at selected sites,
- Keep accurate and organized records of site visits and data collected using Excel spreadsheets,
- Assist with surveys for Atlantic salmon and analyze data,
- Organize a focus working group and presentation with stakeholders to address watershed concerns and environmental monitoring (past and current) for Atlantic salmon in the Gulf Region,
- Design, implement and produce reports related to watershed monitoring programs,
- Develop baseline monitoring plans to ensure that data and information related to monitoring and natural heritage is accessible and secure,
- Provide technical support to Pictou Landing First Nation Fisheries as required,
- Maintain a current working knowledge of relevant government environmental and resource management policy, biological science and principles, natural resource management and watershed stewardship, related to the protection of aquatic ecosystems, and
- Manage budget for project.

Department of Lands and Forestry, Shubenacadie, NS
Nature Interpreter (Seasonal)
May 2016 – May 2020

- Deliver environmental education programs to students, youth, community groups and the general public on topics related to wildlife, ecology, waste, and conservation,

Jillian Saulnier, M.Sc.
jillian@mccallumenvironmental.com

- Develop and deliver interpretive program, such as environmental summer camps,
- Conduct wetland tours,
- Perform daily reptile care,
- Collect and identify aquatic invertebrates,
- Assist with planning and coordinating special events,
- Conduct outreach presentations to schools,
- Design and conduct interpretive activities,
- Research and create interpretive material such as signs and displays.

Nova Scotia Federation of Agriculture, Truro, NS
Environmental Farm Plan Coordinator (EFP)
Sep 2014 – Dec 2015

- Conducted site visits, assessed environmental risks, developed recommendations to reduce risk and generated Environmental Farm Plan reports for farms across Nova Scotia,
- Collected ground and surface water samples,
- Managed database server,
- Provided support materials and guidance regarding issues to farmers,
- Generated monthly, quarterly, and annual reports,
- Assisted with workshops, seminars, and tradeshows,
- Wrote articles for the Federation,
- Organized and managed Environmental Stewardship Award,
- Reviewed provincial programs,
- Mitigated issues for farmers,
- Researched agricultural best management practices.

Mi'kmaw Conservation Group, Confederacy of Mainland Mi'kmaw, Truro, NS
Project Coordinator
June 2014 – Sep 2014

- Worked towards enhancing the health of the Bay of Fundy Watershed,
- Responded to environmental emergencies (effluent spill-contaminated site) by taking soil and water samples,
- Initiated research activities and studies in collaboration with First Nations, Government agencies and private sector,
- Prepared research proposals,
- Developed methods to improve the biodiversity and water quality of two sites in Pictou Landing First Nation,
- Coordinated litter and stream clean-ups with youth and the community,
- Restored riparian habitat,

- Replaced and repaired stream restoration structures,
- Installed in-stream restoration structures,
- Designed signs to discourage illegal dumping in Pictou Landing First Nation,
- Submitted monthly reports to supervisor on program deliverables and success,
- Researched and gathered information regarding waste issues and concerns in the community,
- Liaised with and developed working relationships with partners and stakeholders,
- Created restoration report.

Shubenacadie Watershed Environmental Protection Society (SWEPS), Shubenacadie, NS
Water Coordinator (Part time)
June 2013 – Dec 2013

- Assisted with development of brochure containing water quality impact and protection information,
- Conducted survey (qualitative and quantitative data) on water quality and septic system history with residents and businesses within a specified area along a portion of the Shubenacadie River System,
- Managed and analyzed data and interpret results from survey,
- Enhanced the community's and project partners' (SWEPS, Clean Nova Scotia, Halifax Water, Municipality of East Hants, and Nova Scotia Environment) relationship,
- Provided data to assist community, municipal and provincial governing agencies develop their watershed management strategies and plans,
- Provided outreach to local groups, schools and business on water quality,
- Carried out project planning and reporting,
- Assisted in original proposal writing for the project.

Shubenacadie Watershed Environmental Protection Society (SWEPS), Shubenacadie, NS
Stream Restoration Coordinator (Summer)
June 2012 – Aug 2012

- Developed full-scale project plans and associated communications documents,
- Effectively communicated project expectations to team members and stakeholders in a timely and clear fashion,
- Communicated with project funders (Adopt-a-Stream, Clean Nova Scotia Youth Conservation Corps, and Halifax Water) on project goals,

Jillian Saulnier, M.Sc.
jillian@mccallumenvironmental.com

- Estimated resources and participants needed to achieve project goals as well as purchase material,
- Drafted and submitted budget proposals, and recommended subsequent budget changes where necessary,
- Conducted field monitoring and water quality sampling for pH, temperature and dissolved oxygen (included operation and interpretation of a multi-probe water quality meter),
- Conducted interviews for student hiring through Clean Nova Scotia Youth Conservation Corps,
- Developed Water Monitoring schedule,
- Reported scientific and technical information to the public in writing and through presentations at training sessions, public events and monthly meetings,
- Provided scientific and technical guidance to the students, volunteers and the community,
- Processed and reviewed environmental permits, licenses and related materials,
- Reviewed environmental policies, regulations and guidelines to ensure they comply with appropriate requirements,
- Researched stream restoration structures and procedures,
- Submitted weekly and summer reports on program deliverables and success,
- Installed stream restoration structures,
- Operated GPS units and downloaded collected data.

Clean Nova Scotia (CNS), Dartmouth NS
Project Coordinator programs
Oct 2010 – Oct 2011

- Established and maintained relationships with stakeholders, funders and committee groups,
- Administered financial budgets ($25,000-$40,000),
- Provided report to funders,
- Researched common issues related to freshwater quality, solid and wastewater effects on the environment,
- Contacted teachers and youth leaders to promote program elements and booked presentation,
- Created hands-on classroom and outdoor activities (riparian planting),
- Assisted in stream restoration assessment and Electric Fishing activity.
- Communicated extensively with residents involved in a clean–up project,
- Directed, planned and coordinated clean-up events with communities and volunteers,
- Delivered public speeches and development advertisements,

Jillian Saulnier, M.Sc.
jillian@mccallumenvironmental.com

- Provided tools and resources to public regarding litter concerns,
- Successfully raised funding for environmentally friendly prizes for program,
- Oversaw data entry including registrations and information following a clean-up event,
- Provided report to funders.

Environment Canada, Dartmouth NS
Pesticide Research Technician
May 2009 – Sep 2010

- Oversaw management of financial planning, budget, fieldwork design,
- Developed relationships and agreements with stakeholders such as liaising with staff at the Atlantic Veterinary College to coordinate the birds' housing and care at the college and with Prince Edward Island Potato growers to ensure all arrangements for the project coincide with the timing of pesticide applications,
- Ensured all required permits and approvals were in place,
- Provided assistance and structure in the field during design set up, sampling apparatus, collection of samples and demobilization of field gear upon completion of project,
- Conducted fieldwork independently and in a team setting during data collection and sampling,
- Handled, weighed and observed behaviors of birds in housing at the college and in the field,
- Completed Canadian Animal Care Committee application for the approval of the Department representative,
- Developed description of project design and scope,
- Completed Standing Operation Procedure reports following each field trail,
- Communicated project design in the field to professionals, technical staff and students,
- Provided strategic advice to managers and staff when developing project design.

McCallum Environmental Ltd.

Jose Mulino, B.Sc., B.I.T.
jose@mccallumenvironmental.com

Years in Practice
5

Education
B Sc in Environmental Science, *Mount Royal University, 2020*

Environmental Coop Diploma, *Keyano College, 2014*

B Sc in Veterinary Medicine, *Universidad Central de Venezuela, 2010 (not completed)*

Memberships
- Alberta Society of professional Biologists

Training
- Bear Awareness and Avoidance
- Electrofishing Certification
- Emergency First Aid
- Swiftwater rescue
- Transportation of Dangerous Goods
- Standard First Aid, Aug 2019
- Pleasure Craft Operator
- Supervising Ground Disturbance
- Supervising for Safety
- Pipeline Construction Safety Training (PCST)
- Navigation Through Environmental Law (2015)

Experience

Jose Mulino has been in the environmental profession since 2015. Mr. Mulino coordinated and supported projects related to water quality monitoring, air quality, geotechnical construction monitoring, geotechnical sampling, and wildlife surveys. He was responsible for collecting data and documentation related to field activities. He is a detailed-oriented and organized individual with experience in report writing and statistical data analysis through excel and SPSS. Mr. Mulino has also worked in field activities where driving an ATV and trailering was necessary. Jose's tenure in the oil and gas industry also gives him a sound experience in health and safety standards and procedures.

McCallum Environmental Ltd., Halifax, NS
Environmental
January 2021 - Present
- Project Coordination responsibilities
- Water quality and water quantity data collection and monitoring
- Wildlife surveying activities
- Environmental and Geotechnical construction monitoring responsibilities, including pre-, during, and post- drilling activities
- Permit application and approvals for drilling monitoring activities
- Map production and spatial analyses (ArcGIS and QGIS)

Triton Environmental Consultants., Calgary, AB
Environmental Professional I
July. 2020 – January 2021
- Monitored drinking water parameters through data collection and analysis
- Assisted in water quality reporting, identifying sampling locations in the field, deploying, and retrieving water quality monitoring equipment.
- Liaise with clients to improve water quality monitoring on drilling activities

Wood Buffalo Environmental Association, Fort McMurray, AB
Terrestrial Environmental Effects Monitoring Technician
May. 2019 – Aug. 2019
- Prepared, deployed/retrieved, and maintained air and deposition sampling equipment (i.e. PASS, Denuder, IER's, PM_{10} and $PM_{2.5}$).
- Conducted maintenance of meteorological equipment and site infrastructure (access trails, helipads, plot markers, sampling equipment, etc.).
- Aided in data collection and maintenance of continuous air quality sampling equipment.
- Assisted scientists perform field experiments and studies in air quality, including a community engagement presentation in "Forest Health Monitoring in the Oil Sands"

Jose Mulino, B.Sc., B.I.T.
jose@mccallumenvironmental.com

Terracon Geotechnique, Fort McMurray, AB
Intermediate Environmental Technician
June 2015 – August 2018

- Project coordination of water quality monitoring activities
- Collected and analyzed Slope Inclinometers and vibrating wire piezometer data
- Monitored and reported tailings dyke stability to senior engineers
- Conducted pre-construction bird sweeps and amphibian salvage
- Analyzed data and prepared various records and reports related to water quality regulatory monitoring
- Monitored drinking water parameters using field equipment, such as pH, conductivity, and total dissolved solids meters

APPENDIX C. PRIORITY SPECIES LIST

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
VASCULAR PLANTS					
Silver Maple	*Acer saccharinum*			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).
Nova Scotia Agalinis	*Agalinis neoscotica*			S3S4	Grows in acidic soils in damp locations where there is little competition from shrubs, lakeshores and woods roads. Flowers late summer (Munro, Newell & Hill, 2014)
Purple False-Foxglove	*Agalinis purpurea*			S1	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).
Small-flowered Purple False Foxglove	*Agalinis purpurea var. parviflora*			S1	Sandy soils of stream and lake margins, bogs, and barren (NatureServe, 2021)
White Snakeroot	*Ageratina altissima*			S1	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)
Wild Chives	*Allium schoenoprasum*			S2	Wet meadows, rocky or gravelly stream banks and lake shores. Flowering June to August (Flora North America).
Narrow-leaved Wild Leek	*Allium tricoccum var. burdickii*			S1?	DISTRIBUTION NOT KNOWN IN NS. Dry soil in upland woods. Flowering early June (Flora North America).
Fernald's Serviceberry	*Amelanchier fernaldii*			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).
Nantucket Serviceberry	*Amelanchier nantucketensis*			S1	Found in disturbed habitats such as roadsides, fields, sand plains, riparian meadows and barrens (Munro, Newell & Hill, 2014). Bloom time April to May (Missouri Botanical Garden, nd)
Running Serviceberry	*Amelanchier spicata*			S3	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)

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
Northern Wild Comfrey	*Andersonglossum boreale*			S1	A generalist. along the borders of woods and thickets, along trails and pathways through woods, and within upland deciduous woods. It appears to prefer circumneutral or even calcareous areas. The soils are usually sandy or rocky (New York Natural Heritage Program 2005). Rare in open woods and roadsides (Rhoads and Block 2000). Borders, openings, and clearings or under dense shade in coniferous or mixed woods (fir, cedar, spruce, pine, birch, aspen, and occasionally beech and maple), especially in sandy or rocky soil (Voss 1996). Uplands woods (Gleason & Cronquist 1991). Rich woods and thickets (Fernald 1970). flowers of this plant begin to appear mid-May and persist into early July
Purple-stemmed Angelica	*Angelica atropurpurea*			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)
Yellow Bartonia	*Bartonia virginica*			S3	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.
Michaux's Dwarf Birch	*Betula michauxii*			S2S3	Limited to peat bogs. It flowers later than many, in July and August. Scattered localities from Brier Island, Digby Co., east to Guysborough, Cape Breton and Inverness counties (Munro, Newell & Hill, 2014).
Water Beggarticks	*Bidens beckii*			S3	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).
Small-spike False-nettle	*Boehmeria cylindrica*			S1	Understory herb of moist deciduous forests in Nova Scotia. Flowers from July - September. Elsewhere found in swamps. locally very abundant on the LaHave R from New Germany to Bridgewater , local on the Annapolis R at Kingston and there's one record from the Shubenacadie Wildlife Park (Munro, Newell & Hill, 2014)
Broad-Glumed Brome	*Bromus latiglumis*			S1	Floodplain (River or stream floodplains), forest, shores of rivers or lakes (Go Botany)
Marsh Bellflower	*Campanula aparinoides*			S3	Flowers in August. Rare, known from river banks, meadows and ditches. Northern, from Hants and Cumberland counties to Antigonish, with a single Cape Breton station. part shade, sun; wet meadows, swamps, along shores
Toothed Bittercress	*Cardamine dentata*			S1	rare species of calcareous swamps and fens

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
Large Toothwort	*Cardamine maxima*			S1S2	rich, moist forests. Floodplain (river or stream floodplains), forests, talus and rocky slopes
Lesser Brown Sedge	*Carex adusta*			S2S3	dry open forest or recent clearings (cutblocks) on acidic, gravelly soils. Frequent after fire. Flowering and fruiting from June to September (Munro, Newell & Hill, 2014)
Inflated Narrow-leaved Sedge	*Carex grisea*			S1	floodplain forest and deciduous woods (Munro, Newell & Hill, 2014)
Houghton's Sedge	*Carex houghtoniana*			S2S3	sandy soils, along roadsides. Sandy disturbed area.
Lapland Sedge	*Carex lapponica*			S1?	Sphagnum bogs, wet, nutrient-poor areas, mostly lowlands. Fruiting early summer. (Munro, Newell & Hill, 2014)
Hop Sedge	*Carex lupulina*			S3	Found in muck soils, in forests, swamps, swales and intervales. Flowers and fruits in June (Munro, Newell & Hill 2014)
a Sedge	*Carex normalis*			S1	Open, often wet, woods, thickets, meadows and roadsides. Fruiting early summer (Flora of North America, nd)
White-Tinged Sedge	*Carex peckii*			S2?	Dry or mesic slopes, mixed deciduous forests, rocky outcrops, old quarry. Flowering and fruiting from May - mid-July. So far known from White Rock, Kings Co., Rhodes Co., Lunenburg Co. and Halifax and the Pennants area, Halifax Co. (DAL herbarium only) (Munro, Newell & Hill 2014)
Plantain-Leaved Sedge	*Carex plantaginea*			S1	Rich, moist, deciduous or mixed deciduous-evergreen forests, on slopes along streams or along edges of moit depressions, southward in mountain gorges. Fruiting in spring (Flora of North America, nd)
Rosy Sedge	*Carex rosea*			S3	Grows in dry soils beneath deciduous forests and thickets. Flowers from May to early July.
Scirpuslike Sedge	*Carex scirpoidea ssp. scirpoidea*			S2	Moist alpine meadows, stream banks, and open rocky slopes, thin and rocky soils, rock outcrops, and talus slopes. Flowers June - August (DNR WA, nd)
Greenish Sedge	*Carex viridula ssp. brachyrrhyncha*			S1	Found along river and lake shores (Go Botany).
Long-leaved Panicgrass	*Coleataenia longifolia*			S3	Marshes, meadows and fields, shores of rivers or lakes (GO Botany).
Coastal Plain Panicgrass	*Coleataenia longifolia ssp. longifolia*			S3	Marshes, meadows and fields, shores of rivers or lakes (GO Botany).

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
Bastard's Toadflax	*Comandra umbellata ssp. umbellata*			S2	Found in swamps and bogs, rich mesic sites, dry, sandy or rocky soils, savannas, early successional forests. Flowers March - August (Flora of North America, nd)
Chinese Hemlock-parsley	*Conioselinum chinense*			S2	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).
Quebec Hawthorn	*Crataegus submollis*			S2?	Anthropogenic (man-made or disturbed habitats), forest edges, meadows and fields, shrublands or thickets. Flowers in June (GoBotany, nd).
Fleshy Hawthorn	*Crataegus succulenta*			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).
Fleshy Hawthorn	*Crataegus succulenta var. succulenta*			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).
Buttonbush Dodder	*Cuscuta cephalanthi*			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
Hop Flatsedge	*Cyperus lupulinus ssp. macilentus*			S1	Various well-drained, open places. Fruiting summer (Flora North America).
Small Yellow Lady's-Slipper	*Cypripedium parviflorum var. makasin*			S2	Mesic to wet fens, prairies, meadows, thickets, open coniferous, and mixed forest. Flowering in May to August (Flora of North America).
Lindheimer's Panicgrass	*Dichanthelium lindheimeri*			S1?	It is most commonly associated with sandy, ephemerally wet soils. Typical habitat include prairies, glades, streambanks, floodplains, and lake shores. Fruits from May to November (Royal Botanic Gardens).
Northern Ground-cedar	*Diphasiastrum complanatum*			S3S4	Infrequent, scattered through the Cobequid hills southwest to the Annapolis Valley and east to Cape Breton. Deciduous forests and brushy hillsides spreading out into abandoned fields. Anthropogenic (man-made or disturbed habitats) habitats, forest edges, forests, meadows and fields. Flowers from July to October (Minnesota Environment and Natural Resources Trust Fund, Go Botany and Munro et al., 2014).
Sitka Ground-cedar	*Diphasiastrum sitchense*			S3	Has been observed in Kings County to Northern Victoria County. Commonly found on alpine and subalpine barrens or wooded slopes in Northern Nova Scotia. Also found in anthropogenic habitats (man-made or disturbed habitats), meadows and fields. Subspecies: somewhat rare but widespread ground-cedar hybrid that frequently occurs in the absence of its parents. No sources that state specific flowering time, most likely during the general growing season in Nova Scotia: June to September (Go Botany and Munro et al., 2014).

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
Savin-leaved Ground-cedar	*Diphasiastrum x sabinifolium*			S3?	Has been observed in Kings County to Northern Victoria County. Commonly found on alpine and subalpine barrens or wooded slopes in Northern Nova Scotia. Also found in anthropogenic habitats (man-made or disturbed habitats), meadows and fields. Subspecies: somewhat rare but widespread ground-cedar hybrid that frequently occurs in the absence of its parents. No sources that state specific flowering time, most likely during the general growing season in Nova Scotia: June to September (Go Botany and Munro et al., 2014).
American Waterwort	*Elatine americana*			S1	Brackish or salt marshes and flats, lacustrine (in lakes or ponds), riverine (in rivers or streams), shores of rivers or lakes
Pale Spikerush	*Eleocharis flavescens*			S2S3	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).
Bright-green Spikerush	*Eleocharis flavescens var. olivacea*			S2S3	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).
Ovate Spikerush	*Eleocharis ovata*			S2?	Grows on muddy streamsides, streambeds, and lakeshores often in subisding water. Fruiting from May through October. (Munro, et al. 2014).
Hornemann's Willowherb	*Epilobium hornemannii ssp. hornemannii*			S3	Alpine or subalpine zones, cliffs, balds, or ledges, ridges, shores of rivers or lakes, swamps (GoBotany, nd). Flowers from June - September (Montana State, nd)
White-flowered Willowherb	*Epilobium lactiflorum*			S1?	Alpine or subalpine zones, cliffs, balds or ledges, shores of rivers or lakes (GoBotany, nd).
Common Scouring-rush	*Equisetum hyemale*			S3S4	Scattered, mostly from Digby County, through the Annapolis Valley, northward to Cape Breton. Grows in sandy, gravelly soil, on banks or in low areas; often in calcareous regions. Anthropogenic habitats (man-made or disturbed habitats such a ditches), swamps, floodplains shores of rivers or lakes (subspecies: similar - sandy slopes and roadsides, riverbanks, and borrow pits). No sources that state specific spore production time, most likely during the general growing season in Nova Scotia: June to September (Go Botany and Munro et al., 2014).
Marsh Horsetail	*Equisetum palustre*			S1	A single collection each from Kings County and Halifax Counties. Found in edges of wetlands, marshes, swamps and shores of rivers or lakes. Flowers in summer (Minnesota Environment and Natural Resources Trust Fund, Go Botany and Munro et al., 2014).
Variegated Horsetail	*Equisetum variegatum*			S3	Wide-ranging in NS, with disjunct localities: Halifax County, Cumberland County and Victoria County. Found in wetlands or wet seeps. Anthropogenic habitats (man-made or disturbed habitats), shores of rivers or lakes. Flowers in summer (Minnesota Environment and Natural Resources Trust Fund, Go Botany and Munro et al., 2014).

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
Slender Cottongrass	*Eriophorum gracile*			S2S3	Grows in wet peat and inundated shores. Flowers and fruits during early summer. (Munro, et al. 2014).
Slender Fimbry	*Fimbristylis autumnalis*			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)
Woodland Strawberry	*Fragaria vesca*			S3S4	Forming dense patches in shady forests, ravines. Flowers in June. A white-berried form of this species persists in a number of locations within the province: White Rock, Wolfville, Grand Pré and Barrington. (Munro, Newell & Hill, 2014).
Black Ash	*Fraxinus nigra*		T	S1S2	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 regenerates only in partially opened forest canopies.
Red Ash	*Fraxinus pennsylvanica*			S1	Flowers May - June. Found in riparian and upland forest and shelter belts (Minnesota Wildflowers, nd)
Northern Gentian	*Gentianella amarella ssp. acuta*			S1	Open and forested river banks, subalpine gullies and brook sides, occurring in regions of high-pH bedrock and/or till.
Bicknell's Crane's-bill	*Geranium bicknellii*			S3	Colonizes recently burned or cleared land; recently exposed lakeshores. Flowers from late June to July (Munro, Newell & Hill, 2014)
Downy Rattlesnake-Plantain	*Goodyera pubescens*			S2	Forms in large colonies in woodlands and thickets. Flower in July and August (Munro, et al., 2014).
Lesser Rattlesnake-plantain	*Goodyera repens*			S3	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).
Meadow Barley	*Hordeum brachyantherum*			S1	Grows in pastures and along streams and lake shores (Flora of North America).
Common Hop	*Humulus lupulus var. lupuloides*			S1?	Anthropogenic (man-made or disturbed habitats), floodplain (river or stream floodplains), forests, shrublands or thickets
Large Tick-trefoil	*Hylodesmum glutinosum*			S1	Anthropogenic (man-made or disturbed habitats), cliffs, balds, or ledges, forest edges, forests, ridges or ledges, talus and rocky slopes. Flowers June to August

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Large St John's-wort	*Hypericum majus*			S2	Flowers July to September. Wet or dry open soil.wet or dry open soil in bogs, marshes, ditches, meadows, woodlands, and other damp habitats.[4] It prefers elevations between 0–1,200 m Widely scattered locations. Until recently, only known from Halifax area and Big Baddeck, Victoria County, and thought to be historic.
Northern Green Rush	*Juncus alpinoarticulatus*			S1S2	Fen, fresh tidal marsshes or flats, marshes, meadows and fields, shores of rivers or lakes. Fruiting mid summer to fall (Go Botany).
Greater Poverty Rush	*Juncus anthelatus*			S1?	Exposed or partially shaded sites in moist or seasonally wet sandy or clay soils. Flowering and fruiting in spring (Flora North America).
Moor Rush	*Juncus stygius ssp. americanus*			S2	Wet moss, bogs and bog-pools. Flowering and fruiting in mid to late summer.
Woods-Rush	*Juncus subcaudatus*			S3	Conifer woods and spruce swamps, where substrate is soggy. Flowers and fruits produced from July through October. (Munro, et al. 2014).
Hairy Lettuce	*Lactuca hirsuta*			S2	Grows in dryish soils in open forest and cut-overs. Scattered in the western part of NS. Flowers from July through September (Munro, Newell & Hill, 2014).
Southern Mudwort	*Limosella australis*			S3	Only on muddy shores or gravels of ponds, lakes and rivers along the coast. Flowers late June to October (Munro, Newell & Hill, 2014)
Loesel's Twayblade	*Liparis loeselii*			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).
netted chain fern	*Lorinseria areolata*			S3	Bogs, meadows and fields, swamps, wetland margins (edges of wetlands) (Go Botany).
Black-fruited Woodrush	*Luzula parviflora ssp. melanocarpa*			S3S4	uncommon in damp coniferous or mixed woods, cool ravines and banks (Hinds, 2000)
Whorled Yellow Loosestrife	*Lysimachia quadrifolia*			S1	Anthropogenic (man-made or disturbed habitats), grassland, woodlands, fens, moist prairies (GoBotany, n.d.). Flowers from July - August (LBJ Wildflower Centre, nd).
White Adder's-mouth	*Malaxis monophyllos*			S1	Found in Fens, ridges or ledges, swamps with northern white-cedar. Flowering in summer (GoBotany).
North American White Adder's-mouth	*Malaxis monophyllos var. brachypoda*			S1	Found in swamps and bogs. Flower in summer (Flora fo North America).
Southern Twayblade	*Neottia bifolia*			S3	Bogs and swamps (Go Botany)
Small Yellow Pond-lily	*Nuphar microphylla*			S3S4	Ponds, lakes, sluggish streams, sloughs, ditches and occasionally tidal waters. Flowers summer - early fall (Flora of North America, nd)

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
Northern Adder's-tongue	*Ophioglossum pusillum*			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).
Red Goosefoot	*Oxybasis rubra*			S2	moist, disturbed soils such pond and lake shores, river and creek banks, and mud flats. Flowers July to September
Halberd-leaved Tearthumb	*Persicaria arifolia*			S2	Found inf shaded swamps, ponds, tidal marshes along rivers, wet ravine in forests. Flowers July - October (Flora of North America, nd)
Carey's Smartweed	*Persicaria careyi*			S1	Low thickets, swamps, bogs, moist shorelines, clearings, recent burns, cultivated ground. Flowering July - October (Flora of North America, nd)
Pennsylvania Smartweed	*Persicaria pensylvanica*			S3	Moist, disturbed places, ditches, riverbanks, cultivated fields, shorelines of ponds and reservoirs. Flowers May - December (Flora of North America, nd)
Canada Ricegrass	*Piptatheropsis canadensis*			S2	Dry sandy or gravelly soil. Open woods clearings, pine plantations, barrens, wooded slopes. Fruiting season-July (Minnesota Wildflowers).
Rugel's Plantain	*Plantago rugelii*			S3	Grows in anthropogenic (man-made or disturbed habitat), grassland, meadows, fields (GoBotany, nd)
Pale Green Orchid	*Platanthera flava var. herbiola*			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 Co. (Kemptown) (Munro, Newell & Hill, 2014).
Large Purple Fringed Orchid	*Platanthera grandiflora*			S3	Found in north-central and Southwestern NS. Favours wet meadows and riparian habitiats. Flowers in July.
Hooker's Orchid	*Platanthera hookeri*			S3	Scattered in most of the province, local in the southwestern counties. So far absent from the eastern shore. Grows in open dry forests of mixed conifers. Flower appear from May to August (Munro, et al., 2014).
Fragrant Green Orchid	*Platanthera huronensis*			S1S2	No good record found. Habitat are known from streamsides, in wetlands, even forests. Flowers throughout the summer (Munro, et al., 2014).
Narrow-leaved Knotweed	*Polygonum aviculare ssp. neglectum*			S3?	Found in disturbed areas. Flowers June - November (Flora of North America, nd)
Appalachian Polypody	*Polypodium appalachianum*			S3	Nova Scotia distrbiution still remains unclear. Habitat is restricted to cliffs, rocky slopes, balds, ridges or ledges and talus. No sources that state specific spore production time, most likely during the general growing season in Nova Scotia: June to September (Go Botany and Munro et al., 2014).

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
oblong-leaved pondweed	*Potamogeton polygonifolius*			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).
Canada Cinquefoil	*Potentilla canadensis*			S2S3	Found on dry rock barrens and other open areas. Flowers in June. (Munro, Newell & Hill, 2014)
Marsh Mermaidweed	*Proserpinaca palustris*			S3	Found in lakeshore fens and streamsides. It is only known in Lunenburg and Yarmouth counties, but it may be more widespread. The variation creba is abundant from southwestern NS to Cumberland, and less frequent in Cape Breton. Flowers July to September
Gmelin's Water Buttercup	*Ranunculus gmelinii*			S3	Riverine (in rivers or streams), swamps, slow streams, evergreen swamps and ditches in areas of high-pH bedrock (GoBotany, n.d.). Flowers July - August (Minnesota Wildflowers, n.d.)
Pennsylvania Buttercup	*Ranunculus pensylvanicus*			S1	Found in wet fields, ditches, marshes, along shores. Flowers June - August (Minnesota Wildflowers, nd)
Cursed Buttercup	*Ranunculus sceleratus*			S1S2	Anthropogenic (man-made or disturbed habitats), fresh tidal marshes or flats, marshes, swamps (GoBotany, n.d.). Flowers May - September (Minnesota Wildflowers, nd)
Cursed Buttercup	*Ranunculus sceleratus var. sceleratus*			S1S2	Ponds, riverbanks. Flowers from April - June, October (Jepson Herbarium, 2021)
Little Yellow Rattle	*Rhinanthus minor ssp. groenlandicus*			S1	Grows on disturbed, compacted soils as on roadsides, abandoned fields and the like. Flowers from mid-June through July (Munro, Newell & Hill, 2014)
Prickly Rose	*Rosa acicularis ssp. sayi*			S1	Across its range, it grows in a wide variety of forested and open habitats, with a wide variety of soil and moisture conditions. Flowers in the spring (Schori, 2003)
Cut-Leaved Coneflower	*Rudbeckia laciniata*			S1S2	Grows in wet fertile soils along the edge of swamps, swales or streams. Often colonial. Flowers in August. Common in Kings Co., isolated colonies from Annapolis and Cumberland counties to Guysborough (Munro, Newell & Hill, 2014).
Tierra del Fuego Dock	*Rumex fueginus*			S3S4	Alluvial, riparian, and ruderal habitats, shores, marshes, bogs, wet meadowns, dry streambeds. Flowering late spring - early fall (Flora of North America, nd)
Triangular-valve Dock	*Rumex triangulivalvis*			S2	Grows in moist areas and disturbed habitats, meadows and fields (GoBotany, nd)
Blueberry Willow	*Salix myrtillifolia*			S1	Reed bogs, fens, stream banks, subalpine spruce thickets, Pinus contorta woods, sand dunes, coal spoils. Flowers early May - late July (Flora of North America, nd)
Silky Willow	*Salix sericea*			S2	Low-lying ground as in riparian zones. Flowers in late March until May. Rare and only reported from western NS. Parr Lake and Lake Fanning, Yarmouth Co.; Queens and Lunenburg counties to Halifax County,. (Munro, Newell & Hill, 2014)

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
Autumn Willow	*Salix serissima*			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).
Little Curlygrass Fern	*Schizaea pusilla*			S3S4	Scattered throughout the Atlantic counties and frequent in the northern plateau of Cape Breton. Found in sphagnous wet areas, upper peaty lakeshores and undrained depressions. Spores produced throughout the summer, from July (Munro et al., 2014).
Elliott's Goldenrod	*Solidago latissimifolia*			S3S4	Favours clearings, thickets and bogs, swales and lakeshores. Flowers in August and September. Common in Yarmouth Co., east to Halifax Co. (Munro, Newell & Hill, 2014).
Cedar-swamp Goldenrod	*Solidago rugosa var. sphagnophila*			S1S3	Frequents waste soils, forests and fallow fields. Flowers late in August through September. Common throughout the province (Munro, Newell & Hill, 2014).
Branching Bur-Reed	*Sparganium androcladum*			S1	Found in lakes, ponds, rivers ro streams or the shore of rivers or lakes (Go Botany).
Yellow Ladies'-tresses	*Spiranthes ochroleuca*			S3	Located in the western half of the province, northwest to Hants Co. Found in driest sand barrens, roadsides, and fields. Autumn-flowering from Sept-Oct (Munro, et al., 2014).
Boreal Aster	*Symphyotrichum boreale*			S2?	Favours lacustrine gravels, streamsides and edges of peatlands. Flowers during August and September . Scattered from Yarmouth to Cape Breton uncommon (Munro, Newell & Hill, 2014).
Wavy-leaved Aster	*Symphyotrichum undulatum*			S2	Favours edges of fields and forests. Flowers during August and September. Scattered about Lunenburg Co, Queens, Hants, Kings, and Halifax (Munro, Newell & Hill, 2014).
Forked Bluecurls	*Trichostema dichotomum*			S1	Relatively new to Nova Scotia. Found in anthropogenic/disturbed habitats, grasslands, meadows and fields, sandplains and barrens (GoBotany, nd). Flowers from August to October (Peterson & McKenny, 1968).
Orange-fruited Tinker's Weed	*Triosteum aurantiacum var. aurantiacum*			S2S3	Dry-mesic to mesic forests, woodlands, and forest borders
Narrow False Oats	*Trisetum spicatum*			S3S4	Grows in rocky soils on outcrops, cliffs, streamsides. Flowers and fruits from June through August (Munro, et al., 2014).
Blue Vervain	*Verbena hastata*			S3	Limited to mucky fertile soils, as along floodplains. Flowers during August - September (Munro, Newell & Hill, 2014)
Pink Water-Speedwell	*Veronica catenata*			S1	Shores of rivers or lakes, wetland margins (edges of wetlands) (GoBotany, nd). Flowers May - September (Minnesota Wildflowers, nd)

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
Arrow-Leaved Violet	*Viola sagittata*			S3S4	Sterile woods, clearing and fields. Flowers April - May (Munro, Newell & Hill 2014)
			LICHENS		
Black-foam Lichen	*Anzia colpodes*	T	T	S3	Anzia colpodes requires mature deciduous tree habitats with high humidity and high light levels. The required humidity is supplied by wetlands, nearby brooks, lakes or by the host's position on upland slopes above a water body. Host tree trunks are usually free of dense undergrowth and the lichen usually occurs at or above the height of the undergrowth (in swamps and fens). A few of the Anzia collections from are reported to be from the canopy of Red Maple trees. Recent searches have found that A. colpodes occurs from 20 cm above the ground to 2 m up the tree trunks.
Boreal Felt Lichen - Atlantic pop.	*Erioderma pedicellatum (Atlantic pop.)*	E	E	S1	The existing boreal felt lichen occurs within 25 km of the sea coast at an elevation of up to 300 m above sea level and they are found in forested habitats with low open crown closure. Boreal Felt Lichens are typically found in balsam fir stands, on north-facing trunks of mature and overmature trees. Habitat preference for boreal felt lichen is cool and moist and remains relatively constant throughout the year. They are often located on or at the base of slopes with northern or northeastern exposure.
White-rimmed Shingle Lichen	*Fuscopannaria leucosticta*			S2S3	The second subpopulation in Nova Scotia occurs mainly on the east coast of southwestern Nova Scotia (in Shelburne and Queens counties), with sporadic sites throughout the eastern mainland. Common understorey associates of Fuscopannaria leucosticta include ferns in the genus Osmundastrum, hollies, and ash, with peat mosses dominating the ground cover in depressions and feathermosses dominating on hummocks.Fuscopannaria leucosticta grows on the bark of Red Maple trees in Nova Scotia (COSEWIC Assessment and Status Report).
Wrinkled Shingle Lichen	*Pannaria lurida*	T	T	S1S2	The Wrinkled Shingle Lichen colonizes mature deciduous trees, most often Red Maple that grow near, but not usually within, imperfectly drained habitats. Hence, this lichen is found on trees close to the edge of treed swamps or floodplains. The Wrinkled Shingle Lichen most frequently inhabits sites near imperfectly drained, humid habitats dominated by deciduous trees. Such sites are close to the edge of treed swamps or riparian floodplains, or are at the base of moderate to steep slopes. A few occurrences are known from upland hardwood stands at the tops of slopes that are less than 100m in elevation. Only two occurrences are within a few kilometres of the coast. Canopy density is moderately open. The lichen grows on the rough bark of mature trees, mainly on the more sun-exposed sides. Red maple is the main host species, with poplar the second most frequent species. It is also known from Black and White Ash, Sugar Maple, Red Oak and American Beech.
Blue Felt Lichen	*Pectenia plumbea*	SC	V	S3	The Blue Felt Lichen is usually found on the trunks of old broad-leaved trees growing in moist habitats or close to streams and lake margins. This lichen occurs in coastal suboceanic areas but also some distance inland in damp valleys. It prefers cool, humid

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
					woodlands that may be mixed coniferous/hardwood or dominated by deciduous trees. The Blue Felt Lichen seems to prefer mature deciduous trees, particularly maple, ash and yellow birch. At its northerly limit of distribution in Nova Scotia, the Blue Felt Lichen has once been found on moss-covered rocks.
Eastern Waterfan	*Peltigera hydrothyria*	T	T	S1	Eastern Waterfan grows attached to rocks at or below water level in clear, cool, partially shaded streams. Small waterfalls, exposed boulders and sinuous stream configurations create quiet or protected backwaters where the lichen grows outside the main current. In summer, this lichen is often partially or completely exposed during low water flow periods. Partial shade may be needed to help keep humidity high and temperatures low during summer months.
Frosted Glass-whiskers (Atlantic population)	*Sclerophora peronella (Atlantic pop.)*	SC		S1?	This lichen has only been collected in two localities in Nova Scotia. It was observed on Cape Breton Island, in two forests in Inverness County. 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).
MAMMALS					
Moose	*Alces americanus*		E	S1	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.
Silver-haired Bat	*Lasionycteris noctivagans*			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.
Eastern Red Bat	*Lasiurus borealis*			S1S2B,S1M	Lives in forests, forest edges, and hedgerows. It roosts among foliage, usually in deciduous trees, but sometimes roosts in coniferous trees. Rare in heavily urbanized areas.
Hoary Bat	*Lasiurus cinereus*			S1S2B,S1M	They prefer deciduous and coniferous trees at the edge of clearings, but have been found in trees in heavy forests, open wooded glades, and shade trees along urban streets and in city parks.
Little Brown Myotis	*Myotis lucifugus*	E	E	S1	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

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
					maternity roosting), but it will also use cavities of canopy trees, foliage, tree bark, crevices on cliffs, and other structures.
Northern Long-eared Myotis	*Myotis septentrionalis*	E	E	S1	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.
Fisher	*Pekania pennanti*			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.
Eastern Pipistrelle	*Perimyotis subflavus*	E	E	S1	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.
Maritime Shrew	*Sorex maritimensis*			S3	Often found in marshes and wet meadows The most favoured habitat is the edges of freshwater swamps and marshes which have become overgrown with tangled grass and rushes.
American Water Shrew	*Sorex palustris*			S3S4	Mostly aquatic, the water shrew lives beneath the overhanging banks and in rock crevices along the edges of swiftly flowing mountain streams. Rhododendron and yellow birch are usually the dominant vegetation in these areas.
Southern Bog Lemming	*Synaptomys cooperi*			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.
HERPETOFAUNA					
Snapping Turtle	*Chelydra serpentina*	SC	V	S3	They are common in southwestern Nova Scotia and less common on the northeastern mainland. Although Snapping Turtles occupy a wide variety of habitats, the preferred habitat for this species is characterized by slow-moving water with a soft mud bottom

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					and dense aquatic vegetation. Established populations are most often found in ponds, marshes, swamps, peat bogs, shallow bays, river and lake edges, and slow-moving streams. turtles appear to prefer the following characteristics for their hibernacula: water shallow enough to let the turtle reach the surface to breathe, but deep enough so the water will not freeze to the bottom; a location that is likely to freeze over later in the season and thaw earlier in the spring; a thick layer of mud in which the turtle can bury itself; and additional submerged cover, such as a floating mat of vegetation, roots, stumps, branches or logs, a muskrat dwelling or an overhanging bank.
Eastern Painted Turtle	*Chrysemys picta picta*	SC		S4S5	Eastern Painted Turtle is found in New Brunswick, Nova Scotia, and the Atlantic coastal states east of the Appalachian Mountains. Painted Turtles occupy slow moving, relatively shallow and well-vegetated wetlands (e.g., swamps, marshes, ponds, fens, bogs, and oxbows) and water bodies (e.g., lakes, rivers, creeks, and streams) with abundant basking sites and organic substrate. These turtles are found in association with submergent aquatic plants, which are used for cover and feeding. The species is semi-tolerant of human-altered landscapes and may occasionally be found occupying urban ponds and lands subject to anthropogenic disturbance (e.g., farm ponds, impoundments, water treatment facilities). Suitable nesting habitat includes open, often south-facing, and sloped areas with sandy-loamy and/or gravel substrate usually within 1200 m of aquatic active season habitats. Painted Turtles overwinter in shallow water with deep sediment (COSEWIC Assessment and Status Report).
Wood Turtle	*Glyptemys insculpta*	T	T	S2	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 throughought 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.
Four-toed Salamander	*Hemidactylium scutatum*			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).

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			AVIFAUNA		
Cooper's Hawk	*Accipiter cooperii*			S1?B	Not common in Nova Scotia but does breed in the province. Found in mature forest, open woodlands, wood edges and river groves. Nests in coniferous, deciduous and mixed woods, typically those with tall trees and with openings or edge habitat nearby. Also found among trees along rivers through open country, and increasingly in suburbs and cities where tall trees exist for nesting (e.g. parks, open fields and even backyards with feeders). Breeds between April and July (Audubon and The Cornell Lab)
Northern Goshawk	*Accipiter gentilis*			S3S4	Found in coniferous and mixed forests. Generally restricted to wooded areas (along riparian corridors), but may be in relatively open woods or along edges. Often more common as a breeding bird in mixed woods (e.g. mature and old-growth forests with more than 60% closed canopy). In the East, goshawks seek out nest sites in mixed-hardwood forests where beeches, birch, hemlock and maples dominate. Goshawks often build nests near breaks in the canopy, such as a forest trail, road or opening created by a downed tree and prefer sites with a creek, pond or lake nearby. Breeds between April and July. May mate for life (Audubon and The Cornell Lab).
Spotted Sandpiper	*Actitis macularius*			S3S4B	Common near fresh and saltwater. Habitat includes pebbly lake shores, ponds and streamsides (and seashores in the winter). Spotted Sandpipers spend the winter along the coasts of North America. During migration and winter, this species is found along the coast on mudflats, beaches and breakwaters (also found in inland habitats such as sewage ponds and irrigation ditches). Breeds near the edge of fresh water in a wide variety of settings, including lakes, ponds, rivers and streams (in either open or wooded country). Breeding territories generally need to have a shoreline, a semi-open area for the nest and patches of dense vegetation to conceal the chicks. Breeds between April and July (Audubon and The Cornell Lab).
Nelson's Sparrow	*Ammospiza nelsoni*			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)
Short-eared Owl	*Asio flammeus*	SC		S1S2B	Short-eared Owls breed primarily in well-drained grasslands near coastal wetlands. In areas with extensive coastlines, some caution is warranted in summarizing breeding habitat as inland marshes and bogs are less frequently monitored and thus may be under-represented in assessments of breeding habitat (COSEWIC Assessment and Status Report).
Long-eared Owl	*Asio otus*			S2S3	Known to breed throughout Nova Scotia. They occur at elevations ranging from near sea level to above 6,500 feet. May be nomadic at times, moving about in response to changing food supplies. Favored habitat includes dense trees for nesting and roosting and open country (e.g. grasslands and shrublands) for hunting. Inhabits a wide variety of such settings, including forest with extensive meadows to groves of conifers or deciduous

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					trees. Generally avoids unbroken forest. Known to be an early breeder. Breeds between April and July (Audubon and The Cornell Lab).
American Bittern	*Botaurus lentiginosus*			S3S4B	Found in marshes and reedy lakes. Breeds in freshwater marshes, mainly large, shallow wetlands with a large amount of tall marsh vegetation (cattails, grasses and sedges) and areas of open shallow water. Sometimes feeds in dry grassy fields. They are rarely seen out in the open, prefers vegeation cover. Breeds between April and July (Audubon and The Cornell Lab)
Rough-legged Hawk	*Buteo lagopus*			S3N	Common across Nova Scotia during nonbreeding (winter). Spends the winter in open country, including grasslands, coastal prairies, marshes, farmland and dunes. In tree-covered areas they hunt over open bogs and other clearings. Breeds mostly on tundra, in areas having cliffs for nest sites; some breed along northern edge of coniferous forest zone. Rough-legged Hawks breed in open country of the arctic, both in North America and Eurasia. Breeds between April and July. May mate for life (Audubon and The Cornell Lab).
Semipalmated Sandpiper	*Calidris pusilla*			S3M	Common migrant in Nova Scotia. Migrates in flocks (adults before juveniles). May make very long nonstop flights between major feeding areas on migration. Semipalmated Sandpipers nest in low tundra, usually not far from marshes or ponds (both dry upland habitats with sufficient vegetation cover). In preparation for migration, they gather into flocks in shallow-water mudflats or lakeshores. Migrating birds stop over at sewage ponds, ephemeral wetlands (rain pools), beaches, inlets, estuaries, tidal mudflat, sandbars and freshwater impoundments with shallow margins (edges of lakes and marshes). Breeds between April and July (Audubon and The Cornell Lab).
Canada Warbler	*Cardellina canadensis*	T	E	S3B	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.
Wilson's Warbler	*Cardellina pusilla*			S3B	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).
Turkey Vulture	*Cathartes aura*			S2S3B	In past was not surveyed/very rare to see Turkey Vultures in Nova Scotia, but as the climate warms they are now sighted across the province (MBBA and Nova Scotia Bird Society). Look for Turkey Vultures as they soar high over open areas. They are particularly noticeable along roadsides and at landfills. At night, they roost in trees, on rocks and other high secluded spots. Most common over open or semi-open country (including mixed farmland, forest, rangeland and even small offshore islands), especially within a few miles of rocky or wooded areas providing secure nesting sites. Generally

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					avoids densely forested regions. Breeds between April and July (Audubon and The Cornell Lab)
Veery	*Catharus fuscescens*			S3S4B	Breeds across Nova Scotia, but more common on the mainland (especially Southern Nova Scotia). Migrates mostly at night. During spring and fall migration, they favour mainly deciduous forest edges and second-growth woodlands. Males tend to arrive on breeding grounds first. Veeries breed in dense, damp, mostly deciduous woodlands, often near rivers, streams and swampy areas (trees include oak, maple, cherry, aspen, birch, alder, spruce and fir, among other trees and shrubs). Veeries gravitate toward disturbed forests, where dense understory provides protected nest sites (but generally along streams and other openings). Breeds between April and July (Audubon and The Cornell Lab).
Swainson's Thrush	*Catharus ustulatus*			S3S4B	Breeds throughout Nova Scotia. Spring migration relatively late and spread over a long period (sometimes still migrating at the beginning of June). Breed mainly in coniferous forests, deciduous streamside woodlands, alder or willow thickets and occasionally in coastal scrub. These birds range from sea level up to about 8,500 feet in elevation. During migration, Swainson's Thrushes occupy a wide variety of habitats, seeking mainly areas with dense undergrowth. Look for migrants especially in forests (various types), canyon bottoms, young woodland, swamp forests, lake edges and parks. Breeds between April and July (Audubon and The Cornell Lab).
Killdeer	*Charadrius vociferus*			S3B	Favours fields, sandbars, lawns, river banks, coastal estuaries, mudflats and shores. Often found on open ground, such as pastures, plowed fields and large lawns, even at a great distance from water. This species does well in areas disturbed by humans and is commonly spotted on roads, lawns, airports, parking lots, golf courses, fields and in gravel areas. Most successful nesting areas have some shallow water closeby or other good feeding area for the chicks. Generally the vegetation in fields inhabited by Killdeer is no taller than one inch. You can find Killdeer near water, but unlike many other shorebirds, they are also common in dry areas. Spring migration is very early, returning to some northern areas in February or March. Breeds between March and July (Audubon and The Cornell Lab).
Common Nighthawk	*Chordeiles minor*	T	T	S2B	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.
Northern Harrier	*Circus hudsonius*			S3S4B	Breeds in Nova Scotia but also can be a permanent resident. Breeding Northern Harriers are most common in large, undisturbed tracts of freshwater or brackish wetlands, riverside woodlands and grasslands with low, thick vegetation. During winter they use a range of habitats with low vegetation, including deserts, coastal sand dunes, pasturelands,

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					croplands, dry plains, grasslands, old fields, estuaries, open floodplains and marshes. At least in North America, always migrates singly. Breeds between April and July (Audubon and The Cornell Lab).
Evening Grosbeak	*Coccothraustes vespertinus*	SC	V	S3S4B,S3N	Evening Grosbeak breeding habitat generally includes open, mature mixedwood forests, where fir species and/or White Spruce are dominant, and Spruce Budworm is abundant. Outside the breeding season, the species seems to depend largely on seed crops from various trees such as firs and spruces in the boreal forest, but is also attracted to ornamental trees that produce seeds or fruit, and bird feeders stocked with sunflower seeds.
Black-billed Cuckoo	*Coccyzus erythropthalmus*			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).
Olive-sided Flycatcher	*Contopus cooperi*	T	T	S2B	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).
Eastern Wood-Pewee	*Contopus virens*	SC	V	S3S4B	The Eastern Wood-pewee is mostly associated with the mid-canopy layer of forest clearings and edges of deciduous and mixed forests. It is most abundant in forest stands of intermediate age and in mature stands with little understory vegetation. During migration, a variety of habitats are used, including forest edges, early and successional clearings.
Yellow Rail	*Coturnicops noveboracensis*	SC		SUB	Yellow rail is distributed along northern Nova Scotia. Nesting Yellow Rails are typically found in marshes dominated by sedges, true grasses, and rushes, where there is little or no standing water (generally 0-12 cm water dept), and where the substrate remains saturated throughout the summer. They can be found in damp fields and meadows, on the floodplains of rivers and streams, in the herbaceous vegetation of bogs, and at the upper levels (drier margins) of estuarine and salt marshes. Nesting habitats usually have a dry mat of dead vegetation from previous growing seasons. A greater diversity of habitat types is used during migration and winter than during the breeding season. In winter, the

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					rails are known to use coastal wetlands and rice fields. (COSEWIC Assessment and Status Report).
Gray Catbird	*Dumetella carolinensis*			S3B	Known to breed all through Nova Scotia but seems to be more common in the Southern counties. Gray Catbirds live amid dense undergrowth, shrubs, vine tangles and thickets of young trees in shrubby swamps and along forests and streams in both summer and winter (dense, low growth). Human disturbance and development often create these habitats in the form of suburban gardens, clearings, roadsides, fencerows, abandoned farmland and residential areas. Avoids unbroken forest and coniferous woods. Breeds between April and July (Audubon and The Cornell Lab).
Yellow-bellied Flycatcher	*Empidonax flaviventris*			S3S4B	Common breeder throughout Nova Scotia. Yellow-bellied Flycatchers breed in boreal coniferous forests, bogs, swamps, and peatlands with a thick cover of moss and an understory of shrubs and saplings (e.g. muskegs). In Canada they frequent stands of black spruce with heath, blueberries, laurel and Labrador tea in the understory, but they also use wet boreal forests and deciduous patches near streams. During migration they use deciduous forests, thickets and forest edges. Spring migration is notably late, with most northbound migrants passing through in mid to late May. Almost all migration is through the east. Breeds between April and July (Audubon and The Cornell Lab).
Willow Flycatcher	*Empidonax traillii*			S2B	Uncommon breeder throughout mainland Nova Scotia, not Cape Breton (MBBA, as of July 2021). In winter, they use shrubby clearings, pastures and woodland edges often near water. Migrates relatively late in spring and early in fall. Breeds in thickets of deciduous trees and shrubs, especially willows, or along woodland edges. Often near streams or marshes and may be found in drier habitats than the Alder Flycatcher. Breeds between April and July (Audubon and The Cornell Lab).
Rusty Blackbird	*Euphagus carolinus*	SC	E	S2B	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.
American Kestrel	*Falco sparverius*			S3B	Breeds in Nova Scotia but also can be a permanent resident. American Kestrels favor open areas with short ground vegetation and sparse trees (e.g. meadows, wood edges, grasslands, deserts, parks, farm fields, cities and suburbs). When breeding, kestrels need access to at least a few trees or structures that provide appropriate nesting cavities. American Kestrels are attracted to many habitats modified by humans, including pastures and parkland, and are often found near areas of human activity including towns and cities. In winter, females may occupy open habitats more so than males. Breeds between April and July (Audubon and The Cornell Lab).

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Wilson's Snipe	*Gallinago delicata*			S3B	Common across Nova Scotia during breeding and also known as a permanet resident in the southern areas of the province. Wilson's Snipes can be found in all types of wet, marshy settings, including wet fields, bogs, fens, swamps, wet meadows and along muddy edges of rivers and ponds. They avoid areas with tall, dense vegetation, but need patches of cover to hide in and to provide a safe lookout for predators. During the breeding season they are mainly found around fresh marshes and bogs, shrubby streamsides and northern tundra. Breeds between April and July (Audubon and The Cornell Lab).
Purple Finch	*Haemorhous purpureus*			S3S4N,S4S5B	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)
Barn Swallow	*Hirundo rustica*	T	E	S2S3B	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.
Baltimore Oriole	*Icterus galbula*			S2S3B	Baltimore Orioles are often very common in open woods and groves in summer. Found in open woods, riverside groves, elms, shade trees. Breeds in deciduous or mixed woodland, generally in open woods or edges rather than interior of dense forest. May be common in trees in towns (Audubon). Breeds between April and July (Audubon and The Cornell Lab).
Northern Shrike	*Lanius borealis*			S3S4N	They occur in open but brushy habitats, and on calm, sunny days they may sit up on utility wires, bushes, and trees (Cornell Lab).Nests are usually placed in a low tree or large shrub, often in spruce or willow, usually 6-15' above the ground. Breeds between April and July (Audubon and The Cornell Lab).
Short-billed Dowitcher	*Limnodromus griseus*			S3M	Common migrant in Nova Scotia that prefers coastal habitats. Migrants are opportunistic in their choice of habitat, turning up in man-made environments such as impoundments, sewage ponds and flooded farm fields as well as in muddy margins of rivers, lakes and bays. Migrants also rest on rocky and sandy shorelines (beaches) and occasionally feed in such places, but they forage mostly where there is a fine muddy bottom covered by a few inches of water (pond edges, mudflats and tidal marshes). Breeds far north, mostly in open bogs, marshes and edges of lakes within coniferous forest zone. Breeds between April and July (Audubon and The Cornell Lab).

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
Red Crossbill	*Loxia curvirostra*			S3S4	Found throughout the entire province year-round. Red Crossbills can be found in conifer forests and groves, and breeds in pines (predominately), spruce, hemlock, Douglas-fir, or other evergreens. Breeding occurs from April to July (The Cornell Lab, Audubon)
Northern Mockingbird	*Mimus polyglottos*			S1B	Year-round resident throughout Nova Scotia, less common in Cape Breton. Found year-round in areas with open ground and shrubby vegetation (e.g. dense, low shrubs - hedges, fruiting bushes and thickets). When foraging on the ground, it prefers grassy areas, rather than bare spots. Common places include roadsides, parkland, cultivated land, suburban areas, woodland edges and in second-growth habitat at low elevations. Breeds between April and July (Audubon and The Cornell Lab).
Brown-headed Cowbird	*Molothrus ater*			S2B	Found in farms, fields, prairies, wood edges, river groves. Favors open or semi-open country at all seasons. In winter often concentrates in farmland, pastures, or cattle feedlots. More widespread in breeding season, in grassland, brushy country, forest edges, even desert, but tends to avoid dense unbroken forest. Breeds between April and July, and lays eggs in nests of other birds (Audubon and The Cornell Lab).
Great Crested Flycatcher	*Myiarchus crinitus*			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).
Tennessee Warbler	*Oreothlypis peregrina*			S3S4B	Found in deciduous and mixed forests; in migration, groves, brush. Breeds in bogs, swamps, and forests. Prefers openings in second growth balsam-tamarack bogs, or aspen and pine woods, or edges of dense spruce forest, but can be found in many types of wooded habitats in eastern North America. Nests near slight depressions of boggy ground. Breeds between April and July (Audubon and The Cornell Lab).
Fox Sparrow	*Passerella iliaca*			S3S4B	Found year round in Cape Breton, and throughout the migration season (late March and early November) in the rest of the province. Migrates at night. Found in wooded areas, undergrowth, brush. Breeds in brushy areas including woodland edges and clearings, streamside thickets, scrubby second growth, stunted coastal forest. Winters in similar habitats, also in brushy fields, chaparral, well-vegetated suburbs and parks. Breeds from April to July (The Cornell Lab, Audubon)
Indigo Bunting	*Passerina cyanea*			S1?B	This species favors brushy edges rather than unbroken forest. Indigo Buntings breed in brushy and weedy areas. They're common on the edges of woods and fields; along roads, streams, rivers, and powerline cuts; in logged forest plots, brushy canyons, and abandoned fields where shrubby growth is returning. They are also in clearings within

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
					deciduous woods, edges of swamps. Breeds between April and July (Audubon and The Cornell Lab).
Canada Jay	*Perisoreus canadensis*			S3	Year-round resident throughout Nova Scotia and commonly referred to as the Gray Jay. No regular migration. On rare occasions, small invasions of Canada Jays will move a short distance out of boreal forest in winter. Prefers boreal and subalpine forests across northern North America, usually where black or white spruce trees are common (also aspen, white birch, balsam fir, sugar maple, jack pine, red spruce, eastern white cedar, etc.). Found in various kinds of coniferous and mixed forest, but rarely occurs where there are no spruce trees. Mated pairs stay together all year and defend permanent territories. Breeding and nesting for this species begins very early, during late winter, with breeding grounds still snow-covered. Breeds until, approximately, July (Audubon and The Cornell Lab).
Cliff Swallow	*Petrochelidon pyrrhonota*			S2S3B	Breeds throughout Nova Scotia. A long-distance migrant that migrates in flocks, traveling by day. Typically nests in colonies, sometimes with hundreds of nests crowded close together. These colonies are close to a water source, open fields or pastures for foraging, and a source of mud for nest building. Nest site is usually on vertical surface with some overhead shelter. Natural sites were on cliffs. Most sites today are on the sides of buildings, under bridges, in culverts or similar places. They now live in grasslands, towns, broken forest and river edges, but avoid heavy forest and deserts (e.g. open to semi-open land, farms, river bluffs and lakes). Still unaccountably scarce or missing in some seemingly suitable areas. Breeds between April and July (Audubon and The Cornell Lab).
Rose-breasted Grosbeak	*Pheucticus ludovicianus*			S2S3B	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 favor edges or openings with combination of shrubs and tall trees, rather than unbroken forest. Breeds from April to July (The Cornell Lab, Audubon)
Black-backed Woodpecker	*Picoides arcticus*			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).
Pine Grosbeak	*Pinicola enucleator*			S2S3B,S5N	Found throughout the province year-round. Pine grosbeaks can be found in conifers; in winter, other trees. Breeds in open coniferous forest, especially of spruce and fir. In

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
					winter often found in deciduous trees (especially fruiting trees), also in groves of pines and other conifers. Breeding occurs from April to July (The Cornell Lab, Audubon).
Scarlet Tanager	*Piranga olivacea*			S2B	These birds can be found in oak forests in summer, but they often remain out of sight as they forage in the leafy upper branches. Nest site is in tree (usually deciduous), typically 20-30' above ground. Found in forests and shade trees (especially oaks). Breeds mostly in deciduous forest, predominately oaks but also in maple, beech, mixed pine-oak woods, and coniferous woods dominated by pine or hemlock. Breeding Scarlet Tanagers prefer large forest tracts with large trees. During spring and fall they use similar forest habitats as well as open spaces such as parks and gardens. Breeds between April and July (The Cornell Lab, Audubon)
Boreal Chickadee	*Poecile hudsonicus*			S3	Year-round resident throughout Nova Scotia. Occasional small southward invasions in fall, with a few appearing south of breeding range (similar to Black-capped Chickadees invasions). Boreal Chickadees inhabit mostly mature coniferous forests (sometimes mixed forests), usually spruce and balsam fir, often near water. During late fall and winter irruptions, they tend to be found mostly in areas dominated by coniferous trees. Occurs in low stunted spruces as far North as treeline (e.g. spruce bogs). May mate for life, the birds remaining together all year. Nests in a hole in a tree, either a natural cavity or one they created (or from another species). Breeds between April and July (Audubon and The Cornell Lab).
Ruby-crowned Kinglet	*Regulus calendula*			S3S4B	Breeds throughout Nova Scotia. Migrates a little earlier in fall and later in spring compared to the Golden-crowned Kinglet. In many areas, peak migration periods are October and April. In summer, Ruby-Crowned Kinglets are common in spruce-fir forests (also fir and pine). They also live in mixed woods, isolated trees in meadows, coniferous and deciduous forests, mountain-shrub habitat and floodplain forests of oak, pine, spruce or aspen. These birds nest high in trees, and so prefer older, taller and denser stands. During migration and winter they are common in various woods and thickets (e.g. open deciduous woods, also in coniferous and mixed woods, mesquite brush and streamside thickets). Breeds between April and July (Audubon and The Cornell Lab).
Bank Swallow	*Riparia riparia*	T	E	S2S3B	As with other swallow species, migratory stopover points are usually centred on large marshes where birds roost at night and disperse to forage throughout the day. There is little information available for Bank Swallows in terms of the importance of area requirements of these disparate habitats and their proximity to each other.
Bay-breasted Warbler	*Setophaga castanea*			S3S4B	Bay-breasted warblers are found in woodlands, conifers in summer. Usually breeds in northern coniferous forest, in thick stands of spruce and fir. They are preators of spruce budworm, and are abundant in spruce forests during outbreaks. Where spruce is not found, will nest in deciduous or mixed second-growth woods of birches, maples, firs, and pines. Breed from April to July, typically in the latter half of the breeding window (The Cornell Lab, Audubon)

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
Pine Warbler	*Setophaga pinus*			S1B	Pine Warblers live in pine or mixed pine-deciduous forest. Also sometimes in cedar or cypress. Various spottings throughout Nova Scotia, generally in the southern portion of the province. Breeds April to July (The Cornell Lab, Audubon)
Blackpoll Warbler	*Setophaga striata*			S3S4B	The blackpoll warbler can be found in conifers; broadleaf trees in migration. Breeds in low northern spruce forest. In migration, moves through forests, parks and gardens, they stop over in scrubby thickets and mature evergreen and deciduous forests. Found in the southern half of Nova Scotia during migration and the northern half during the breeding season. Breeding occurs from April to July (The Cornell Lab, Audubon).
Cape May Warbler	*Setophaga tigrina*			S2B	The Cape May Warbler can be found in spruce forest; other trees in migration. Breeds in spruce forest, especially during spruce budworm outbreaks, either in pure stands or mixed with firs or other trees, generally in more open woods or near the forest edge. During migration often favors conifers, but also forages in deciduous trees and thickets. Breeding occurs from April to July (The Cornell Lab, Audubon)
Red-breasted Nuthatch	*Sitta canadensis*			S3	Year-round reisdent throughout Nova Scotia. Red-breasted Nuthatches live mainly in coniferous forests of spruce, fir, pine, hemlock, larch and western red cedar. Eastern populations use more deciduous woods, including aspen, birch, poplar, oak and maple. During irruptive winters, nuthatches may use habitats such as orchards, scrub, parks, plantations and shade trees. Winter range varies from year to year, especially in the East (but conifers always chosen if available). Big Southward invasions occur in fall of some years, perhaps mainly when cone crops are poor in the North (but will remain year-round on nesting territory during years with good food supply). Nesting habitat almost always has many conifers, such as spruce, fir and hemlock, either in pure stands or mixed with deciduous trees. Mature forest preferred, due to old decaying wood for nest sites. Breeds between April and July (Audubon and The Cornell Lab).
Pine Siskin	*Spinus pinus*			S2S3	Found throughout the province year-round. Pine Siskins can be found in conifers, mixed woods, alders, weedy areas. Breeds mostly in coniferous and mixed woods, often around edges or clearings; sometimes in deciduous woods, isolated conifer groves. In migration and winter occurs in many kinds of semi-open areas, woodland edges, weedy fields. Breeding occurs from April to July (The Cornell Lab, Audubon)
Brown Thrasher	*Toxostoma rufum*			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).
Lesser Yellowlegs	*Tringa flavipes*			S3M	Common migrant throughout Nova Scotia. Occurs widely in migration, including coastal estuaries, salt and fresh marshes, mudflats, shores/edges of lakes and ponds; typically more common on freshwater habitats. Often in same places as Greater Yellowlegs, but

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
					may be less frequent on tidal flats. Wetland habitats ranging from tidal flats to sewage ponds to flooded fields; often in the company of other shorebird species. Breeds in open boreal forests and meadows interspersed with marshes and bogs. Breeds between April and July (Audubon and The Cornell Lab).
Greater Yellowlegs	*Tringa melanoleuca*			S3B,S3S 4M	Common migrant in Nova Scotia (migrates in flocks). During migration and throughout the winter, Greater Yellowlegs use a wide variety of fresh and brackish wetlands, including mudflats, estuaries, beaches, marshes, lake and pond edges, wet meadows, sewage ponds and flooded agricultural fields. Breeds in boggy and marshes places within northern coniferous forest. Breeds between April and July (Audubon and The Cornell Lab).
American Robin	*Turdus migratorius*			S3N,S5B,	Common in most of Nova Scotia as a year-round resident and for breeding in the very Northern part of the province (mainly Cape Breton). This species occupies many habitat types, such as lawns, farmland, fields and city parks, as well as in more wild places like woodlands, forests, mountains up to near treeline, recently burned forests and tundra. During winter many robins move to moist woods where berry-producing trees and shrubs are common. Males arrive first in the breeding season. Nests where there are trees and mud for nest-making material. Breeds between April and July (Audubon and The Cornell Lab).
Eastern Kingbird	*Tyrannus tyrannus*			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).
Warbling Vireo	*Vireo gilvus*			S1B	Occurs in deciduous and mixed woods, aspen groves, poplars, shade trees. Breeds in open deciduous or mixed woodland; also in orchards, shade trees of towns (Audubon). They stay high in deciduous treetos (Cornell Lab). Breeds between April and July (Audubon and The Cornell Lab).
Philadelphia Vireo	*Vireo philadelphicus*			S2?B	Occurs in second growth; poplars, willows, alders. Breeds in deciduous and mixed woodlands, especially near their edges, or in the young growth of overgrown pastures. Also nests in willows and alders along streams, lakes, and ponds. Breeds between April and July (Audubon).
FISH					
Alewife	*Alosa pseudoharengus*			S3	A marine fish that uses freshwater sreams for spawning, and is now landlocked in many inland lakes. They have been known to enter Grand, Shudenacadie Lake, as well as

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
					Fletcher Run and Rawdon rivers. In the Maritime provinces, spawning commences in May and continues until late in June (Scott and Crossman, 1973).
American Eel	*Anguilla rostrata*			S2	During their oceanic migrations, eels occupy salt water and in their continental phase (growth in continental waters), they use all salinity zones. In freshwater habitats, preferred habitat can be found in both lentic and lotic waters including all waters extending from the high-water mark down to at least 10 m depth for all reaches currently or formerly used by the American Eel (COSEWIC Assessment and Status Report).
Brook Stickleback	*Culaea inconstans*			S3	Inhabits clear, cold, densely vegetated waters of small streams and spring-fed ponds, and is found along the swampy margins of beach ponds of larger lakes. They are tolerant of salt water for short periods of time. Spawning occurs in shallow water from late April to July, depending on the water temperature (Scott and Crossman, 1973)
Northern Pearl Dace	*Margariscus nachtriebi*			S3	Cool, clear headwater streams in the south, bog drainage streams, ponds and small lakes in the north, and in stained, peaty waters of beaver ponds.. Spawning occurs in clear water over sand or gravel in weak or moderate current (Scott and Crossman 1973).
Brook Trout	*Salvelinus fontinalis*			S3	Most common in cool well-oxygenated waters of lakes and streams. In autumn, brook trout move into smaller, shallower streams and require free passage along streams to move between areas of use. Spawning occurs from October - early December (Gilhen, 1974)
INVERTEBRATE					
Suckley's Cuckoo Bumble Bee	*Bombus suckleyi*			SNR	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 1200 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).
Yellow-banded Bumblebee	*Bombus terricola*	SC	V	S3	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.
Transverse Lady Beetle	*Coccinella transversoguttata richardsoni*			SH	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,

Common Name	Scientific Name	SARA	NSESA	SRank	Habitat Description
					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).
Monarch	*Danaus plexippus plexippus*	SC	E	S2B	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.)
Skillet Clubtail	*Gomphus ventricosus*	E		S1	In Nova Scotia there are only two historical records of collection of this species. One from Mount Uniacke in Hants County and the second from Shubenacadie River in Halifax County. the fact that specimens are not available to verify the Nova Scotia reports, appears to be a satisfactory reason to exclude these from range calculations. Small to large turbid rivers with at least a partly muddy bottom but good water quality. Sometimes clean lakes with sand or sand-marl (calcium-rich) bottoms (COSEWIC Assessment and Status Report)
Creeper	*Strophitus undulatus*			S1	Shallow freshwater. Riffles, moderate-low gradient, creek, pool (Nature Serve Explorer, 2021).

APPENDIX D. ACCDC REPORT

DATA REPORT 6659: Head of St. Margaret's Bay, NS

Prepared 27 July 2020
by C. Robicheau, Data Manager

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
HdStMargaretNS_6659ob.xls	Rare and legally protected Flora and Fauna in your study area
HdStMargaretNS_6659ob100km.xls	A list of Rare and legally protected Flora and Fauna within 100 km of your study area
HdStMargaretNS_6659ma.xls	Managed 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 in order 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
Tel: (506) 364-2658
sean.blaney@accdc.ca

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

Plant Communities
Sarah Robinson, Community Ecologist
Tel: (506) 364-2664
sarah.robinson@accdc.ca

Data Management, GIS
James Churchill, Data Manager
Tel: (902) 679-6146
james.churchill@accdc.ca

Billing
Jean Breau
Tel: (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
Duncan.Bayne@novascotia.ca

Western: Sarah Spencer
(902) 634-7555
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(902) 893-6350
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Lisa.Doucette@novascotia.ca

Eastern: Terry Power
(902) 563-3370
Terrance.Power@novascotia.ca

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

2.0 RARE AND ENDANGERED SPECIES

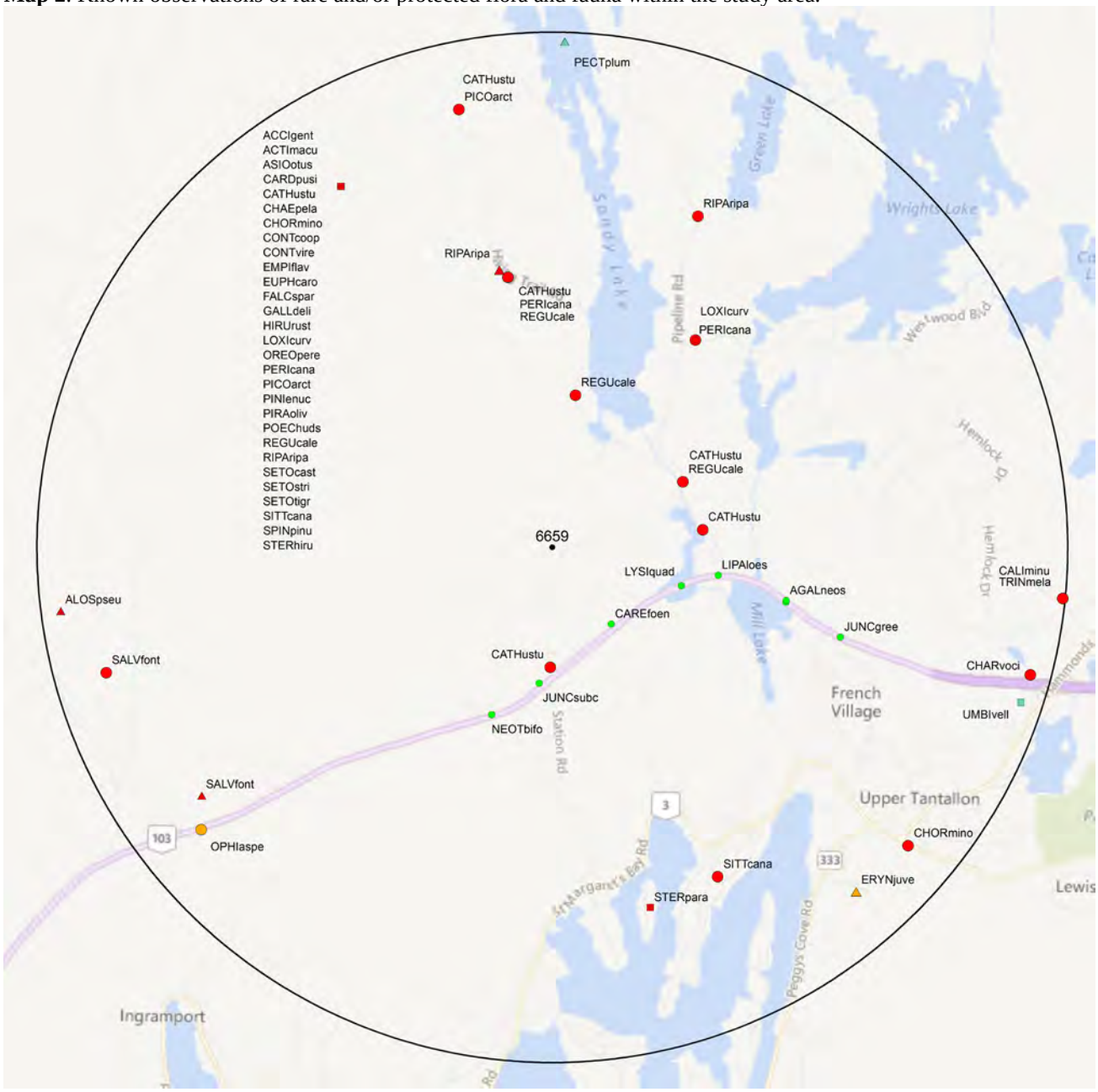
2.1 FLORA

The study area contains 8 records of 7 vascular and 2 records of 2 nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

The study area contains 148 records of 36 vertebrate and 3 records of 2 invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). 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

- 4.7 within 50s of kilometers
- 4.0 within 10s of kilometers
- 3.7 within 5s of kilometers
- 3.0 within kilometers
- 2.7 within 500s of meters
- 2.0 within 100s of meters
- 1.7 within 10s of meters

HIGHER TAXON

- vertebrate fauna
- invertebrate fauna
- vascular flora
- nonvascular flora

3.0 SPECIAL AREAS

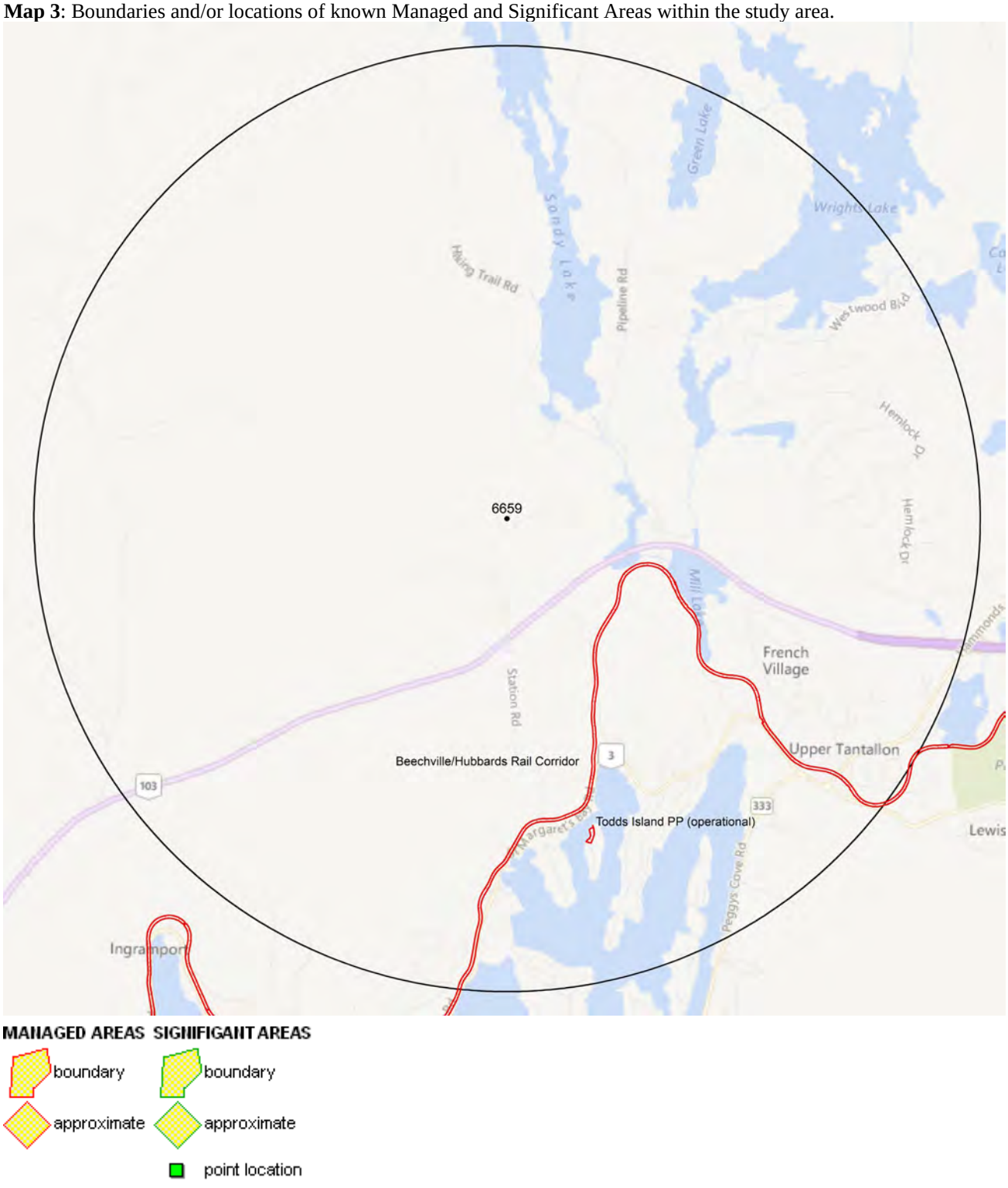
3.1 MANAGED AREAS

The GIS scan identified 2 managed areas in the vicinity of the study area (Map 3 and attached file: *ma*.xls).

3.2 SIGNIFICANT AREAS

The GIS scan identified no biologically significant sites in the vicinity of the study area (Map 3 and attached file: *sa*.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	Prov GS Rank	# recs	Distance (km)
N	*Pectenia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	4 Secure	1	4.9 ± 0.0
N	*Umbilicaria vellea*	Grizzled Rocktripe Lichen				S1	5 Undetermined	1	4.8 ± 5.0
P	*Lysimachia quadrifolia*	Whorled Yellow Loosestrife				S1	5 Undetermined	1	1.3 ± 0.0
P	*Juncus greenei*	Greene's Rush				S1S2	2 May Be At Risk	1	2.9 ± 0.0
P	*Carex foenea*	Fernald's Hay Sedge				S3	4 Secure	1	0.9 ± 0.0
P	*Juncus subcaudatus*	Woods-Rush				S3	3 Sensitive	1	1.3 ± 0.0
P	*Neottia bifolia*	Southern Twayblade				S3	4 Secure	1	1.7 ± 0.0
P	*Agalinis neoscotica*	Nova Scotia Agalinis				S3S4	4 Secure	2	2.3 ± 0.0
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	4 Secure	1	1.6 ± 0.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2B,S1M	1 At Risk	2	4.1 ± 7.0
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2 May Be At Risk	8	2.7 ± 1.0
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	7	4.1 ± 7.0
A	*Cardellina canadensis*	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	1	4.1 ± 7.0
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	2 May Be At Risk	4	4.1 ± 7.0
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S2B	1 At Risk	7	4.1 ± 7.0
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	5	4.1 ± 7.0
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	2	4.1 ± 7.0
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	3 Sensitive	3	4.1 ± 7.0
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	4 Secure	1	4.1 ± 7.0
A	*Calidris minutilla*	Least Sandpiper				S1B,S3M	4 Secure	1	5.0 ± 0.0
A	*Setophaga tigrina*	Cape May Warbler				S2B	3 Sensitive	4	4.1 ± 7.0
A	*Piranga olivacea*	Scarlet Tanager				S2B	5 Undetermined	2	4.1 ± 7.0
A	*Asio otus*	Long-eared Owl				S2S3	2 May Be At Risk	2	4.1 ± 7.0
A	*Spinus pinus*	Pine Siskin				S2S3	3 Sensitive	3	4.1 ± 7.0
A	*Pinicola enucleator*	Pine Grosbeak				S2S3B,S5N	2 May Be At Risk	2	4.1 ± 7.0
A	*Perisoreus canadensis*	Canada Jay				S3	3 Sensitive	11	2.4 ± 0.0
A	*Poecile hudsonicus*	Boreal Chickadee				S3	3 Sensitive	6	4.1 ± 7.0
A	*Sitta canadensis*	Red-breasted Nuthatch				S3	4 Secure	12	3.6 ± 0.0
A	*Alosa pseudoharengus*	Alewife				S3	3 Sensitive	1	4.8 ± 0.0
A	*Salvelinus fontinalis*	Brook Trout				S3	3 Sensitive	2	4.2 ± 0.0
A	*Falco sparverius*	American Kestrel				S3B	4 Secure	4	4.1 ± 7.0
A	*Charadrius vociferus*	Killdeer				S3B	3 Sensitive	1	4.8 ± 0.0
A	*Gallinago delicata*	Wilson's Snipe				S3B	3 Sensitive	2	4.1 ± 7.0
A	*Sterna paradisaea*	Arctic Tern				S3B	2 May Be At Risk	1	3.6 ± 7.0
A	*Cardellina pusilla*	Wilson's Warbler				S3B	3 Sensitive	2	4.1 ± 7.0
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S3S4M	3 Sensitive	1	5.0 ± 0.0
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	3 Sensitive	6	4.1 ± 7.0
A	*Loxia curvirostra*	Red Crossbill				S3S4	4 Secure	2	2.4 ± 0.0
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	4	4.1 ± 7.0
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	3	4.1 ± 7.0
A	*Regulus calendula*	Ruby-crowned Kinglet				S3S4B	3 Sensitive	12	1.4 ± 0.0

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Catharus ustulatus*	Swainson's Thrush				S3S4B	4 Secure	13	1.2 ± 0.0
A	*Oreothlypis peregrina*	Tennessee Warbler				S3S4B	3 Sensitive	2	4.1 ± 7.0
A	*Setophaga castanea*	Bay-breasted Warbler				S3S4B	3 Sensitive	6	4.1 ± 7.0
A	*Setophaga striata*	Blackpoll Warbler				S3S4B	3 Sensitive	3	4.1 ± 7.0
I	*Ophiogomphus aspersus*	Brook Snaketail				S2S3	2 May Be At Risk	1	4.4 ± 0.0
I	*Erynnis juvenalis*	Juvenal's Duskywing				S3S4	4 Secure	2	4.5 ± 1.0

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?
Fraxinus nigra	Black Ash		Threatened	No
Emydoidea blandingii	*Blanding's Turtle - Nova Scotia pop.*	Endangered	Vulnerable	No
Glyptemys insculpta	Wood Turtle	Threatened	Threatened	No
Falco peregrinus pop. 1	Peregrine Falcon - anatum/tundrius pop.	Special Concern	Vulnerable	No
Bat Hibernaculum		**[Endangered][1]**	**[Endangered][1]**	**YES**

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.

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.

# recs	CITATION
113	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
26	Erskine, A.J. 1992. Maritime Breeding Bird Atlas Database. NS Museum & Nimbus Publ., Halifax, 82,125 recs.
7	LaPaix, R.W.; Crowell, M.J.; MacDonald, M. 2011. Stantec rare plant records, 2010-11. Stantec Consulting, 334 recs.
4	iNaturalist. 2020. iNaturalist Data Export 2020. iNaturalist.org and iNaturalist.ca, Web site: 128728 recs.
3	Brazner, J. 2016. Nova Scotia Forested Wetland Bird Surveys. Nova Scotia Department of Lands and Forestry.
2	Staff, DNR 2007. Restricted & Limited Use Land Database (RLUL).
1	Benjamin, L.K. (compiler). 2007. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 8439 recs.
1	Blaney, C.S. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre. Sackville NB, 1042 recs.
1	Brunelle, P.-M. (compiler). 2009. ADIP/MDDS Odonata Database: data to 2006 inclusive. Atlantic Dragonfly Inventory Program (ADIP), 24200 recs.
1	Cameron, R.P. 2018. Degelia plumbea records. Nova Scotia Environment.
1	eBird. 2020. eBird Basic Dataset. Version: EBD_relNov-2019. Ithaca, New York. Nov 2019, Cape Breton Bras d'Or Lakes Watershed subset. Cornell Lab of Ornithology.
1	Layberry, R.A. & Hall, P.W., LaFontaine, J.D. 1998. The Butterflies of Canada. University of Toronto Press. 280 pp+plates.
1	Munro, Marian K. Tracked lichen specimens, Nova Scotia Provincial Museum of Natural History Herbarium. Atlantic Canada Conservation Data Centre. 2019.
1	Ogden, K. Nova Scotia Museum butterfly specimen database. Nova Scotia Museum. 2017.

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 44,211 records of 162 vertebrate and 1446 records of 68 invertebrate fauna; 14,388 records of 322 vascular and 1857 records of 187 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	Prov GS Rank	# recs	Distance (km)	Prov
A	*Coregonus huntsmani*	Atlantic Whitefish	Endangered	Endangered	Endangered	S1	7 Exotic	127	62.6 ± 1.0	NS
A	*Myotis lucifugus*	Little Brown Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	96	11.6 ± 0.0	NS
A	*Myotis septentrionalis*	Northern Long-eared Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	5	29.3 ± 0.0	NS
A	*Perimyotis subflavus*	Eastern Pipistrelle	Endangered	Endangered	Endangered	S1	1 At Risk	7	29.3 ± 0.0	NS
A	*Emydoidea blandingii*	Blanding's Turtle - Nova Scotia pop.	Endangered	Endangered	Endangered	S1	1 At Risk	5276	72.0 ± 0.0	NS
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy pop.	Endangered	Endangered		S1	2 May Be At Risk	33	9.1 ± 0.0	NS
A	*Charadrius melodus melodus*	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B	1 At Risk	1081	26.3 ± 0.0	NS
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1B	1 At Risk	66	10.7 ± 0.0	NS
A	*Morone saxatilis pop. 2*	Striped Bass - Bay of Fundy pop.	Endangered			S1B	2 May Be At Risk	4	37.3 ± 0.0	NS
A	*Dermochelys coriacea (Atlantic pop.)*	Leatherback Sea Turtle - Atlantic pop.	Endangered	Endangered		S1S2N		3	12.2 ± 5.0	NS
A	*Calidris canutus rufa*	Red Knot rufa ssp	Endangered	Endangered	Endangered	S2M	1 At Risk	630	35.3 ± 0.0	NS
A	*Melanerpes erythrocephalus*	Red-headed Woodpecker	Endangered	Threatened		SNA	8 Accidental	3	77.4 ± 0.0	NS
A	*Protonotaria citrea*	Prothonotary Warbler	Endangered	Endangered		SNA	8 Accidental	1	39.6 ± 0.0	NS
A	*Icteria virens*	Yellow-Breasted Chat	Endangered	Endangered		SNA	8 Accidental	5	30.4 ± 0.0	NS
A	*Delphinapterus leucas*	Beluga Whale - St Lawrence Estuary pop.	Endangered	Endangered		SNA		1	96.5 ± 1.0	NS
A	*Colinus virginianus*	Northern Bobwhite	Endangered	Endangered				8	25.6 ± 0.0	NS
A	*Antrostomus vociferus*	Eastern Whip-Poor-Will	Threatened	Threatened	Threatened	S1?B	1 At Risk	15	22.5 ± 7.0	NS
A	*Limosa haemastica*	Hudsonian Godwit	Threatened			S1S2M	3 Sensitive	90	35.3 ± 0.0	NS
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2	3 Sensitive	1335	17.9 ± 0.0	NS
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened			S2	2 May Be At Risk	7	34.8 ± 0.0	NS
A	*Anguilla rostrata*	American Eel	Threatened			S2	4 Secure	48	9.4 ± 0.0	NS
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2B,S1M	1 At Risk	363	4.1 ± 7.0	NS
A	*Thamnophis sauritus pop. 3*	Eastern Ribbonsnake - Atlantic pop.	Threatened	Threatened	Threatened	S2S3	1 At Risk	682	70.4 ± 0.0	NS
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2 May Be At Risk	1500	2.7 ± 1.0	NS
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	798	4.1 ± 7.0	NS
A	*Cardellina canadensis*	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	725	4.1 ± 7.0	NS
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Vulnerable	S3S4B	3 Sensitive	408	8.7 ± 7.0	NS
A	*Sturnella magna*	Eastern Meadowlark	Threatened	Threatened		SHB	3 Sensitive	2	29.1 ± 7.0	NS
A	*Melanerpes lewis*	Lewis's Woodpecker	Threatened	Threatened		SNA	8 Accidental	1	39.3 ± 0.0	NS
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened		SUB	5 Undetermined	35	46.4 ± 7.0	NS
A	*Passerculus sandwichensis princeps*	Savannah Sparrow princeps ssp	Special Concern	Special Concern		S1B	3 Sensitive	4	37.7 ± 0.0	NS
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern		S1N	1 At Risk	2	54.5 ± 2.0	NS
A	*Asio flammeus*	Short-eared Owl	Special Concern	Special Concern		S1S2B	2 May Be At Risk	11	27.8 ± 0.0	NS
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	2 May Be At Risk	188	4.1 ± 7.0	NS
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S2B	1 At Risk	409	4.1 ± 7.0	NS
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	562	4.1 ± 7.0	NS
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S2N	1 At Risk	40	23.4 ± 2.0	NS
A	*Balaenoptera physalus*	Fin Whale	Special Concern	Special Concern		S2S3		1	48.7 ± 0.0	NS
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern	Special Concern		S2S3M	3 Sensitive	8	39.9 ± 0.0	NS
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	3 Sensitive	284	8.5 ± 0.0	NS
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	702	4.1 ± 7.0	NS
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern	Special Concern	Vulnerable	S3S4B,S3N	4 Secure	394	6.8 ± 7.0	NS
A	*Phocoena phocoena pop. 1*	Harbour Porpoise - Northwest Atlantic pop.	Special Concern			S4		6	28.1 ± 1.0	NS
A	*Podiceps auritus*	Horned Grebe	Special Concern	Special Concern		S4N	4 Secure	7	8.0 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Chrysemys picta picta*	Eastern Painted Turtle	Special Concern			S4S5	4 Secure	397	13.5 ± 0.0	NS
A	*Calidris subruficollis*	Buff-breasted Sandpiper	Special Concern	Special Concern		SNA	8 Accidental	47	39.9 ± 0.0	NS
A	*Zonotrichia querula*	Harris's Sparrow	Special Concern			SNA	8 Accidental	1	29.8 ± 0.0	NS
A	*Lynx canadensis*	Canadian Lynx	Not At Risk		Endangered	S1	1 At Risk	2	61.0 ± 1.0	NS
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1?B	5 Undetermined	3	18.3 ± 7.0	NS
A	*Fulica americana*	American Coot	Not At Risk			S1B	5 Undetermined	10	21.9 ± 0.0	NS
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Not At Risk	Special Concern	Vulnerable	S1B,SNAM	3 Sensitive	110	18.5 ± 0.0	NS
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk			S2	3 Sensitive	3	68.1 ± 0.0	NS
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S2?B	5 Undetermined	4	60.4 ± 7.0	NS
A	*Glaucomys volans*	Southern Flying Squirrel	Not At Risk			S2S3	3 Sensitive	6	46.2 ± 0.0	NS
A	*Globicephala melas*	Long-finned Pilot Whale	Not At Risk			S2S3		2	40.6 ± 0.0	NS
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S3	4 Secure	30	17.1 ± 0.0	NS
A	*Megaptera novaeangliae*	Humpback Whale (NW Atlantic pop.)	Not At Risk			S3		3	62.1 ± 0.0	NS
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	3 Sensitive	208	4.1 ± 7.0	NS
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	3 Sensitive	76	28.7 ± 0.0	NS
A	*Buteo lagopus*	Rough-legged Hawk	Not At Risk			S3N	4 Secure	1	39.2 ± 0.0	NS
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	4 Secure	125	4.1 ± 7.0	NS
A	*Lagenorhynchus acutus*	Atlantic White-sided Dolphin	Not At Risk			S3S4		5	11.9 ± 0.0	NS
A	*Circus hudsonius*	Northern Harrier	Not At Risk			S3S4B	4 Secure	253	10.3 ± 7.0	NS
A	*Ammospiza nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	4 Secure	103	27.7 ± 7.0	NS
A	*Morone saxatilis*	Striped Bass	E,SC			S2S3	2 May Be At Risk	8	27.3 ± 0.0	NS
A	*Gadus morhua*	Atlantic Cod	E,SC,DD			SNR		2	24.4 ± 0.0	NS
A	*Salmo salar*	Atlantic Salmon	E,T,SC			S1	2 May Be At Risk	33	10.7 ± 0.0	NS
A	*Martes americana*	American Marten			Endangered	S1	1 At Risk	2	83.0 ± 0.0	NS
A	*Alces americanus*	Moose			Endangered	S1	1 At Risk	16	20.1 ± 0.0	NS
A	*Passerina cyanea*	Indigo Bunting				S1?B	5 Undetermined	26	24.0 ± 0.0	NS
A	*Uria aalge*	Common Murre				S1?B,S5N	4 Secure	1	44.2 ± 0.0	NS
A	*Anas acuta*	Northern Pintail				S1B	2 May Be At Risk	24	22.3 ± 7.0	NS
A	*Oxyura jamaicensis*	Ruddy Duck				S1B	4 Secure	1	36.0 ± 0.0	NS
A	*Gallinula galeata*	Common Gallinule				S1B	5 Undetermined	2	34.9 ± 7.0	NS
A	*Myiarchus crinitus*	Great Crested Flycatcher				S1B	2 May Be At Risk	34	19.1 ± 7.0	NS
A	*Cistothorus palustris*	Marsh Wren				S1B	5 Undetermined	2	55.8 ± 0.0	NS
A	*Mimus polyglottos*	Northern Mockingbird				S1B	4 Secure	51	18.3 ± 7.0	NS
A	*Toxostoma rufum*	Brown Thrasher				S1B	5 Undetermined	13	24.3 ± 0.0	NS
A	*Vireo gilvus*	Warbling Vireo				S1B	5 Undetermined	20	19.1 ± 7.0	NS
A	*Setophaga pinus*	Pine Warbler				S1B	5 Undetermined	20	19.8 ± 0.0	NS
A	*Calidris minutilla*	Least Sandpiper				S1B,S3M	4 Secure	1217	5.0 ± 0.0	NS
A	*Charadrius semipalmatus*	Semipalmated Plover				S1B,S3S4M	4 Secure	1683	9.4 ± 0.0	NS
A	*Vespertilionidae sp.*	bat species				S1S2		176	4.4 ± 0.0	NS
A	*Lasiurus cinereus*	Hoary Bat				S1S2B,S1M	2 May Be At Risk	5	39.6 ± 0.0	NS
A	*Pluvialis dominica*	American Golden-Plover				S1S2M	3 Sensitive	239	35.3 ± 0.0	NS
A	*Vireo philadelphicus*	Philadelphia Vireo				S2?B	5 Undetermined	15	35.5 ± 0.0	NS
A	*Spatula clypeata*	Northern Shoveler				S2B	2 May Be At Risk	11	35.2 ± 0.0	NS
A	*Mareca strepera*	Gadwall				S2B	2 May Be At Risk	25	28.7 ± 7.0	NS
A	*Empidonax traillii*	Willow Flycatcher				S2B	3 Sensitive	31	27.0 ± 0.0	NS
A	*Setophaga tigrina*	Cape May Warbler				S2B	3 Sensitive	94	4.1 ± 7.0	NS
A	*Piranga olivacea*	Scarlet Tanager				S2B	5 Undetermined	46	4.1 ± 7.0	NS
A	*Pooecetes gramineus*	Vesper Sparrow				S2B	2 May Be At Risk	46	15.7 ± 7.0	NS
A	*Molothrus ater*	Brown-headed Cowbird				S2B	4 Secure	153	6.8 ± 7.0	NS
A	*Alca torda*	Razorbill				S2B,S4N	3 Sensitive	17	37.9 ± 0.0	NS
A	*Bucephala clangula*	Common Goldeneye				S2B,S5N	4 Secure	123	7.9 ± 8.0	NS
A	*Branta bernicla*	Brant				S2M	3 Sensitive	2	55.1 ± 0.0	NS
A	*Phalacrocorax carbo*	Great Cormorant				S2S3	3 Sensitive	30	7.9 ± 8.0	NS
A	*Asio otus*	Long-eared Owl				S2S3	2 May Be At Risk	21	4.1 ± 7.0	NS
A	*Spinus pinus*	Pine Siskin				S2S3	3 Sensitive	363	4.1 ± 7.0	NS
A	*Cathartes aura*	Turkey Vulture				S2S3B	3 Sensitive	38	11.5 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Rallus limicola*	Virginia Rail				S2S3B	5 Undetermined	18	39.2 ± 0.0	NS
A	*Tringa semipalmata*	Willet				S2S3B	2 May Be At Risk	1484	6.8 ± 7.0	NS
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	2 May Be At Risk	215	8.7 ± 7.0	NS
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S2S3B	3 Sensitive	319	15.7 ± 7.0	NS
A	*Icterus galbula*	Baltimore Oriole				S2S3B	2 May Be At Risk	78	13.7 ± 7.0	NS
A	*Pinicola enucleator*	Pine Grosbeak				S2S3B,S5N	2 May Be At Risk	121	4.1 ± 7.0	NS
A	*Numenius phaeopus hudsonicus*	Hudsonian Whimbrel				S2S3M	3 Sensitive	251	23.1 ± 0.0	NS
A	*Calidris melanotos*	Pectoral Sandpiper				S2S3M	4 Secure	337	35.3 ± 0.0	NS
A	*Phalaropus fulicarius*	Red Phalarope				S2S3M	3 Sensitive	4	39.9 ± 0.0	NS
A	*Perisoreus canadensis*	Canada Jay				S3	3 Sensitive	431	2.4 ± 0.0	NS
A	*Poecile hudsonicus*	Boreal Chickadee				S3	3 Sensitive	431	4.1 ± 7.0	NS
A	*Sitta canadensis*	Red-breasted Nuthatch				S3	4 Secure	973	3.6 ± 0.0	NS
A	*Alosa pseudoharengus*	Alewife				S3	3 Sensitive	20	4.8 ± 0.0	NS
A	*Salvelinus fontinalis*	Brook Trout				S3	3 Sensitive	49	4.2 ± 0.0	NS
A	*Salvelinus namaycush*	Lake Trout				S3	3 Sensitive	1	52.4 ± 0.0	NS
A	*Menidia menidia*	Atlantic Silverside				S3		1	54.7 ± 0.0	NS
A	*Synaptomys cooperi*	Southern Bog Lemming				S3	4 Secure	1	68.1 ± 0.0	NS
A	*Pekania pennanti*	Fisher				S3	3 Sensitive	9	43.3 ± 5.0	NS
A	*Calidris maritima*	Purple Sandpiper				S3?N	3 Sensitive	185	14.3 ± 8.0	NS
A	*Calcarius lapponicus*	Lapland Longspur				S3?N	4 Secure	2	27.0 ± 0.0	NS
A	*Falco sparverius*	American Kestrel				S3B	4 Secure	255	4.1 ± 7.0	NS
A	*Charadrius vociferus*	Killdeer				S3B	3 Sensitive	530	4.8 ± 0.0	NS
A	*Gallinago delicata*	Wilson's Snipe				S3B	3 Sensitive	429	4.1 ± 7.0	NS
A	*Sterna paradisaea*	Arctic Tern				S3B	2 May Be At Risk	54	3.6 ± 7.0	NS
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	2 May Be At Risk	48	31.0 ± 7.0	NS
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	3 Sensitive	209	22.3 ± 7.0	NS
A	*Dumetella carolinensis*	Gray Catbird				S3B	2 May Be At Risk	416	6.8 ± 7.0	NS
A	*Cardellina pusilla*	Wilson's Warbler				S3B	3 Sensitive	83	4.1 ± 7.0	NS
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S3S4M	3 Sensitive	1739	5.0 ± 0.0	NS
A	*Oceanodroma leucorhoa*	Leach's Storm-Petrel				S3B,S5M	4 Secure	28	13.0 ± 0.0	NS
A	*Rissa tridactyla*	Black-legged Kittiwake				S3B,S5N	3 Sensitive	8	37.9 ± 0.0	NS
A	*Fratercula arctica*	Atlantic Puffin				S3B,S5N	3 Sensitive	20	34.6 ± 0.0	NS
A	*Pluvialis squatarola*	Black-bellied Plover				S3M	4 Secure	1847	8.0 ± 0.0	NS
A	*Tringa flavipes*	Lesser Yellowlegs				S3M	4 Secure	790	24.4 ± 0.0	NS
A	*Arenaria interpres*	Ruddy Turnstone				S3M	4 Secure	723	26.3 ± 0.0	NS
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	3 Sensitive	1512	23.7 ± 0.0	NS
A	*Calidris fuscicollis*	White-rumped Sandpiper				S3M	4 Secure	843	35.3 ± 0.0	NS
A	*Limnodromus griseus*	Short-billed Dowitcher				S3M	4 Secure	1180	23.7 ± 0.0	NS
A	*Calidris alba*	Sanderling				S3M,S2N	4 Secure	1341	26.1 ± 0.0	NS
A	*Chroicocephalus ridibundus*	Black-headed Gull				S3N	4 Secure	7	35.9 ± 0.0	NS
A	*Somateria mollissima*	Common Eider				S3S4	4 Secure	486	6.8 ± 7.0	NS
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	3 Sensitive	120	4.1 ± 7.0	NS
A	*Loxia curvirostra*	Red Crossbill				S3S4	4 Secure	188	2.4 ± 0.0	NS
A	*Botaurus lentiginosus*	American Bittern				S3S4B	3 Sensitive	137	22.5 ± 7.0	NS
A	*Spatula discors*	Blue-winged Teal				S3S4B	2 May Be At Risk	59	28.2 ± 7.0	NS
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	742	4.1 ± 7.0	NS
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	401	4.1 ± 7.0	NS
A	*Regulus calendula*	Ruby-crowned Kinglet				S3S4B	3 Sensitive	884	1.4 ± 0.0	NS
A	*Catharus fuscescens*	Veery				S3S4B	4 Secure	529	6.8 ± 7.0	NS
A	*Catharus ustulatus*	Swainson's Thrush				S3S4B	4 Secure	838	1.2 ± 0.0	NS
A	*Oreothlypis peregrina*	Tennessee Warbler				S3S4B	3 Sensitive	229	4.1 ± 7.0	NS
A	*Setophaga castanea*	Bay-breasted Warbler				S3S4B	3 Sensitive	295	4.1 ± 7.0	NS
A	*Setophaga striata*	Blackpoll Warbler				S3S4B	3 Sensitive	83	4.1 ± 7.0	NS
A	*Passerella iliaca*	Fox Sparrow				S3S4B	4 Secure	57	6.8 ± 7.0	NS
A	*Mergus serrator*	Red-breasted Merganser				S3S4B,S5N	4 Secure	123	6.8 ± 7.0	NS
A	*Bucephala albeola*	Bufflehead				S3S4N	4 Secure	47	8.8 ± 0.0	NS
A	*Lanius borealis*	Northern Shrike				S3S4N	4 Secure	1	37.2 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Leucophaeus atricilla*	Laughing Gull				SHB	4 Secure	11	10.7 ± 0.0	NS
A	*Progne subis*	Purple Martin				SHB	2 May Be At Risk	5	44.0 ± 0.0	NS
A	*Eremophila alpestris*	Horned Lark				SHB,S4S5N	4 Secure	12	31.0 ± 7.0	NS
A	*Morus bassanus*	Northern Gannet				SHB,S5M	4 Secure	18	22.3 ± 0.0	NS
A	*Aythya americana*	Redhead				SHB,SNAM	4 Secure	2	29.0 ± 0.0	NS
I	*Epeoloides pilosula*	Macropis Cuckoo Bee	Endangered	Endangered	Endangered	S1	1 At Risk	2	94.3 ± 5.0	NS
I	*Gomphus ventricosus*	Skillet Clubtail	Endangered	Endangered		S1	2 May Be At Risk	2	21.2 ± 1.0	NS
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Endangered	S2B	3 Sensitive	274	14.5 ± 0.0	NS
I	*Danaus plexippus plexippus*	Monarch	Endangered	Special Concern		S2B	3 Sensitive	1	29.3 ± 0.0	NS
I	*Barnea truncata*	Atlantic Mud-piddock	Threatened	Threatened		S1	1 At Risk	1	77.1 ± 1.0	NS
I	*Alasmidonta varicosa*	Brook Floater	Special Concern	Special Concern	Threatened	S1S2	3 Sensitive	5	54.9 ± 0.0	NS
I	*Bombus terricola*	Yellow-banded Bumblebee	Special Concern	Special Concern	Vulnerable	S3	3 Sensitive	26	22.7 ± 0.0	NS
I	*Cicindela formosa*	Big Sand Tiger Beetle				S1	2 May Be At Risk	1	58.8 ± 1.0	NS
I	*Satyrium acadica*	Acadian Hairstreak				S1	5 Undetermined	4	87.6 ± 2.0	NS
I	*Erora laeta*	Early Hairstreak				S1	2 May Be At Risk	1	23.7 ± 1.0	NS
I	*Ophiogomphus anomalus*	Extra-Striped Snaketail				S1	6 Not Assessed	8	84.7 ± 0.0	NS
I	*Somatochlora brevicincta*	Quebec Emerald				S1	2 May Be At Risk	1	48.1 ± 0.0	NS
I	*Leptodea ochracea*	Tidewater Mucket				S1	3 Sensitive	9	94.9 ± 1.0	NS
I	*Polygonia comma*	Eastern Comma				S1?	1 At Risk	19	24.5 ± 2.0	NS
I	*Polygonia satyrus*	Satyr Comma				S1?	3 Sensitive	7	21.8 ± 2.0	NS
I	*Strymon melinus*	Grey Hairstreak				S1S2	4 Secure	13	24.5 ± 1.0	NS
I	*Nymphalis l-album*	Compton Tortoiseshell				S1S2	4 Secure	18	14.1 ± 0.0	NS
I	*Somatochlora kennedyi*	Kennedy's Emerald				S1S2	2 May Be At Risk	7	21.2 ± 1.0	NS
I	*Coenagrion resolutum*	Taiga Bluet				S1S2	2 May Be At Risk	2	27.3 ± 1.0	NS
I	*Stylurus scudderi*	Zebra Clubtail				S1S2	2 May Be At Risk	9	39.1 ± 0.0	NS
I	*Lycaena hyllus*	Bronze Copper				S2	4 Secure	15	34.9 ± 1.0	NS
I	*Satyrium calanus*	Banded Hairstreak				S2	5 Undetermined	64	20.3 ± 2.0	NS
I	*Boloria chariclea*	Arctic Fritillary				S2	3 Sensitive	2	82.1 ± 2.0	NS
I	*Aglais milberti*	Milbert's Tortoiseshell				S2	4 Secure	20	24.5 ± 1.0	NS
I	*Epitheca princeps*	Prince Baskettail				S2	3 Sensitive	15	20.9 ± 0.0	NS
I	*Williamsonia fletcheri*	Ebony Boghaunter				S2	2 May Be At Risk	3	93.1 ± 0.0	NS
I	*Enallagma signatum*	Orange Bluet				S2	2 May Be At Risk	9	27.6 ± 1.0	NS
I	*Margaritifera margaritifera*	Eastern Pearlshell				S2	3 Sensitive	70	43.6 ± 0.0	NS
I	*Pantala hymenaea*	Spot-Winged Glider				S2?B	3 Sensitive	6	27.6 ± 1.0	NS
I	*Thorybes pylades*	Northern Cloudywing				S2S3	3 Sensitive	5	82.2 ± 2.0	NS
I	*Amblyscirtes hegon*	Pepper and Salt Skipper				S2S3	4 Secure	26	20.3 ± 2.0	NS
I	*Satyrium liparops*	Striped Hairstreak				S2S3	5 Undetermined	28	11.0 ± 1.0	NS
I	*Euphydryas phaeton*	Baltimore Checkerspot				S2S3	4 Secure	22	20.3 ± 2.0	NS
I	*Ophiogomphus aspersus*	Brook Snaketail				S2S3	2 May Be At Risk	2	4.4 ± 0.0	NS
I	*Ophiogomphus mainensis*	Maine Snaketail				S2S3	2 May Be At Risk	9	63.1 ± 0.0	NS
I	*Ophiogomphus rupinsulensis*	Rusty Snaketail				S2S3	2 May Be At Risk	31	31.3 ± 0.0	NS
I	*Somatochlora forcipata*	Forcipate Emerald				S2S3	2 May Be At Risk	5	26.4 ± 1.0	NS
I	*Somatochlora franklini*	Delicate Emerald				S2S3	3 Sensitive	1	21.2 ± 1.0	NS
I	*Erythrodiplax berenice*	Seaside Dragonlet				S2S3	3 Sensitive	3	42.5 ± 0.0	NS
I	*Enallagma vesperum*	Vesper Bluet				S2S3	3 Sensitive	7	52.3 ± 1.0	NS
I	*Alasmidonta undulata*	Triangle Floater				S2S3	4 Secure	31	21.7 ± 0.0	NS
I	*Strophiona nitens*	a Longhorned Beetle				S3		2	15.2 ± 0.0	NS
I	*Hippodamia parenthesis*	Parenthesis Lady Beetle				S3	5 Undetermined	2	34.5 ± 0.0	NS
I	*Naemia seriata*	a Ladybird beetle				S3	3 Sensitive	14	38.7 ± 0.0	NS
I	*Chilocorus stigma*	Twice-stabbed Lady Beetle				S3	4 Secure	4	26.4 ± 0.0	NS
I	*Trachysida aspera*	a Longhorned Beetle				S3		1	28.9 ± 0.0	NS
I	*Astylopsis sexguttata*	A Longhorned Beetle				S3		1	25.9 ± 0.0	NS
I	*Callophrys henrici*	Henry's Elfin				S3	4 Secure	39	14.9 ± 0.0	NS
I	*Callophrys lanoraieensis*	Bog Elfin				S3	2 May Be At Risk	20	15.6 ± 2.0	NS
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3	4 Secure	41	21.2 ± 2.0	NS
I	*Polygonia faunus*	Green Comma				S3	4 Secure	13	23.3 ± 2.0	NS
I	*Megisto cymela*	Little Wood-satyr				S3	4 Secure	8	28.6 ± 2.0	NS
I	*Oeneis jutta*	Jutta Arctic				S3	2 May Be At Risk	5	21.2 ± 2.0	NS

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I	*Aeshna clepsydra*	Mottled Darner				S3	4 Secure	17	14.3 ± 1.0	NS
I	*Aeshna constricta*	Lance-Tipped Darner				S3	4 Secure	17	21.2 ± 1.0	NS
I	*Boyeria grafiana*	Ocellated Darner				S3	3 Sensitive	10	32.1 ± 1.0	NS
I	*Gomphaeschna furcillata*	Harlequin Darner				S3	3 Sensitive	23	20.9 ± 1.0	NS
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S3	4 Secure	23	21.2 ± 1.0	NS
I	*Nannothemis bella*	Elfin Skimmer				S3	4 Secure	30	11.8 ± 1.0	NS
I	*Enallagma vernale*	Vernal Bluet				S3	5 Undetermined	5	13.0 ± 1.0	NS
I	*Amphiagrion saucium*	Eastern Red Damsel				S3	4 Secure	1	87.8 ± 1.0	NS
I	*Cupido comyntas*	Eastern Tailed Blue				S3?		22	15.7 ± 7.0	NS
I	*Polygonia interrogationis*	Question Mark				S3B	4 Secure	148	15.7 ± 7.0	NS
I	*Erynnis juvenalis*	Juvenal's Duskywing				S3S4	4 Secure	122	4.5 ± 1.0	NS
I	*Amblyscirtes vialis*	Common Roadside-Skipper				S3S4	4 Secure	39	13.9 ± 0.0	NS
I	*Polygonia progne*	Grey Comma				S3S4	4 Secure	31	21.8 ± 2.0	NS
I	*Lanthus parvulus*	Northern Pygmy Clubtail				S3S4	4 Secure	4	85.5 ± 0.0	NS
I	*Lampsilis radiata*	Eastern Lampmussel				S3S4	3 Sensitive	20	54.9 ± 0.0	NS
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1	1 At Risk	194	19.8 ± 0.0	NS
N	*Erioderma mollissimum*	Graceful Felt Lichen	Endangered	Endangered	Endangered	S1S2	2 May Be At Risk	11	23.9 ± 0.0	NS
N	*Peltigera hydrothyria*	Eastern Waterfan	Threatened	Threatened	Threatened	S1	2 May Be At Risk	13	74.5 ± 0.0	NS
N	*Pannaria lurida*	Wrinkled Shingle Lichen	Threatened	Threatened	Threatened	S1S2	2 May Be At Risk	140	20.9 ± 13.0	NS
N	*Fuscopannaria leucosticta*	White-rimmed Shingle Lichen	Threatened			S2S3	2 May Be At Risk	28	17.6 ± 0.0	NS
N	*Anzia colpodes*	Black-foam Lichen	Threatened	Threatened	Threatened	S3	3 Sensitive	39	23.1 ± 0.0	NS
N	*Sclerophora peronella (Atlantic pop.)*	Frosted Glass-whiskers (Atlantic population)	Special Concern	Special Concern		S1?		24	12.6 ± 0.0	NS
N	*Pectenia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	4 Secure	92	4.9 ± 0.0	NS
N	*Fissidens exilis*	Pygmy Pocket Moss	Not At Risk			S1S2	1 At Risk	3	35.3 ± 1.0	NS
N	*Fissidens exilis*	Pygmy Pocket Moss	Not At Risk			S1S2	1 At Risk	10	31.6 ± 0.0	NS
N	*Pseudevernia cladonia*	Ghost Antler Lichen	Not At Risk			S2S3	3 Sensitive	15	22.5 ± 0.0	NS
N	*Aloina brevirostris*	Short-Beaked Rigid Screw Moss				S1		1	29.1 ± 2.0	NS
N	*Umbilicaria vellea*	Grizzled Rocktripe Lichen				S1	5 Undetermined	1	4.8 ± 5.0	NS
N	*Usnea perplexans*	Powdered Beard Lichen				S1	2 May Be At Risk	1	52.8 ± 0.0	NS
N	*Leptogium azureum*	Blue Jellyskin Lichen				S1		1	88.5 ± 1.0	NS
N	*Leptogium dactylinum*	Brown-buttoned Jellyskin Lichen				S1	2 May Be At Risk	2	74.0 ± 0.0	NS
N	*Collema cristatum*	Fingered Tarpaper Lichen				S1	5 Undetermined	3	36.7 ± 0.0	NS
N	*Ephebe perspinulosa*	Thread Lichen				S1		2	73.8 ± 1.0	NS
N	*Fuscopannaria praetermissa*	Moss Shingles Lichen				S1	2 May Be At Risk	1	32.3 ± 0.0	NS
N	*Leptogium schraderi*	Schrader's Jellyskin Lichen				S1		1	66.6 ± 0.0	NS
N	*Pseudevernia consocians*	Common Antler Lichen				S1	2 May Be At Risk	1	57.8 ± 0.0	NS
N	*Peltigera lepidophora*	Scaly Pelt Lichen				S1	2 May Be At Risk	3	31.4 ± 0.0	NS
N	*Bryoria nitidula*	Tundra Horsehair Lichen				S1	5 Undetermined	1	39.3 ± 2.0	NS
N	*Calypogeia neogaea*	Common Pouchwort				S1?		1	57.3 ± 0.0	NS
N	*Moerckia hibernica*	Irish Ruffwort				S1?		1	56.0 ± 0.0	NS
N	*Aloina rigida*	Aloe-Like Rigid Screw Moss				S1?	2 May Be At Risk	3	29.1 ± 2.0	NS
N	*Bryum muehlenbeckii*	Muehlenbeck's Bryum Moss				S1?	5 Undetermined	2	38.0 ± 0.0	NS
N	*Conardia compacta*	Coast Creeping Moss				S1?	3 Sensitive	1	24.0 ± 2.0	NS
N	*Tortula obtusifolia*	a Moss				S1?	5 Undetermined	3	88.6 ± 1.0	NS
N	*Didymodon tophaceus*	Olive Beard Moss				S1?		1	55.4 ± 0.0	NS
N	*Paludella squarrosa*	Tufted Fen Moss				S1?	3 Sensitive	3	33.5 ± 0.0	NS
N	*Physcomitrium immersum*	a Moss				S1?	3 Sensitive	1	62.1 ± 0.0	NS
N	*Schistostega pennata*	Luminous Moss				S1?	3 Sensitive	1	34.8 ± 0.0	NS
N	*Syntrichia ruralis*	a Moss				S1?	3 Sensitive	1	27.9 ± 0.0	NS
N	*Trichodon cylindricus*	Cylindric Hairy-teeth Moss				S1?		1	83.5 ± 3.0	NS
N	*Plagiomnium ellipticum*	Marsh Leafy Moss				S1?	2 May Be At Risk	1	87.2 ± 0.0	NS
N	*Collema crispum*	Crinkled Pulp Lichen				S1?		1	55.5 ± 0.0	NS
N	*Lichina confinis*	Marine Seaweed Lichen				S1?	6 Not Assessed	3	39.4 ± 1.0	NS

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N	*Polychidium muscicola*	Eyed Mossthorns Woollybear Lichen				S1?	2 May Be At Risk	2	86.8 ± 0.0	NS
N	*Parmeliella parvula*	Poor-man's Shingles Lichen				S1?	2 May Be At Risk	1	29.6 ± 0.0	NS
N	*Aulacomnium heterostichum*	One-sided Groove Moss				S1S2	3 Sensitive	3	29.1 ± 2.0	NS
N	*Brachythecium turgidum*	Thick Ragged Moss				S1S2	3 Sensitive	3	83.5 ± 3.0	NS
N	*Hypnum pratense*	Meadow Plait Moss				S1S2	3 Sensitive	1	68.4 ± 3.0	NS
N	*Mnium thomsonii*	Thomson's Leafy Moss				S1S2	3 Sensitive	1	33.7 ± 2.0	NS
N	*Tortula acaulon*	Cuspidate Earth Moss				S1S2	3 Sensitive	1	70.0 ± 2.0	NS
N	*Plagiothecium latebricola*	Alder Silk Moss				S1S2	3 Sensitive	2	29.0 ± 5.0	NS
N	*Platydictya confervoides*	a Moss				S1S2	3 Sensitive	1	31.4 ± 0.0	NS
N	*Sematophyllum demissum*	a Moss				S1S2	3 Sensitive	2	27.2 ± 2.0	NS
N	*Sphagnum platyphyllum*	Flat-leaved Peat Moss				S1S2		3	31.4 ± 3.0	NS
N	*Timmia megapolitana*	Metropolitan Timmia Moss				S1S2	3 Sensitive	3	75.3 ± 1.0	NS
N	*Tortula mucronifolia*	Mucronate Screw Moss				S1S2	3 Sensitive	1	70.5 ± 3.0	NS
N	*Bryohaplocladium microphyllum*	Tiny-leaved Haplocladium Moss				S1S2		1	75.0 ± 5.0	NS
N	*Collema bachmanianum*	Bachman's Tarpaper Lichen				S1S2	6 Not Assessed	1	36.9 ± 0.0	NS
N	*Catapyrenium squamulosum*	Limy Soil Stipplescale Lichen				S1S2		1	89.2 ± 6.0	NS
N	*Rhizoplaca subdiscrepans*	Scattered Rock-posy Lichen				S1S2		1	24.2 ± 1.0	NS
N	*Sticta limbata*	Powdered Moon Lichen				S1S2	2 May Be At Risk	4	18.1 ± 3.0	NS
N	*Candelaria concolor*	Elfin Candleflame Lichen				S1S2	5 Undetermined	1	27.9 ± 0.0	NS
N	*Porella pinnata*	Pinnate Scalewort				S1S3	5 Undetermined	1	86.6 ± 0.0	NS
N	*Heterodermia galactophylla*	Branching Fringe Lichen				S1S3	5 Undetermined	1	24.5 ± 0.0	NS
N	*Melanelia culbersonii*	Appalachain Camouflage Lichen				S1S3	5 Undetermined	1	22.5 ± 0.0	NS
N	*Peltigera neckeri*	Black-saddle Pelt Lichen				S1S3	5 Undetermined	1	92.5 ± 0.0	NS
N	*Stereocaulon grande*	Grand Foam Lichen				S1S3	5 Undetermined	1	93.6 ± 0.0	NS
N	*Stereocaulon intermedium*	Pacific Brain Foam Lichen				S1S3		5	19.4 ± 0.0	NS
N	*Cystocoleus ebeneus*	Rockgossamer Lichen				S2		2	17.6 ± 0.0	NS
N	*Nephroma resupinatum*	a lichen				S2	2 May Be At Risk	4	22.4 ± 0.0	NS
N	*Parmotrema reticulatum*	Netted Ruffle Lichen				S2	3 Sensitive	4	55.4 ± 0.0	NS
N	*Riccardia multifida*	Delicate Germanderwort				S2?	5 Undetermined	1	76.3 ± 0.0	NS
N	*Anacamptodon splachnoides*	a Moss				S2?	3 Sensitive	2	25.6 ± 30.0	NS
N	*Weissia muhlenbergiana*	a Moss				S2?	3 Sensitive	5	33.7 ± 1.0	NS
N	*Atrichum angustatum*	Lesser Smoothcap Moss				S2?	3 Sensitive	2	82.9 ± 5.0	NS
N	*Bryum algovicum*	a Moss				S2?	3 Sensitive	1	29.1 ± 2.0	NS
N	*Campylium polygamum*	a Moss				S2?	5 Undetermined	3	24.4 ± 2.0	NS
N	*Campylium radicale*	Long-stalked Fine Wet Moss				S2?	5 Undetermined	1	68.4 ± 3.0	NS
N	*Dicranum condensatum*	Condensed Broom Moss				S2?	5 Undetermined	3	15.3 ± 0.0	NS
N	*Ditrichum rhynchostegium*	a Moss				S2?	3 Sensitive	1	18.0 ± 1.0	NS
N	*Fissidens bushii*	Bush's Pocket Moss				S2?	3 Sensitive	3	96.7 ± 0.0	NS
N	*Fissidens taxifolius*	Yew-leaved Pocket Moss				S2?	3 Sensitive	8	27.4 ± 0.0	NS
N	*Grimmia anomala*	Mountain Forest Grimmia				S2?	3 Sensitive	1	38.0 ± 1.0	NS
N	*Hygrohypnum bestii*	Best's Brook Moss				S2?	3 Sensitive	1	98.3 ± 0.0	NS
N	*Kiaeria starkei*	Starke's Fork Moss				S2?	3 Sensitive	1	67.7 ± 10.0	NS
N	*Orthotrichum anomalum*	Anomalous Bristle Moss				S2?	3 Sensitive	1	32.8 ± 2.0	NS
N	*Philonotis marchica*	a Moss				S2?	5 Undetermined	2	96.7 ± 0.0	NS
N	*Physcomitrium collenchymatum*	a Moss				S2?	3 Sensitive	1	83.6 ± 0.0	NS
N	*Platydictya jungermannioides*	False Willow Moss				S2?	3 Sensitive	1	57.0 ± 0.0	NS
N	*Racomitrium affine*	a Moss				S2?	5 Undetermined	3	18.4 ± 2.0	NS
N	*Sematophyllum marylandicum*	a Moss				S2?	3 Sensitive	2	27.2 ± 3.0	NS
N	*Sphagnum subnitens*	Lustrous Peat Moss				S2?	3 Sensitive	1	81.0 ± 2.0	NS
N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S2?	3 Sensitive	3	76.1 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
N	*Plagiomnium rostratum*	Long-beaked Leafy Moss				S2?	5 Undetermined	1	82.6 ± 2.0	NS
N	*Pseudotaxiphyllum distichaceum*	a Moss				S2?	3 Sensitive	2	89.3 ± 0.0	NS
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2?	3 Sensitive	1	27.6 ± 5.0	NS
N	*Platylomella lescurii*	a Moss				S2?	3 Sensitive	5	14.8 ± 0.0	NS
N	*Phylliscum demangeonii*	Black Rock-wafer Lichen				S2?	5 Undetermined	4	29.9 ± 0.0	NS
N	*Usnea flavocardia*	Blood-splattered Beard Lichen				S2?	3 Sensitive	1	13.7 ± 4.0	NS
N	*Leptogium teretiusculum*	Beaded Jellyskin Lichen				S2?	3 Sensitive	10	30.8 ± 0.0	NS
N	*Rostania occultata*	Crusted Tarpaper Lichen				S2?	5 Undetermined	3	72.7 ± 0.0	NS
N	*Leptogium imbricatum*	Scaly Jellyskin Lichen				S2?	5 Undetermined	1	60.3 ± 0.0	NS
N	*Placynthium flabellosum*	Scaly Ink Lichen				S2?	5 Undetermined	2	59.2 ± 17.0	NS
N	*Xanthoparmelia mougeotii*	Powdered Rock-shield Lichen				S2?	2 May Be At Risk	1	84.1 ± 0.0	NS
N	*Peltigera collina*	Tree Pelt Lichen				S2?	3 Sensitive	5	17.3 ± 0.0	NS
N	*Ephemerum serratum*	a Moss				S2S3	3 Sensitive	5	34.7 ± 5.0	NS
N	*Eurhynchium hians*	Light Beaked Moss				S2S3	3 Sensitive	5	26.4 ± 5.0	NS
N	*Platydictya subtilis*	Bark Willow Moss				S2S3	3 Sensitive	3	81.1 ± 0.0	NS
N	*Tortula truncata*	a Moss				S2S3	3 Sensitive	6	52.9 ± 0.0	NS
N	*Limprichtia revolvens*	a Moss				S2S3	3 Sensitive	2	24.4 ± 2.0	NS
N	*Collema leptaleum*	Crumpled Bat's Wing Lichen				S2S3	3 Sensitive	42	14.5 ± 1.0	NS
N	*Solorina saccata*	Woodland Owl Lichen				S2S3	2 May Be At Risk	8	37.0 ± 0.0	NS
N	*Ahtiana aurescens*	Eastern Candlewax Lichen				S2S3	5 Undetermined	9	12.7 ± 0.0	NS
N	*Usnocetraria oakesiana*	Yellow Band Lichen				S2S3	2 May Be At Risk	11	18.0 ± 0.0	NS
N	*Cladonia mateocyatha*	Mixed-up Pixie-cup				S2S3		4	19.6 ± 5.0	NS
N	*Cladonia parasitica*	Fence-rail Lichen				S2S3	5 Undetermined	3	17.4 ± 0.0	NS
N	*Hypotrachyna catawbiensis*	Powder-tipped Antler Lichen				S2S3	2 May Be At Risk	4	23.6 ± 0.0	NS
N	*Leptogium milligranum*	Stretched Jellyskin Lichen				S2S3	3 Sensitive	9	33.5 ± 0.0	NS
N	*Leptogium tenuissimum*	Birdnest Jellyskin Lichen				S2S3	6 Not Assessed	6	17.5 ± 0.0	NS
N	*Melanohalea septentrionalis*	Northern Camouflage Lichen				S2S3		1	53.0 ± 0.0	NS
N	*Myelochroa aurulenta*	Powdery Axil-bristle Lichen				S2S3	5 Undetermined	4	53.7 ± 2.0	NS
N	*Parmelia fertilis*	Fertile Shield Lichen				S2S3	5 Undetermined	1	80.5 ± 0.0	NS
N	*Hypotrachyna minarum*	Hairless-spined Shield Lichen				S2S3	3 Sensitive	2	55.8 ± 0.0	NS
N	*Parmeliopsis ambigua*	Green Starburst Lichen				S2S3	3 Sensitive	1	54.2 ± 2.0	NS
N	*Racodium rupestre*	Rockhair Lichen				S2S3	5 Undetermined	3	17.1 ± 1.0	NS
N	*Umbilicaria polyphylla*	Petalled Rocktripe Lichen				S2S3	3 Sensitive	1	54.2 ± 2.0	NS
N	*Usnea cavernosa*	Pitted Beard Lichen				S2S3	3 Sensitive	2	52.8 ± 0.0	NS
N	*Usnea ceratina*	Warty Beard Lichen				S2S3	3 Sensitive	2	57.6 ± 0.0	NS
N	*Usnea mutabilis*	Bloody Beard Lichen				S2S3	3 Sensitive	1	52.8 ± 0.0	NS
N	*Usnea rubicunda*	Red Beard Lichen				S2S3	3 Sensitive	4	27.3 ± 0.0	NS
N	*Stereocaulon condensatum*	Granular Soil Foam Lichen				S2S3	5 Undetermined	2	75.2 ± 0.0	NS
N	*Physcia subtilis*	Slender Rosette Lichen				S2S3	3 Sensitive	1	64.4 ± 0.0	NS
N	*Cetraria arenaria*	Sand-loving Icelandmoss Lichen				S2S3	5 Undetermined	16	45.0 ± 0.0	NS
N	*Cladonia coccifera*	Eastern Boreal Pixie-cup Lichen				S2S3	3 Sensitive	3	39.3 ± 2.0	NS
N	*Cladonia deformis*	Lesser Sulphur-cup Lichen				S2S3	5 Undetermined	3	30.8 ± 4.0	NS
N	*Cladonia phyllophora*	Felt Lichen				S2S3	5 Undetermined	2	64.6 ± 4.0	NS
N	*Usnea flammea*	Coastal Bushy Beard Lichen				S2S3	3 Sensitive	1	39.4 ± 1.0	NS
N	*Ramalina thrausta*	Angelhair Ramalina Lichen				S3	3 Sensitive	2	71.2 ± 0.0	NS
N	*Collema tenax*	Soil Tarpaper Lichen				S3		5	33.3 ± 0.0	NS
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S3	3 Sensitive	17	22.9 ± 0.0	NS
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3	3 Sensitive	26	9.2 ± 0.0	NS
N	*Leptogium subtile*	Appressed Jellyskin Lichen				S3	3 Sensitive	20	19.0 ± 0.0	NS
N	*Fuscopannaria ahlneri*	Corrugated Shingles Lichen				S3	4 Secure	47	15.3 ± 0.0	NS
N	*Heterodermia speciosa*	Powdered Fringe Lichen				S3	4 Secure	26	28.1 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
N	*Heterodermia squamulosa*	Scaly Fringe Lichen				S3	3 Sensitive	54	55.3 ± 0.0	NS
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S3	3 Sensitive	65	7.6 ± 0.0	NS
N	*Leptogium lichenoides*	Tattered Jellyskin Lichen				S3	2 May Be At Risk	8	31.3 ± 0.0	NS
N	*Nephroma bellum*	Naked Kidney Lichen				S3	3 Sensitive	1	13.7 ± 4.0	NS
N	*Placynthium nigrum*	Common Ink Lichen				S3	5 Undetermined	2	90.4 ± 0.0	NS
N	*Punctelia appalachensis*	Appalachian Speckleback Lichen				S3	3 Sensitive	65	68.4 ± 0.0	NS
N	*Moelleropsis nebulosa*	Blue-gray Moss Shingle Lichen				S3	4 Secure	25	12.2 ± 0.0	NS
N	*Usnea hirta*	Bristly Beard Lichen				S3	5 Undetermined	2	27.3 ± 0.0	NS
N	*Fuscopannaria sorediata*	a Lichen				S3		3	17.1 ± 1.0	NS
N	*Ephebe lanata*	Waterside Rockshag Lichen				S3	3 Sensitive	2	59.2 ± 17.0	NS
N	*Usnea macaronesica*	Beard Lichen				S3	5 Undetermined	3	23.0 ± 1.0	NS
N	*Metzgeria conjugata*	Rock Veilwort				S3?	5 Undetermined	1	97.1 ± 0.0	NS
N	*Barbula convoluta*	Lesser Bird's-claw Beard Moss				S3?	5 Undetermined	3	31.4 ± 0.0	NS
N	*Calliergon giganteum*	Giant Spear Moss				S3?	3 Sensitive	3	28.5 ± 3.0	NS
N	*Drummondia prorepens*	a Moss				S3?	3 Sensitive	2	29.9 ± 5.0	NS
N	*Anomodon tristis*	a Moss				S3?	3 Sensitive	9	69.6 ± 0.0	NS
N	*Helodium blandowii*	Wetland-plume Moss				S3?	4 Secure	6	30.6 ± 0.0	NS
N	*Mnium stellare*	Star Leafy Moss				S3?	5 Undetermined	3	30.5 ± 0.0	NS
N	*Sphagnum riparium*	Streamside Peat Moss				S3?	3 Sensitive	3	67.3 ± 0.0	NS
N	*Phaeophyscia pusilloides*	Pompom-tipped Shadow Lichen				S3?	5 Undetermined	5	27.6 ± 0.0	NS
N	*Cladonia stygia*	Black-footed Reindeer Lichen				S3?	3 Sensitive	4	58.9 ± 0.0	NS
N	*Anomodon rugelii*	Rugel's Anomodon Moss				S3S4	3 Sensitive	5	69.6 ± 0.0	NS
N	*Dichelyma capillaceum*	Hairlike Dichelyma Moss				S3S4	4 Secure	3	23.9 ± 3.0	NS
N	*Dicranella varia*	a Moss				S3S4	5 Undetermined	3	42.5 ± 0.0	NS
N	*Dicranum leioneuron*	a Dicranum Moss				S3S4	4 Secure	1	24.8 ± 0.0	NS
N	*Sphagnum lindbergii*	Lindberg's Peat Moss				S3S4	4 Secure	1	94.8 ± 0.0	NS
N	*Splachnum ampullaceum*	Cruet Dung Moss				S3S4	4 Secure	1	66.8 ± 0.0	NS
N	*Thamnobryum alleghaniense*	a Moss				S3S4	3 Sensitive	8	56.6 ± 4.0	NS
N	*Schistidium agassizii*	Elf Bloom Moss				S3S4	4 Secure	4	38.0 ± 1.0	NS
N	*Hylocomiastrum pyrenaicum*	a Feather Moss				S3S4	3 Sensitive	2	27.3 ± 0.0	NS
N	*Arctoparmelia incurva*	Finger Ring Lichen				S3S4	4 Secure	54	8.9 ± 0.0	NS
N	*Hypogymnia vittata*	Slender Monk's Hood Lichen				S3S4	4 Secure	23	9.3 ± 0.0	NS
N	*Leptogium acadiense*	Acadian Jellyskin Lichen				S3S4		13	9.8 ± 0.0	NS
N	*Cladonia floerkeana*	Gritty British Soldiers Lichen				S3S4	5 Undetermined	3	31.3 ± 0.0	NS
N	*Vahliella leucophaea*	Shelter Shingle Lichen				S3S4	4 Secure	1	86.8 ± 0.0	NS
N	*Melanohalea olivacea*	Spotted Camouflage Lichen				S3S4	5 Undetermined	2	52.8 ± 0.0	NS
N	*Parmotrema chinense*	Powdered Ruffle Lichen				S3S4	4 Secure	13	45.8 ± 0.0	NS
N	*Peltigera hymenina*	Cloudy Pelt Lichen				S3S4	4 Secure	1	39.3 ± 2.0	NS
N	*Physconia detersa*	Bottlebrush Frost Lichen				S3S4	3 Sensitive	11	27.9 ± 0.0	NS
N	*Sphaerophorus fragilis*	Fragile Coral Lichen				S3S4	4 Secure	6	24.2 ± 3.0	NS
N	*Coccocarpia palmicola*	Salted Shell Lichen				S3S4	4 Secure	213	10.6 ± 0.0	NS
N	*Physcia caesia*	Blue-gray Rosette Lichen				S3S4	5 Undetermined	2	39.4 ± 1.0	NS
N	*Physcia tenella*	Fringed Rosette Lichen				S3S4	6 Not Assessed	3	29.2 ± 0.0	NS
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	4 Secure	58	15.4 ± 0.0	NS
N	*Bryoria pikei*	Pike's Horsehair Lichen				S3S4	5 Undetermined	3	21.0 ± 5.0	NS
N	*Evernia prunastri*	Valley Oakmoss Lichen				S3S4	3 Sensitive	17	27.3 ± 0.0	NS
N	*Dermatocarpon luridum*	Brookside Stippleback Lichen				S3S4	4 Secure	24	20.3 ± 5.0	NS
N	*Heterodermia neglecta*	Fringe Lichen				S3S4	4 Secure	56	12.8 ± 0.0	NS
P	*Rhynchospora macrostachya*	Tall Beakrush	Endangered	Endangered	Endangered	S1	2 May Be At Risk	7	79.8 ± 0.0	NS
P	*Clethra alnifolia*	Coast Pepper-Bush	Endangered	Threatened	Vulnerable	S1	1 At Risk	36	32.9 ± 0.0	NS
P	*Juglans cinerea*	Butternut	Endangered	Endangered		SNA	7 Exotic	12	17.2 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Fraxinus nigra*	Black Ash	Threatened		Threatened	S1S2	1 At Risk	262	14.7 ± 0.0	NS
P	*Liatris spicata*	Dense Blazing Star	Threatened	Threatened		SNA		5	27.3 ± 0.0	NS
P	*Lilaeopsis chinensis*	Eastern Lilaeopsis	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	150	56.7 ± 1.0	NS
P	*Eleocharis tuberculosa*	Tubercled Spike-rush	Special Concern	Special Concern	Vulnerable	S2	1 At Risk	1	97.4 ± 0.0	NS
P	*Lachnanthes caroliniana*	Redroot	Special Concern	Special Concern	Vulnerable	S2	1 At Risk	1470	78.9 ± 0.0	NS
P	*Lophiola aurea*	Goldencrest	Special Concern	Special Concern	Vulnerable	S2	1 At Risk	777	65.4 ± 1.0	NS
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	13	84.9 ± 0.0	NS
P	*Scirpus longii*	Long's Bulrush	Special Concern		Vulnerable	S3	3 Sensitive	427	72.4 ± 0.0	NS
P	*Floerkea proserpinacoides*	False Mermaidweed	Not At Risk			S2	3 Sensitive	25	65.8 ± 1.0	NS
P	*Smilax rotundifolia*	Round-leaved Greenbrier	Not At Risk			S3	4 Secure	160	81.5 ± 0.0	NS
P	*Crocanthemum canadense*	Long-branched Frostweed			Endangered	S1	1 At Risk	127	10.3 ± 1.0	NS
P	*Cypripedium arietinum*	Ram's-Head Lady's-Slipper			Endangered	S1	1 At Risk	167	25.2 ± 0.0	NS
P	*Thuja occidentalis*	Eastern White Cedar			Vulnerable	S1	1 At Risk	93	14.6 ± 0.0	NS
P	*Acer saccharinum*	Silver Maple				S1	5 Undetermined	11	63.0 ± 0.0	NS
P	*Toxicodendron vernix*	Poison Sumac				S1	2 May Be At Risk	4	99.7 ± 0.0	NS
P	*Osmorhiza depauperata*	Blunt Sweet Cicely				S1	2 May Be At Risk	1	54.5 ± 5.0	NS
P	*Sanicula odorata*	Clustered Sanicle				S1	2 May Be At Risk	10	31.7 ± 0.0	NS
P	*Zizia aurea*	Golden Alexanders				S1	2 May Be At Risk	23	57.3 ± 0.0	NS
P	*Antennaria rosea ssp. arida*	Rosy Pussytoes				S1	2 May Be At Risk	1	93.1 ± 0.0	NS
P	*Antennaria parlinii ssp. fallax*	Parlin's Pussytoes				S1		25	29.0 ± 0.0	NS
P	*Ageratina altissima*	White Snakeroot				S1	2 May Be At Risk	2	93.8 ± 0.0	NS
P	*Andersonglossum boreale*	Northern Wild Comfrey				S1	2 May Be At Risk	5	32.6 ± 1.0	NS
P	*Turritis glabra*	Tower Mustard				S1	5 Undetermined	1	53.7 ± 0.0	NS
P	*Draba glabella*	Rock Whitlow-Grass				S1	2 May Be At Risk	4	71.3 ± 0.0	NS
P	*Lobelia spicata*	Pale-Spiked Lobelia				S1	2 May Be At Risk	8	62.4 ± 7.0	NS
P	*Silene antirrhina*	Sleepy Catchfly				S1	2 May Be At Risk	5	83.1 ± 0.0	NS
P	*Stellaria crassifolia*	Fleshy Stitchwort				S1	2 May Be At Risk	1	99.0 ± 2.0	NS
P	*Astragalus robbinsii var. minor*	Robbins' Milkvetch				S1	2 May Be At Risk	28	93.0 ± 0.0	NS
P	*Desmodium canadense*	Canada Tick-trefoil				S1	2 May Be At Risk	12	53.8 ± 7.0	NS
P	*Hylodesmum glutinosum*	Large Tick-trefoil				S1	2 May Be At Risk	34	34.4 ± 0.0	NS
P	*Ribes americanum*	Wild Black Currant				S1	5 Undetermined	4	33.3 ± 3.0	NS
P	*Trichostema dichotomum*	Forked Bluecurls				S1	2 May Be At Risk	6	77.7 ± 0.0	NS
P	*Fraxinus pennsylvanica*	Red Ash				S1	2 May Be At Risk	12	21.2 ± 0.0	NS
P	*Polygala polygama*	Racemed Milkwort				S1	5 Undetermined	4	27.0 ± 1.0	NS
P	*Persicaria careyi*	Carey's Smartweed				S1	5 Undetermined	1	75.6 ± 3.0	NS
P	*Podostemum ceratophyllum*	Horn-leaved Riverweed				S1	2 May Be At Risk	4	63.7 ± 0.0	NS
P	*Montia fontana*	Water Blinks				S1	2 May Be At Risk	3	27.2 ± 1.0	NS
P	*Lysimachia quadrifolia*	Whorled Yellow Loosestrife				S1	5 Undetermined	1	1.3 ± 0.0	NS
P	*Amelanchier nantucketensis*	Nantucket Serviceberry				S1	2 May Be At Risk	1	85.0 ± 1.0	NS
P	*Salix myrtillifolia*	Blueberry Willow				S1	2 May Be At Risk	1	66.6 ± 0.0	NS
P	*Salix serissima*	Autumn Willow				S1	2 May Be At Risk	2	66.6 ± 0.0	NS
P	*Agalinis purpurea var. parviflora*	Small-flowered Purple False Foxglove				S1		2	14.7 ± 0.0	NS
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S1	5 Undetermined	2	79.7 ± 1.0	NS
P	*Dirca palustris*	Eastern Leatherwood				S1	2 May Be At Risk	55	28.6 ± 0.0	NS
P	*Boehmeria cylindrica*	Small-spike False-nettle				S1	2 May Be At Risk	50	48.7 ± 0.0	NS
P	*Pilea pumila*	Dwarf Clearweed				S1	2 May Be At Risk	4	26.1 ± 0.0	NS
P	*Carex digitalis*	Slender Wood Sedge				S1	2 May Be At Risk	2	87.4 ± 0.0	NS
P	*Carex garberi*	Garber's Sedge				S1	2 May Be At Risk	3	98.1 ± 0.0	NS
P	*Carex gynocrates*	Northern Bog Sedge				S1	2 May Be At Risk	2	66.7 ± 0.0	NS
P	*Carex haydenii*	Hayden's Sedge				S1	2 May Be At Risk	4	61.1 ± 1.0	NS
P	*Carex pellita*	Woolly Sedge				S1	2 May Be At Risk	2	89.3 ± 10.0	NS
P	*Carex laxiflora*	Loose-Flowered Sedge				S1	2 May Be At Risk	2	68.2 ± 1.0	NS
P	*Carex ormostachya*	Necklace Spike Sedge				S1	2 May Be At Risk	1	69.9 ± 5.0	NS
P	*Carex plantaginea*	Plantain-Leaved Sedge				S1	2 May Be At Risk	2	92.2 ± 0.0	NS
P	*Carex prairea*	Prairie Sedge				S1	2 May Be At Risk	2	67.2 ± 1.0	NS
P	*Carex viridula var.*	Greenish Sedge				S1	2 May Be At Risk	3	73.6 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	saxilittoralis									
P	*Scirpus atrovirens*	Dark-green Bulrush				S1		5	32.5 ± 0.0	NS
P	*Schoenoplectus torreyi*	Torrey's Bulrush				S1	2 May Be At Risk	8	76.2 ± 0.0	NS
P	*Iris prismatica*	Slender Blue Flag				S1	2 May Be At Risk	1	62.3 ± 100.0	NS
P	*Sisyrinchium fuscatum*	Coastal Plain Blue-eyed-grass				S1	2 May Be At Risk	3	61.8 ± 0.0	NS
P	*Juncus secundus*	Secund Rush				S1	2 May Be At Risk	2	67.9 ± 0.0	NS
P	*Juncus vaseyi*	Vasey Rush				S1	2 May Be At Risk	1	99.1 ± 0.0	NS
P	*Allium tricoccum*	Wild Leek				S1	2 May Be At Risk	56	66.3 ± 0.0	NS
P	*Trillium grandiflorum*	White Trillium				S1	5 Undetermined	3	67.2 ± 1.0	NS
P	*Malaxis monophyllos var. brachypoda*	North American White Adder's-mouth				S1	2 May Be At Risk	5	62.4 ± 10.0	NS
P	*Spiranthes casei var. casei*	Case's Ladies'-Tresses				S1	2 May Be At Risk	2	44.5 ± 0.0	NS
P	*Bromus latiglumis*	Broad-Glumed Brome				S1	2 May Be At Risk	24	84.4 ± 0.0	NS
P	*Dichanthelium xanthophysum*	Slender Panic Grass				S1	2 May Be At Risk	9	60.3 ± 1.0	NS
P	*Elymus wiegandii*	Wiegand's Wild Rye				S1	2 May Be At Risk	6	28.7 ± 7.0	NS
P	*Elymus hystrix*	Spreading Wild Rye				S1	2 May Be At Risk	11	31.6 ± 0.0	NS
P	*Torreyochloa pallida var. pallida*	Pale False Manna Grass				S1	0.1 Extirpated	1	83.3 ± 1.0	NS
P	*Adiantum pedatum*	Northern Maidenhair Fern				S1	2 May Be At Risk	11	18.2 ± 1.0	NS
P	*Equisetum palustre*	Marsh Horsetail				S1	2 May Be At Risk	1	61.0 ± 5.0	NS
P	*Botrychium lunaria*	Common Moonwort				S1	2 May Be At Risk	6	44.2 ± 0.0	NS
P	*Selaginella rupestris*	Rock Spikemoss				S1	2 May Be At Risk	1	31.9 ± 0.0	NS
P	*Solidago hispida*	Hairy Goldenrod				S1?	2 May Be At Risk	1	28.7 ± 7.0	NS
P	*Suaeda rolandii*	Roland's Sea-Blite				S1?	2 May Be At Risk	5	32.8 ± 2.0	NS
P	*Carex pensylvanica*	Pennsylvania Sedge				S1?	2 May Be At Risk	3	35.7 ± 0.0	NS
P	*Juncus anthelatus*	Greater Poverty Rush				S1?	2 May Be At Risk	1	91.5 ± 0.0	NS
P	*Dichanthelium lindheimeri*	Lindheimer's Panicgrass				S1?	5 Undetermined	3	59.9 ± 1.0	NS
P	*Panicum dichotomiflorum ssp. puritanorum*	Spreading Panicgrass				S1?	2 May Be At Risk	1	94.3 ± 0.0	NS
P	*Rudbeckia laciniata*	Cut-Leaved Coneflower				S1S2	2 May Be At Risk	14	13.7 ± 7.0	NS
P	*Arabis pycnocarpa*	Cream-flowered Rockcress				S1S2	2 May Be At Risk	1	75.7 ± 0.0	NS
P	*Cardamine maxima*	Large Toothwort				S1S2	2 May Be At Risk	3	79.7 ± 0.0	NS
P	*Proserpinaca intermedia*	Intermediate Mermaidweed				S1S2	2 May Be At Risk	5	58.5 ± 0.0	NS
P	*Conopholis americana*	American Cancer-root				S1S2	2 May Be At Risk	23	59.8 ± 1.0	NS
P	*Anemone virginiana var. alba*	Virginia Anemone				S1S2	3 Sensitive	5	87.8 ± 7.0	NS
P	*Hepatica americana*	Round-lobed Hepatica				S1S2	2 May Be At Risk	56	27.8 ± 3.0	NS
P	*Ranunculus sceleratus*	Cursed Buttercup				S1S2	2 May Be At Risk	23	22.7 ± 0.0	NS
P	*Gratiola neglecta*	Clammy Hedge-Hyssop				S1S2	3 Sensitive	4	78.5 ± 2.0	NS
P	*Carex livida*	Livid Sedge				S1S2	2 May Be At Risk	13	18.9 ± 0.0	NS
P	*Juncus greenei*	Greene's Rush				S1S2	2 May Be At Risk	5	2.9 ± 0.0	NS
P	*Platanthera huronensis*	Fragrant Green Orchid				S1S2	5 Undetermined	1	33.6 ± 10.0	NS
P	*Calamagrostis stricta ssp. stricta*	Slim-stemmed Reed Grass				S1S2	3 Sensitive	1	96.1 ± 7.0	NS
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S1S2	2 May Be At Risk	55	59.5 ± 0.0	NS
P	*Festuca subverticillata*	Nodding Fescue				S1S2	2 May Be At Risk	13	45.1 ± 7.0	NS
P	*Cryptogramma stelleri*	Steller's Rockbrake				S1S2	2 May Be At Risk	3	34.8 ± 0.0	NS
P	*Carex vacillans*	Estuarine Sedge				S1S3	5 Undetermined	1	86.1 ± 0.0	NS
P	*Conioselinum chinense*	Chinese Hemlock-parsley				S2	3 Sensitive	5	52.1 ± 0.0	NS
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2	2 May Be At Risk	18	34.6 ± 0.0	NS
P	*Erigeron philadelphicus*	Philadelphia Fleabane				S2	3 Sensitive	2	89.8 ± 1.0	NS
P	*Eutrochium dubium*	Coastal Plain Joe Pye Weed				S2	2 May Be At Risk	2	87.5 ± 0.0	NS
P	*Lactuca hirsuta*	Hairy Lettuce				S2	3 Sensitive	5	48.1 ± 7.0	NS
P	*Symphyotrichum undulatum*	Wavy-leaved Aster				S2	3 Sensitive	137	18.1 ± 1.0	NS
P	*Symphyotrichum ciliolatum*	Fringed Blue Aster				S2	3 Sensitive	19	35.8 ± 0.0	NS
P	*Impatiens pallida*	Pale Jewelweed				S2	3 Sensitive	3	67.8 ± 7.0	NS

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P	*Caulophyllum thalictroides*	Blue Cohosh				S2	2 May Be At Risk	44	18.1 ± 7.0	NS
P	*Boechera stricta*	Drummond's Rockcress				S2	3 Sensitive	10	68.2 ± 1.0	NS
P	*Cardamine parviflora*	Small-flowered Bittercress				S2	3 Sensitive	15	13.5 ± 50.0	NS
P	*Draba arabisans*	Rock Whitlow-Grass				S2	3 Sensitive	16	68.2 ± 1.0	NS
P	*Stellaria humifusa*	Saltmarsh Starwort				S2	3 Sensitive	8	75.7 ± 1.0	NS
P	*Stellaria longifolia*	Long-leaved Starwort				S2	3 Sensitive	9	59.9 ± 5.0	NS
P	*Oxybasis rubra*	Red Goosefoot				S2	2 May Be At Risk	2	95.0 ± 2.0	NS
P	*Hudsonia ericoides*	Pinebarren Golden Heather				S2	3 Sensitive	179	14.5 ± 0.0	NS
P	*Hypericum majus*	Large St John's-wort				S2	3 Sensitive	5	6.7 ± 10.0	NS
P	*Crassula aquatica*	Water Pygmyweed				S2	3 Sensitive	1	24.5 ± 0.0	NS
P	*Oxytropis campestris*	Field Locoweed				S2	2 May Be At Risk	1	93.7 ± 0.0	NS
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S2	2 May Be At Risk	25	93.1 ± 0.0	NS
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S2	3 Sensitive	9	21.1 ± 1.0	NS
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S2	3 Sensitive	3	40.2 ± 3.0	NS
P	*Utricularia resupinata*	Inverted Bladderwort				S2	3 Sensitive	12	73.1 ± 0.0	NS
P	*Oenothera fruticosa ssp. tetragona*	Narrow-leaved Evening Primrose				S2	5 Undetermined	7	24.4 ± 7.0	NS
P	*Persicaria arifolia*	Halberd-leaved Tearthumb				S2	3 Sensitive	18	52.1 ± 0.0	NS
P	*Rumex triangulivalvis*	Triangular-valve Dock				S2	3 Sensitive	10	29.5 ± 0.0	NS
P	*Primula mistassinica*	Mistassini Primrose				S2	3 Sensitive	15	87.8 ± 7.0	NS
P	*Anemonastrum canadense*	Canada Anemone				S2	2 May Be At Risk	14	23.6 ± 7.0	NS
P	*Anemone quinquefolia*	Wood Anemone				S2	3 Sensitive	30	63.8 ± 0.0	NS
P	*Anemone virginiana*	Virginia Anemone				S2	3 Sensitive	16	32.6 ± 1.0	NS
P	*Anemone virginiana var. virginiana*	Virginia Anemone				S2	3 Sensitive	2	33.6 ± 7.0	NS
P	*Caltha palustris*	Yellow Marsh Marigold				S2	3 Sensitive	5	23.7 ± 0.0	NS
P	*Galium boreale*	Northern Bedstraw				S2	2 May Be At Risk	7	62.4 ± 7.0	NS
P	*Galium labradoricum*	Labrador Bedstraw				S2	3 Sensitive	79	63.9 ± 0.0	NS
P	*Salix pedicellaris*	Bog Willow				S2	3 Sensitive	148	59.1 ± 0.0	NS
P	*Salix sericea*	Silky Willow				S2	2 May Be At Risk	127	36.5 ± 1.0	NS
P	*Saxifraga paniculata ssp. laestadii*	Laestadius' Saxifrage				S2	3 Sensitive	12	62.4 ± 7.0	NS
P	*Tiarella cordifolia*	Heart-leaved Foamflower				S2	3 Sensitive	15	60.5 ± 0.0	NS
P	*Viola nephrophylla*	Northern Bog Violet				S2	3 Sensitive	6	50.1 ± 1.0	NS
P	*Carex bebbii*	Bebb's Sedge				S2	3 Sensitive	24	30.7 ± 0.0	NS
P	*Carex capillaris*	Hairlike Sedge				S2	3 Sensitive	8	84.1 ± 0.0	NS
P	*Carex castanea*	Chestnut Sedge				S2	2 May Be At Risk	26	48.9 ± 0.0	NS
P	*Carex comosa*	Bearded Sedge				S2	3 Sensitive	9	32.6 ± 5.0	NS
P	*Carex hystericina*	Porcupine Sedge				S2	2 May Be At Risk	8	63.9 ± 0.0	NS
P	*Carex tenera*	Tender Sedge				S2	3 Sensitive	7	36.0 ± 0.0	NS
P	*Carex tuckermanii*	Tuckerman's Sedge				S2	3 Sensitive	23	30.8 ± 0.0	NS
P	*Carex atratiformis*	Scabrous Black Sedge				S2	3 Sensitive	3	84.0 ± 0.0	NS
P	*Vallisneria americana*	Wild Celery				S2	2 May Be At Risk	11	55.2 ± 1.0	NS
P	*Allium schoenoprasum*	Wild Chives				S2	2 May Be At Risk	4	54.2 ± 0.0	NS
P	*Allium schoenoprasum var. sibiricum*	Wild Chives				S2	2 May Be At Risk	1	87.8 ± 7.0	NS
P	*Lilium canadense*	Canada Lily				S2	2 May Be At Risk	56	26.4 ± 7.0	NS
P	*Najas gracillima*	Thread-Like Naiad				S2	3 Sensitive	7	24.8 ± 0.0	NS
P	*Cypripedium parviflorum var. pubescens*	Yellow Lady's-slipper				S2	3 Sensitive	17	22.5 ± 7.0	NS
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	3 Sensitive	13	30.7 ± 0.0	NS
P	*Cypripedium reginae*	Showy Lady's-Slipper				S2	2 May Be At Risk	49	27.6 ± 0.0	NS
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S2	3 Sensitive	21	29.0 ± 0.0	NS
P	*Platanthera flava*	Southern Rein-Orchid				S2	3 Sensitive	37	59.5 ± 0.0	NS
P	*Platanthera flava var. flava*	Southern Rein Orchid				S2	3 Sensitive	19	54.0 ± 7.0	NS
P	*Platanthera flava var.*	Pale Green Orchid				S2	5 Undetermined	25	52.1 ± 1.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	herbiola									
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S2	3 Sensitive	5	34.3 ± 1.0	NS
P	*Spiranthes casei*	Case's Ladies'-Tresses				S2	3 Sensitive	1	83.8 ± 0.0	NS
P	*Spiranthes casei var. novaescotiae*	Case's Ladies'-Tresses				S2	3 Sensitive	1	89.8 ± 0.0	NS
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2	2 May Be At Risk	13	34.3 ± 1.0	NS
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S2	3 Sensitive	16	35.6 ± 7.0	NS
P	*Piptatheropsis canadensis*	Canada Ricegrass				S2	3 Sensitive	20	40.2 ± 1.0	NS
P	*Piptatheropsis pungens*	Slender Ricegrass				S2	3 Sensitive	10	50.9 ± 10.0	NS
P	*Potamogeton friesii*	Fries' Pondweed				S2	2 May Be At Risk	10	61.2 ± 1.0	NS
P	*Potamogeton richardsonii*	Richardson's Pondweed				S2	2 May Be At Risk	7	51.9 ± 0.0	NS
P	*Dryopteris fragrans*	Fragrant Wood Fern				S2	3 Sensitive	12	77.1 ± 0.0	NS
P	*Woodsia glabella*	Smooth Cliff Fern				S2	3 Sensitive	2	89.8 ± 1.0	NS
P	*Symphyotrichum boreale*	Boreal Aster				S2?	3 Sensitive	7	33.4 ± 5.0	NS
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2?	5 Undetermined	2	12.2 ± 0.0	NS
P	*Epilobium coloratum*	Purple-veined Willowherb				S2?	3 Sensitive	7	14.8 ± 0.0	NS
P	*Rumex persicarioides*	Peach-leaved Dock				S2?	2 May Be At Risk	1	28.0 ± 0.0	NS
P	*Crataegus submollis*	Quebec Hawthorn				S2?	5 Undetermined	5	20.4 ± 7.0	NS
P	*Carex peckii*	White-Tinged Sedge				S2?	2 May Be At Risk	4	33.3 ± 5.0	NS
P	*Eleocharis ovata*	Ovate Spikerush				S2?	3 Sensitive	4	8.2 ± 5.0	NS
P	*Scirpus pedicellatus*	Stalked Bulrush				S2?	3 Sensitive	7	49.9 ± 0.0	NS
P	*Potamogeton pulcher*	Spotted Pondweed			Vulnerable	S2S3	3 Sensitive	19	56.8 ± 0.0	NS
P	*Hieracium robinsonii*	Robinson's Hawkweed				S2S3	3 Sensitive	2	87.7 ± 1.0	NS
P	*Iva frutescens*	Big-leaved Marsh-elder				S2S3	3 Sensitive	31	36.1 ± 1.0	NS
P	*Senecio pseudoarnica*	Seabeach Ragwort				S2S3	3 Sensitive	15	27.0 ± 0.0	NS
P	*Betula michauxii*	Michaux's Dwarf Birch				S2S3	3 Sensitive	56	26.4 ± 0.0	NS
P	*Sagina nodosa*	Knotted Pearlwort				S2S3	4 Secure	39	23.8 ± 0.0	NS
P	*Sagina nodosa ssp. borealis*	Knotted Pearlwort				S2S3	4 Secure	8	33.0 ± 0.0	NS
P	*Ceratophyllum echinatum*	Prickly Hornwort				S2S3	3 Sensitive	7	59.7 ± 0.0	NS
P	*Hypericum x dissimulatum*	Disguised St. John's-wort				S2S3	3 Sensitive	6	23.0 ± 10.0	NS
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S2S3	3 Sensitive	23	31.6 ± 0.0	NS
P	*Shepherdia canadensis*	Soapberry				S2S3	3 Sensitive	95	23.6 ± 7.0	NS
P	*Empetrum atropurpureum*	Purple Crowberry				S2S3	3 Sensitive	5	16.4 ± 7.0	NS
P	*Euphorbia polygonifolia*	Seaside Spurge				S2S3	3 Sensitive	3	42.0 ± 3.0	NS
P	*Halenia deflexa*	Spurred Gentian				S2S3	3 Sensitive	3	26.8 ± 0.0	NS
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	3 Sensitive	17	29.1 ± 5.0	NS
P	*Polygonum aviculare ssp. buxiforme*	Box Knotweed				S2S3	5 Undetermined	7	27.5 ± 7.0	NS
P	*Polygonum oxyspermum ssp. raii*	Ray's Knotweed				S2S3	5 Undetermined	5	24.9 ± 1.0	NS
P	*Polygonum oxyspermum*	Sharp-fruit Knotweed				S2S3	5 Undetermined	1	17.8 ± 0.0	NS
P	*Amelanchier fernaldii*	Fernald's Serviceberry				S2S3	5 Undetermined	1	58.4 ± 7.0	NS
P	*Potentilla canadensis*	Canada Cinquefoil				S2S3	3 Sensitive	7	14.0 ± 0.0	NS
P	*Galium aparine*	Common Bedstraw				S2S3	3 Sensitive	19	29.1 ± 0.0	NS
P	*Galium obtusum*	Blunt-leaved Bedstraw				S2S3	3 Sensitive	3	75.5 ± 0.0	NS
P	*Salix pellita*	Satiny Willow				S2S3	3 Sensitive	7	69.6 ± 2.0	NS
P	*Carex adusta*	Lesser Brown Sedge				S2S3	3 Sensitive	6	24.7 ± 5.0	NS
P	*Carex hirtifolia*	Pubescent Sedge				S2S3	3 Sensitive	24	31.8 ± 2.0	NS
P	*Carex houghtoniana*	Houghton's Sedge				S2S3	3 Sensitive	3	72.0 ± 1.0	NS
P	*Eleocharis flavescens var. olivacea*	Bright-green Spikerush				S2S3	3 Sensitive	12	28.8 ± 0.0	NS
P	*Eriophorum gracile*	Slender Cottongrass				S2S3	3 Sensitive	6	48.4 ± 7.0	NS
P	*Coeloglossum viride*	Long-bracted Frog Orchid				S2S3	2 May Be At Risk	13	47.6 ± 1.0	NS
P	*Cypripedium parviflorum*	Yellow Lady's-slipper				S2S3	3 Sensitive	524	27.3 ± 1.0	NS
P	*Poa glauca*	Glaucous Blue Grass				S2S3	3 Sensitive	8	36.6 ± 1.0	NS
P	*Botrychium lanceolatum ssp. angustisegmentum*	Narrow Triangle Moonwort				S2S3	3 Sensitive	5	58.7 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Botrychium simplex*	Least Moonwort				S2S3	3 Sensitive	7	35.1 ± 1.0	NS
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	3 Sensitive	5	22.5 ± 7.0	NS
P	*Angelica atropurpurea*	Purple-stemmed Angelica				S3	4 Secure	2	77.8 ± 0.0	NS
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	3 Sensitive	16	26.4 ± 7.0	NS
P	*Hieracium paniculatum*	Panicled Hawkweed				S3	4 Secure	29	22.0 ± 11.0	NS
P	*Bidens beckii*	Water Beggarticks				S3	4 Secure	8	56.9 ± 0.0	NS
P	*Packera paupercula var. paupercula*	Balsam Groundsel				S3	4 Secure	1	29.3 ± 0.0	NS
P	*Packera paupercula*	Balsam Groundsel				S3	4 Secure	56	27.6 ± 1.0	NS
P	*Alnus serrulata*	Smooth Alder				S3	3 Sensitive	615	62.3 ± 0.0	NS
P	*Betula pumila*	Bog Birch				S3	3 Sensitive	3	64.3 ± 0.0	NS
P	*Campanula aparinoides*	Marsh Bellflower				S3	3 Sensitive	18	40.1 ± 1.0	NS
P	*Mononeuria groenlandica*	Greenland Stitchwort				S3	3 Sensitive	144	12.6 ± 0.0	NS
P	*Empetrum eamesii*	Pink Crowberry				S3	3 Sensitive	93	8.5 ± 0.0	NS
P	*Vaccinium boreale*	Northern Blueberry				S3	3 Sensitive	2	56.1 ± 0.0	NS
P	*Vaccinium cespitosum*	dwarf bilberry				S3	4 Secure	50	30.8 ± 0.0	NS
P	*Vaccinium uliginosum*	Alpine Bilberry				S3	3 Sensitive	3	37.8 ± 1.0	NS
P	*Bartonia virginica*	Yellow Bartonia				S3	4 Secure	36	24.5 ± 0.0	NS
P	*Geranium bicknellii*	Bicknell's Crane's-bill				S3	4 Secure	19	34.9 ± 3.0	NS
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	4 Secure	69	30.9 ± 0.0	NS
P	*Proserpinaca pectinata*	Comb-leaved Mermaidweed				S3	4 Secure	53	18.1 ± 1.0	NS
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	55	12.2 ± 0.0	NS
P	*Decodon verticillatus*	Swamp Loosestrife				S3	4 Secure	30	82.0 ± 0.0	NS
P	*Epilobium strictum*	Downy Willowherb				S3	3 Sensitive	8	52.9 ± 1.0	NS
P	*Polygala sanguinea*	Blood Milkwort				S3	3 Sensitive	19	6.3 ± 0.0	NS
P	*Persicaria pensylvanica*	Pennsylvania Smartweed				S3	4 Secure	25	34.9 ± 1.0	NS
P	*Fallopia scandens*	Climbing False Buckwheat				S3	3 Sensitive	18	22.7 ± 2.0	NS
P	*Plantago rugelii*	Rugel's Plantain				S3	4 Secure	9	25.6 ± 0.0	NS
P	*Primula laurentiana*	Laurentian Primrose				S3	4 Secure	28	60.5 ± 7.0	NS
P	*Samolus parviflorus*	Seaside Brookweed				S3	3 Sensitive	58	22.6 ± 1.0	NS
P	*Pyrola asarifolia*	Pink Pyrola				S3	4 Secure	8	43.8 ± 1.0	NS
P	*Pyrola minor*	Lesser Pyrola				S3	3 Sensitive	2	28.4 ± 0.0	NS
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	4 Secure	59	30.6 ± 0.0	NS
P	*Endotropis alnifolia*	alder-leaved buckthorn				S3	4 Secure	150	33.4 ± 0.0	NS
P	*Agrimonia gryposepala*	Hooked Agrimony				S3	4 Secure	146	29.0 ± 0.0	NS
P	*Amelanchier spicata*	Running Serviceberry				S3	4 Secure	56	26.8 ± 3.0	NS
P	*Cephalanthus occidentalis*	Common Buttonbush				S3	3 Sensitive	1522	26.9 ± 0.0	NS
P	*Geocaulon lividum*	Northern Comandra				S3	4 Secure	1	82.4 ± 1.0	NS
P	*Limosella australis*	Southern Mudwort				S3	4 Secure	14	35.0 ± 3.0	NS
P	*Lindernia dubia*	Yellow-seeded False Pimperel				S3	4 Secure	12	34.8 ± 0.0	NS
P	*Laportea canadensis*	Canada Wood Nettle				S3	3 Sensitive	40	30.6 ± 0.0	NS
P	*Verbena hastata*	Blue Vervain				S3	4 Secure	123	31.2 ± 5.0	NS
P	*Carex cryptolepis*	Hidden-scaled Sedge				S3	4 Secure	14	31.6 ± 0.0	NS
P	*Carex eburnea*	Bristle-leaved Sedge				S3	3 Sensitive	5	66.4 ± 0.0	NS
P	*Carex lupulina*	Hop Sedge				S3	4 Secure	48	31.9 ± 4.0	NS
P	*Carex rosea*	Rosy Sedge				S3	4 Secure	32	29.0 ± 2.0	NS
P	*Carex swanii*	Swan's Sedge				S3	3 Sensitive	11	19.2 ± 0.0	NS
P	*Carex tribuloides*	Blunt Broom Sedge				S3	4 Secure	13	31.2 ± 0.0	NS
P	*Carex wiegandii*	Wiegand's Sedge				S3	3 Sensitive	3	44.9 ± 0.0	NS
P	*Carex foenea*	Fernald's Hay Sedge				S3	4 Secure	14	0.9 ± 0.0	NS
P	*Eleocharis nitida*	Quill Spikerush				S3	4 Secure	15	39.3 ± 5.0	NS
P	*Elodea canadensis*	Canada Waterweed				S3	4 Secure	11	31.8 ± 0.0	NS
P	*Juncus marginatus*	Grassleaf Rush				S3	3 Sensitive	8	78.7 ± 0.0	NS
P	*Juncus subcaudatus*	Woods-Rush				S3	3 Sensitive	23	1.3 ± 0.0	NS
P	*Juncus dudleyi*	Dudley's Rush				S3	4 Secure	23	25.1 ± 1.0	NS
P	*Goodyera repens*	Lesser Rattlesnake-plantain				S3	3 Sensitive	7	46.6 ± 0.0	NS
P	*Neottia bifolia*	Southern Twayblade				S3	4 Secure	120	1.7 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	4 Secure	52	27.1 ± 0.0	NS
P	*Platanthera hookeri*	Hooker's Orchid				S3	4 Secure	17	31.2 ± 0.0	NS
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3	4 Secure	47	31.9 ± 4.0	NS
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S3	4 Secure	35	7.2 ± 0.0	NS
P	*Alopecurus aequalis*	Short-awned Foxtail				S3	4 Secure	12	54.2 ± 0.0	NS
P	*Dichanthelium clandestinum*	Deer-tongue Panic Grass				S3	4 Secure	274	20.7 ± 0.0	NS
P	*Coleataenia longifolia*	Long-leaved Panicgrass				S3	4 Secure	1024	72.2 ± 0.0	NS
P	*Potamogeton obtusifolius*	Blunt-leaved Pondweed				S3	4 Secure	1	55.4 ± 0.0	NS
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3	3 Sensitive	3	60.3 ± 1.0	NS
P	*Potamogeton zosteriformis*	Flat-stemmed Pondweed				S3	3 Sensitive	15	57.0 ± 0.0	NS
P	*Sparganium natans*	Small Burreed				S3	4 Secure	10	35.6 ± 1.0	NS
P	*Asplenium trichomanes*	Maidenhair Spleenwort				S3	4 Secure	15	49.9 ± 0.0	NS
P	*Asplenium viride*	Green Spleenwort				S3	3 Sensitive	12	74.5 ± 7.0	NS
P	*Equisetum pratense*	Meadow Horsetail				S3	3 Sensitive	16	31.7 ± 0.0	NS
P	*Equisetum variegatum*	Variegated Horsetail				S3	4 Secure	35	17.8 ± 0.0	NS
P	*Isoetes tuckermanii ssp. acadiensis*	Acadian Quillwort				S3	3 Sensitive	9	13.9 ± 0.0	NS
P	*Diphasiastrum sitchense*	Sitka Ground-cedar				S3	4 Secure	2	54.7 ± 1.0	NS
P	*Huperzia appressa*	Mountain Firmoss				S3	3 Sensitive	17	69.4 ± 7.0	NS
P	*Sceptridium dissectum*	Dissected Moonwort				S3	4 Secure	6	54.8 ± 0.0	NS
P	*Polypodium appalachianum*	Appalachian Polypody				S3	5 Undetermined	21	42.3 ± 0.0	NS
P	*Bidens vulgata*	Tall Beggarticks				S3?	7 Exotic	5	24.2 ± 0.0	NS
P	*Persicaria amphibia var. emersa*	Long-root Smartweed				S3?	5 Undetermined	26	31.6 ± 0.0	NS
P	*Diphasiastrum x sabinifolium*	Savin-leaved Ground-cedar				S3?	4 Secure	3	85.2 ± 0.0	NS
P	*Solidago latissimifolia*	Elliott's Goldenrod				S3S4	4 Secure	10	88.0 ± 0.0	NS
P	*Atriplex glabriuscula var. franktonii*	Frankton's Saltbush				S3S4	4 Secure	14	36.0 ± 0.0	NS
P	*Suaeda calceoliformis*	Horned Sea-blite				S3S4	4 Secure	8	28.7 ± 7.0	NS
P	*Vaccinium corymbosum*	Highbush Blueberry				S3S4	4 Secure	4	22.7 ± 0.0	NS
P	*Myriophyllum sibiricum*	Siberian Water Milfoil				S3S4	4 Secure	5	90.3 ± 0.0	NS
P	*Rhexia virginica*	Virginia Meadow Beauty				S3S4	4 Secure	912	53.7 ± 5.0	NS
P	*Sanguinaria canadensis*	Bloodroot				S3S4	4 Secure	63	21.2 ± 0.0	NS
P	*Polygonum fowleri*	Fowler's Knotweed				S3S4	4 Secure	1	78.3 ± 1.0	NS
P	*Rumex fueginus*	Tierra del Fuego Dock				S3S4	4 Secure	17	36.1 ± 0.0	NS
P	*Crataegus succulenta*	Fleshy Hawthorn				S3S4	5 Undetermined	1	23.1 ± 0.0	NS
P	*Fragaria vesca ssp. americana*	Woodland Strawberry				S3S4	4 Secure	67	30.8 ± 0.0	NS
P	*Salix petiolaris*	Meadow Willow				S3S4	4 Secure	19	43.3 ± 0.0	NS
P	*Agalinis neoscotica*	Nova Scotia Agalinis				S3S4	4 Secure	55	2.3 ± 0.0	NS
P	*Viola sagittata*	Arrow-Leaved Violet				S3S4	4 Secure	2	29.4 ± 0.0	NS
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S3S4	4 Secure	33	24.5 ± 1.0	NS
P	*Symplocarpus foetidus*	Eastern Skunk Cabbage				S3S4	4 Secure	3	26.9 ± 0.0	NS
P	*Carex argyrantha*	Silvery-flowered Sedge				S3S4	4 Secure	11	31.3 ± 1.0	NS
P	*Eriophorum russeolum*	Russet Cottongrass				S3S4	4 Secure	9	16.3 ± 3.0	NS
P	*Sisyrinchium atlanticum*	Eastern Blue-Eyed-Grass				S3S4	4 Secure	106	44.8 ± 0.0	NS
P	*Triglochin gaspensis*	Gasp ├⌐ Arrowgrass				S3S4	5 Undetermined	9	26.8 ± 0.0	NS
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	4 Secure	13	23.1 ± 0.0	NS
P	*Luzula parviflora*	Small-flowered Woodrush				S3S4	4 Secure	4	76.7 ± 0.0	NS
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	4 Secure	8	1.6 ± 0.0	NS
P	*Panicum philadelphicum*	Philadelphia Panicgrass				S3S4	4 Secure	19	36.0 ± 0.0	NS
P	*Trisetum spicatum*	Narrow False Oats				S3S4	4 Secure	20	29.5 ± 0.0	NS
P	*Cystopteris bulbifera*	Bulblet Bladder Fern				S3S4	4 Secure	91	30.6 ± 0.0	NS
P	*Equisetum hyemale ssp. affine*	Common Scouring-rush				S3S4	4 Secure	96	20.2 ± 2.0	NS
P	*Equisetum scirpoides*	Dwarf Scouring-Rush				S3S4	4 Secure	72	30.7 ± 0.0	NS
P	*Diphasiastrum complanatum*	Northern Ground-cedar				S3S4	4 Secure	14	22.7 ± 1.0	NS
P	*Schizaea pusilla*	Little Curlygrass Fern				S3S4	4 Secure	82	24.1 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Viola canadensis*	Canada Violet				SH	0.1 Extirpated	2	36.4 ± 0.0	NS
P	*Calamagrostis cinnoides*	Small Reedgrass				SH	0.1 Extirpated	1	23.8 ± 6.0	NS

5.1 SOURCE BIBLIOGRAPHY (100 km)

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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