Appendix E
Biophysical Survey Report

Biophysical Survey Report

Name of Project:

Sporting Mountain Quarry
Location: Seaview, Cape Breton, Nova Scotia
Prepared for: GHD Limited
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Date: March, 2020

Executive Summary

McCallum Environmental Ltd. (MEL) was retained by GHD Limited (GHD) to complete the biophysical field programs for a provincial environmental assessment (EA) on behalf of Nova Construction Co. Ltd. (the proponent). The proponent is proposing to develop a quarry on Property Identification Number (PID) 75044156 in the community of Seaview in Richmond County, on Cape Breton Island, Nova Scotia.

Biophysical field programs took place between Spring and Fall 2019 and were completed in accordance with the requirements for a *Class I* undertaking under Section 9(1) of the Nova Scotia Environmental Assessment Regulations. Studies included habitat surveys, botanical surveys, Canada lynx surveys, fauna surveys, avian surveys, wetland and watercourse evaluations, water quality assessments, and species at risk (SAR) surveys.

The Study Area investigated for this development was found to contain a mosaic of disturbed and intact forest. Disturbances were largely related to human activity, including an aggregate quarry and forestry. The soils in the area were found to be generally moderate in richness. The presence of disturbance and lack of relatively rich soils may have led to the identification of no rare vascular plant species. Several priority lichen species were observed within the Study Area including two Species at Risk (blue felt lichen (*Pectenia plumbea;* Species at Risk Act (SARA) & Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Special Concern; Nova Scotia Endangered Species Act (NSESA) Vulnerable; Atlantic Canada Conservation Data Centre (ACCDC) S3) and frosted glass-whiskers (*Sclerophora peronella;* SARA & COSEWIC Special Concern; ACCDC S1?) and four Species of Conservation Interest. None of these occurrences will be affected by the proposed quarry expansion.

Dedicated fauna surveys led to the identification of Canada lynx (*Lynx canadensis;* NSESA Endangered, ACCDC S1) confirmed and potential evidence (both scat and tracks) within and beyond the Study Area. Canada lynx habitat and their prey's habitat are both present within the northern section of the Study Area, albeit in small, lower quality patches. Given the poor-quality prey habitat, and sensory effects from the adjacent current quarry (i.e. noise and human presence), and access to the area by competitor species the Study Area does not present good quality habitat for Canada lynx. No other mammalian priority species were observed.

Four seasonal avian surveys were completed in the Study Area: spring migration, breeding bird, fall migration, and common nighthawk surveys. A total of 916 minutes (15 hours and 16 minutes) were spent on dedicated avian surveys, resulting in the observation of 725 individuals, representing 63 species. Including incidental observations, a total of 756 individuals representing 64 species were observed. Avian surveys were completed between May and October 2019. Seventeen priority avian species were observed, of these, two were Species at Risk (Canada warbler (*Cardellina canadensis*; SARA Threatened; COSEWIC Threatened; NSESA Endangered; S3B) and barn swallow (*Hirundo rustica;* SARA Threatened; COSEWIC Threatened; NSESA Endangered; S2S3B)), and fifteen were Species of Conservation Interest. All of the species observed are native in this region; they are typical species commonly found within the Study Area habitat and its surroundings. No obvious concentrations of one particular bird group were observed, nor was an identifiable migratory pathway

noted. None of the priority avian species observations occurred within the proposed quarry development area.

Two watercourses were identified and evaluated, and were found to be intermittent, headwater streams. The overall quality of fish habitat within Watercourse 1 that is accessible to fish was deemed to be low. Fish collection surveys (i.e. electrofishing and trapping) were not able to take place during low flow conditions due to the intermittency of water, however, 2-3 individual fish were observed approximately 275m downstream (outside of the Study Area) stranded in residual pools. While fish may be able to access the lower portions of Watercourse 1 within the Study Area (approximately 250 m of linear channel), a lack of hydrologic connectivity was observed during low and high flow conditions that stops fish from being able to swim further north and into the quarry area. The second watercourse was deemed to not support fish habitat due to a lack of hydrologic connectivity with downstream fish-bearing systems.

During wetland evaluations, a total of eleven wetlands were delineated within the Study Area. Nine of these were swamps (a mixture of mixedwood treed swamps, clear-cut swamps, and shrub swamps), one was a complex (comprised of mixedwood treed swamp, alder swamp, clear-cut swamp, treed/shrub bog, open bog, and disturbed cattail-dominated bog), and one was a marsh. In general, wetlands within the Study Area have similar functions to each other and those within this region of Nova Scotia; they are not unique in their functional roles as analyzed by Wetland Ecosystem Services Protocol – Atlantic Canada (WESP-AC). There are historical disturbances evident within some wetlands, mostly from forestry practices, however this has not affected wetland functions in a major capacity.

Priority species were observed during targeted surveys and incidentally during other field surveys. In total no vascular priority species, six lichen priority species, seventeen avian priority species, and one mammalian priority species were observed. These include the following:

- Blue felt lichen (*Pectenia plumbea;* SARA Special Concern; COSEWIC Special Concern; NSESA Vulnerable; S3)
- Frosted glass whiskers lichen (*Sclerophora peronella*)
- Fringe lichen (*Heterodermia neglecta;* ACCDC S3S4)
- Powdered fringe lichen (*Heterodermia speciose;* ACCDC S3)
- Slender monk's hood lichen (*Hypogymnia vittata;* ACCDC S3S4)
- Corrugated shingles lichen (*Fuscopannaria cf. ahlneri;* ACCDC S3)
- Canada lynx (*Lynx canadensis;* NSESA Endangered; S1)
- Barn swallow (*Hirundo rustica;* SARA Threatened; COSEWIC Threatened; NSESA Endangered; S2S3B)
- Canada warbler (*Cardellina canadensis;* SARA Threatened; COSEWIC Threatened; NSESA Endangered; S3B)
- Northern goshawk (*Accipiter gentilis;* S3S4)
- Spotted sandpiper (*Actitis macularius;* S3S4B)
- Pine siskin (*Carduelis pinus;* S2S3)
- Swainson's thrush (*Catharus ustulatus;* S3S4B)

- Bay-breasted warbler (*Dendroica castanea;* S3S4B)
- Blackpoll warbler (*Dendroica striata;* S3S4B)
- Gray catbird (*Dumetella carolinensis;* S3B)
- Yellow-bellied flycatcher (*Empidonax flaviventris;* S3S4B)
- American kestrel (*Falco sparverius;* S3B)
- Fox sparrow (*Passerella iliaca;* S3S4B)
- Gray jay (*Perisoreus canadensis;* S3)
- Pine grosbeak (*Pinicola enucleator;* S2S3B, S5N)
- Boreal chickadee (*Poecile hudsonica;* S3)
- Ruby-crowned kinglet (*Regulus calendula;* S3S4B)
- Red-breasted nuthatch (*Sitta canadensis;* S3)

Most of the observed priority species are mobile species, they have home ranges within and beyond the Study Area that may be used at various times of the year (i.e. some areas are used only during breeding season). Avoidance of these timing windows may be incorporated into mitigation measures. None of the non-mobile species (i.e. the lichens) require legislated buffers, although a distance of 100m is recommended. Furthermore, quarry expansion is not proposed to affect the lichens priority species identified.

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List of Acronyms

ACCDC	Atlantic Canadian Conservation Data Centre
AMO	Abandoned mine opening
BFL	Boreal felt lichen
CCME	Canadian Council of Ministers of the Environment
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DO	Dissolved oxygen
EA	Environmental Assessment
ECB	Eastern Cape Breton
FAC	Facultative vegetation
FACW	Facultative wetland vegetation
FEC	Forest Ecosystem Classification for Nova Scotia
FWAL	Protection of Aquatic Life for Freshwater Guidelines
GPS	Global Positioning System
HA	Hectares
HAP	Habitat Assessment Point
IBA	Important Bird Area
KM	Kilometer
M	Meters
MBBA	Maritime Breeding Bird Atlas
MBS	Migratory Bird Sanctuary
MEL	McCallum Environmental Ltd.
MTRI	Mersey Tobeatic Research Institute
MW	Mixedwood
NSDNR	Nova Scotia Department of Natural Resources
NSE	Nova Scotia Environment
NSESA	Nova Scotia Endangered Species Act
NSDL&F	Nova Scotia Department of Lands and Forestry
NSTB	Nova Scotia Topographic Database
OBL	Obligate vegetation
PC	Point Counts
PID	Property Identification Number
SAR	Species at Risk
SARA	Species at Risk Act
SMP	Special Management Practice
SOCI	Species of Conservation Interest
Sp.Con	Specific water conductivity
S-Rank	Status rank
TDS	Total dissolved solids
TH	Tolerant Hardwood
VT	Vegetation Type
WESP-AC	Wetland Ecosystem Services Protocol – Atlantic Canada
WC	Watercourse
WL	Wetland

1.0 INTRODUCTION

Nova Construction are proposing the expansion of an existing quarry (the Project) located on Property Identification Number (PID) 75044156 in the community if Seaview, Richmond County, Nova Scotia (Figure 1, Appendix A).

In support of registering a provincial Environmental Assessment (EA) Registration document with New Scotia Environment (NSE), this Study has been completed to identify the biophysical conditions existing within, and in close 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 for the Study Area. 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

The field components of the Study were initiated in Spring 2019 and extended until Winter 2019. Studies were performed in accordance with the requirements of a *Class I* undertaking under Section 9(1) of the Nova Scotia Environmental Assessment Regulations. These 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. Botanical Surveys (Summer and Fall 2019)
2. Lynx Surveys (Spring and Fall 2019)
3. Avian Surveys
    (1) Spring migration (Spring 2019);
    (2) Breeding bird (Early summer 2019);
    (3) Fall migration (Fall 2019);
    (4) Common nighthawk (Early summer 2019);
4. Wetland and Watercourse Evaluations (Summer and Winter 2019);
5. Habitat Surveys (Summer 2019); and,
6. Species at Risk Surveys (Spring and Summer 2019).

Field surveys were completed by McCallum Environmental biologists and expert birder Mr. Chris Pepper. CVs are provided in Appendix B.

1.2 Priority Species

Assessment of wildlife, vegetation, and habitat was completed based on the requirements outlined in the NSE *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document* (NSE, 2009). A Priority Species list was generated in accordance with this guide as outlined in Section 8.0.

Development of a priority list of species for each taxonomic group was completed based on a compilation of listed species from the following sources:

1) Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the *Federal Species-at Risk Act* (SARA). All species listed as Endangered, Threatened, or of Special Concern;
2) *Nova Scotia Endangered Species Act* (NSESA). All species listed as Endangered, Threatened, or Vulnerable; and,
3) Conservation Rank: All species designated as S1, S2 or S3 or any combination thereof (i.e. S3S4 is considered a Priority Species) as defined by the Atlantic Canadian Conservation Data Centre (ACCDC).

Collectively, this group of species is known as priority species. 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 on SARA or NSESA. After having considered all species listed by SARA, NSESA, and COSEWIC, the Project Team uses ACCDC breeding status qualifiers to identify any additional SOCI. A breeding status, such as "B" for breeding or "N" for nonbreeding, is only used for species that have distinct breeding or non-breeding populations in the province, such as avifauna (ACCDC 2019). These qualifiers refer to the season in which the species conservation status applies. For instance, the American robin (*Turdus migratorius*) is not listed by SARA, NSESA, or COSEWIC yet it has a conservation status rank (S-Rank) of S5B,S3N, therefore, it is ranked secure during the breeding season and vulnerable during the nonbreeding season (ACCDC 2019). In these particular instances, Maritime Breeding Bird Atlas (MBBA) breeding evidence codes in conjunction with time of year are applied to avian observations. If a species with a conservation status rank during the breeding seasons was observed outside of its breeding dates (see www.mba-aom.ca/downloads/breedingdates.pdf), but ample breeding evidence was concurrently observed, it would then be considered a SOCI.

The priority species list is referenced across the various biophysical assessments and is provided in Appendix C. See Table 1-1 for S-Rank definitions.

Table 1-1. Provincial Status Ranks Definition

S-rank	Definition
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.
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.
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.

S-rank	Definition
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.
S4	**Apparently Secure** - Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	**Secure** - Common, widespread, and abundant in the province.
SNR	**Unranked** - Nation or state/province conservation status not yet assessed.
SU	**Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNA	**Not Applicable** - A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
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).
Not Provided	Species is not known to occur in the province.
Breeding Status Qualifiers	
Qualifier	**Definition**
B	Breeding - Conservation status refers to the breeding population of the species in the province.
N	Nonbreeding - Conservation status refers to the non-breeding population of the species in the province.
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.

A detailed methodology for development of the Priority Species List is provided in Section 8.0.

1.3 Study Area

The Study Area for the biophysical field studies is located in Richmond County, Cape Breton Island, on land situated between the southern end of the Bras d'Or Lakes and the Atlantic Ocean. The proposed quarry is approximately 10 km northwest of St. Peter's and 10 km east of Dundee (Figure 1, Appendix A). The Study Area is approximately 4 km directly north of Highway 104.

The Study Area is located on a 40 ha private property approximately 0.4 km wide by 1.0 km long. The Study Area contains the current quarry, previously logged areas, and forested land. In general, the Study Area slopes down gradient from north to south.

The Study Area is not located in any protected or conservation areas within federal, provincial, or municipal jurisdiction. The Nova Scotia Provincial Landscape Viewer identified the following:

- a mapped Significant Habitat for Species at Risk (common loon, *Gavia immer*) approximately 1.5 km west of the Study Area in Hill Lake;
- a mapped Significant Habitat for Species at Risk (bald eagle, *Haliaeetus leucocephalus*) approximately 1.8 km southwest of the Study Area; and
- the Study Area is within the Cape Breton Island lynx (*Lynx canadensis)* range and Canada lynx buffers.

The closest NSE Wetland of Special Significance is located approximately 5.25 km northwest of the Study Area, on the shore of the Bras d'Or Lake.

The majority of biophysical surveys occurred within the Study Area, except for the lynx survey, which extended west and north onto adjacent crown land.

1.4 **Project 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 1-2. Project Team

Team Member	Role
Andy Walter, BSc. (Hort)	Senior Project Manager
John Gallop B.Sc., Emma Posluns, B.Sc., MSc. Amber Stoffer, B.Sc., MREM	Biologists, Wetland Delineator and Assessors, Species at Risk Evaluator and Report Writers.
Chris Pepper	Expert Birder

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

2.0 HABITAT

2.1 **Methodology**

2.1.1 *Desktop Review*

During July 2019, a desktop review was conducted using the available GIS forestry (NSDNR, 2016) and wetland inventory layers (NSE, 2017). Using the GIS, an approximate survey route (transect) was designed that covered all major forest cover types present within the Study Area. A desktop review of

the Ecological Land Classification database (NSDNR, 2015) was assessed prior to field surveys in order to understand the ecosystem types in the Study Area.

2.1.2 *Field Surveys*

On July 30th - 31st, 2019, habitat assessments were completed within the Study Area by Ms. Amber Stoffer and Ms. Emma Posluns. Meandering transects within the Study Area were traveled by foot and habitat types were surveyed whenever noticeable habitat changes occurred. The surveyed locations are referred to as habitat assessment points (HAP) within this report. All wetland habitats within the Study Area were surveyed in detail during the wetland assessments, and information regarding stand type and vegetative community structure in these features was documented. Therefore, the habitat assessment surveys only consisted of assessing upland habitat types. Vegetation Types (VTs) and ecosite types were recorded at each survey location as per the Forest Ecosystem Classification for Nova Scotia (FEC) guide (Neily *et al.,* 2010) to identify the ecosite and vegetation type for each habitat survey location.

During the assessments, the following information was documented:

- VTs were determined using Part 1 of the FEC guide (Neily, 2010). Each stand was classified by overall forest group code and vegetation type using the keys provided in the guidebook. Forest Groups are general groupings of VTs. Within each forest group (e.g. open woodland), there are several specific VTs. VTs are recurring and identifiable plant communities which reflect differences in site conditions, natural disturbance regimes and successional stage. For example, TH4 is a tolerant hardwood forest group dominated by Sugar Maple and White Ash VT, while TH6 is a tolerant hardwood forest group dominated by Red Oak and Yellow Birch VT.
- Ecosite was determined using Part 3 of the FEC Guide (Keys *et al.*, 2010). This guide provides keys to identify ecosite using an edatopic grid, which is a two-dimensional diagram used to plot ecosystems and ecosites based on their relative moisture and nutrient regimes. Ecosites are ecosystem units that have developed under particular nutrient and moisture regimes. A finite range of vegetation types will naturally grow in any given ecosite.
- Approximate stand age was determined through qualitative observations of multiple factors such as level of canopy coverage, microtopography and species composition of the understory herb and shrub layers
- Natural or anthropogenic disturbance is recorded in each site. The level and type of disturbance is identified. Examples of anthropogenic disturbances include timber harvesting or road development. Natural disturbance regimes include fire, pests, wind throw and natural senescence.
- Representative photos were taken of each site.

It is also important to note that the habitat survey methods and results are presented with the acknowledgment of three biases built into the survey methods and are found below:

- One bias is towards upland habitat. This bias was purposefully built into the survey methods with the understanding that all wetlands within the Study Area were delineated and described in detail and their function as habitats within the landscape of the Study Area would be captured in the wetland evaluation.
- The second bias is towards forested landscape as opposed to non-forested landscapes. In this context, clear cut lands, or those which have experienced timber harvesting of any sort, are still considered forested because the removal of timber is only a temporary disturbance. Non-forested portions of the landscape, such as roads or extensive gravel areas, often associated with historic mine workings, were not assessed during the habitat survey simply because they lack forest cover to be described and their capability for supporting forest cover in the foreseeable future is low based on the level of disturbance.
- The third bias in this survey is that habitat surveys were completed at discrete points and no effort was made to delineate the extent of that habitat type around those points. As such, the ability to extrapolate habitat survey results across the entire Study Area is limited. These habitat survey points are meant to describe habitat in 'snapshots' of specific locations and completed to provide a summary of habitats present within the Study Area and also to inform specific biophysical field surveys. The results of the habitat survey are meant to describe the diversity of habitat types present throughout the Study Area and the relative abundance thereof, rather than absolute percent cover of each habitat type throughout the Study Area.

2.2 **Results**

2.2.1 *Desktop Review*

The Study Area is located in south western Cape Breton within the Cape Breton Hills ecodistrict within the Nova Scotia Uplands ecoregion (Neily *et al.,* 2017).

The Cape Breton Hills ecodistrict often has steep sloped hills with well drained soils and moderately coarse textured soils; in relation to the rest of Nova Scotia, this ecodistrict is more elevated: often around 150 – 300 m above sea level (Neily *et al.,* 2017). Low lying areas in this ecodistrict tend to have imperfectly drained, fine textured tills that are often nutrient rich and provide suitable habitat for vascular flora rarities. Within this ecodistrict in lower elevations, karst topography exists which gives rise to calcium rich soil which is often good habitat for vascular flora rarities.

As a result of the bedrock and climatic conditions, this ecodistrict is primarily tolerant hardwood forests with scattered softwood species (Neily *et al.,* 2017).

2.2.2 *Field Surveys*

During the field surveys it was noted that a large percentage of the Study Area is disturbed by the existing quarry and timber clear-cuts, with approximately 42% (n=16.8 ha) of disturbance.[1] The remainder of the Study Area consists of both regenerative and mature hardwood, softwood and mixed wood canopies.

[1] Disturbance area is an estimate based on google earth imagery assessed November 15th, 2019. This estimate does not include regenerative forests as these features cannot be accurately delineated by desktop review.

A total of 9 HAP were surveyed with a total of four ecosites and six vegetative types (VT). Locations of the HAP are found in Figure 2 (Appendix A) and discussed below.

2.2.2.1 Ecosites

Within the Study Area, the ecosites generally consisted of medium to rich nutrient regimes to moderate to well drained soils which all fall within the Acadian ecosites (i.e. AC9, AC10, AC11 and AC13). HAP2 and HAP3 which are located at the eastern and western and extents of the Study Area consisted of richer soils (AC11). The remaining ecosites, located in the central and northern regions consisted of medium nutrient levels as reflective of the VTs described in the section below.

2.2.2.2 Vegetation Types

The most prevalent VTs out of the HAPs surveyed is the Balsam fir/wood fern/Schreber's moss (SH8, 33% of HAP surveyed) and the red spruce – balsam fir/Schreber's moss (SH5, 22% of HAP surveyed) which both belong to the spruce hemlock forest group (SH) and comprise of 55% of the total HAPs surveyed. This group is a conifer dominant vegetative community which is typically indicative of soils of poor to medium nutrient regimes. The SH group is scattered throughout the Study Area.

Tolerant hardwood forests (TH) that comprise of 22% of the HAPs surveyed were located in the southern portions of the Study Area. Tolerant hardwoods are indicative of richer soils that can often support vascular rarities (NSDNR, 2010), however, these HAPs were on the edge or in close proximity to disturbances and no rare vascular plant species were observed during field surveys as discussed in Section 3.2.2.

Mixedwood forests (MW) comprise of 22% of the HAPs surveyed and are located in the south and north of the Study Area, with evidence of natural disturbances (i.e. wind blowdown and timber harvesting surrounding the quarry open pit).

Table 2-1, below presents the description of each HAP surveyed with a discussion about stand maturity and the presence/absence of disturbances.

Table 2-1. Vegetation Types and Ecosites

Habitat Survey Points	Ecosite	Vegetation Type	Habitat Description
HAP1	AC10	SH8	An early to mid-successional VT which, within the Study Area, was predominately regenerative balsam fir (*Abies balsamea*) and disturbed from clearings associated with quarry development, immediately adjacent to the HAP. The herbaceous layer primarily consists of lambkill and Schreber's moss. This ecosite (AC10) occurs on well drained slopes with medium nutrient levels.
HAP2	AC11	MW1	A late successional VT typically dominated by red spruce and yellow birch (*Betula alleghaniensis*). Multiple fern species are often found within this VT which include New York fern (*Thelypteris noveboracensis*) and hay-scented fern (*Dennstaedtia punctilobula*). This particular HAP was on the edge of a clearing with regenerating

Habitat Survey Points	Ecosite	Vegetation Type	Habitat Description
			balsam fir. This ecosite (AC11) is characterized by imperfectly drained soils with soils of medium richness.
HAP3	AC11	TH2a	This is a late-successional VT typically dominated by yellow birch and sugar maple and generally associated with moist and slightly fertile soils. Herbaceous cover often consists of fern species such as New York fern and the evergreen wood fern (*Dryopteris intermedia*). This HAP is on the edge of associated quarry clearings. This ecosite (AC11) is characterized by imperfectly drained soils with soils of medium richness.
HAP4	AC10	SH8	An early to mid-successional VT which within the Study Area, was predominately mature balsam fir with no evidence of direct disturbance, although quarry associated clearings were located approximately 50m west of the HAP. The herbaceous layer primarily consists of lambkill and Schreber's moss. This ecosite (AC10) occurs on well drained slopes with medium nutrient levels.
HAP5	AC13	TH2	This is a late-successional VT typically dominated by sugar maple and yellow birch and generally associated with moist and slightly fertile soils. Herbaceous cover often consists of fern species such as New York fern and the evergreen wood fern. No evidence of direct disturbance was noted at this HAP and the closest associated quarry clearing is approximately 110m west of the HAP. This ecosite (AC13) typically occurs on moderately to imperfectly drained, nutrient rich soils.
HAP6	AC9	SH5	A mid-successional VT with red spruce and balsam fir as the dominant canopy cover. This VT typically has a sparse understory commonly dominated with red maple (*Acer rubrum*) and false holly. The herbaceous layer across was dominated by Schreber's moss and *Bazzani sp,* forbs were sparse. No evidence of direct disturbance was observed. This ecosite (AC9) is characterized by well drained soils with medium richness.
HAP7	AC10	SH8	An early to mid-successional VT which, within the SA, was predominately regenerative balsam fir from previously logged areas. This VT is one of the most dominate canopy types throughout the SA. The herbaceous layer primarily consists of lambkill and Schreber's moss. This ecosite (AC10) occurs on well drained slopes with medium nutrient levels.
HAP8	AC11	MW5	This early successional mixedwood VT is dominated by white birch and balsam fir with a sparse herbaceous layer consisting of stair-step moss. No direct evidence of human disturbance was observed, however, downed trees by natural occurrences (i.e. wind) were observed. This ecosite occurs on imperfectly drained nutrient rich soils that typically support mixedwood canopies. This ecosite (AC11) is characterized by imperfectly drained soils with medium richness.

Habitat Survey Points	Ecosite	Vegetation Type	Habitat Description
HAP9	AC9	SH5	A mid-successional VT with red spruce and balsam fir as the dominant canopy cover. This VT typically has a sparse understory commonly dominated with red maple and False Holly. The herbaceous layer across was dominated by bunch berry (*Cornus canadensis*), Schreber's moss, and *Bazzani sp,* forbs were sparse. No evidence of direct disturbance. This ecosite (AC9) is characterized by well drained soils with medium richness.

In general, the Study Area is a mosaic of disturbed and intact forests, with areas consisting primarily of the spruce hemlock (SH) forest group. The disturbances within the Study Area consist of an open pit quarry and timber clear-cuts resulting in fragmented habitats. The nutrient regimes within the Study Area varied from medium to rich, with medium nutrient regimes being the most prevalent. Although HAP5 was recorded to be in a higher nutrient regime, the surrounding landscape was disturbed and fragmented, and it didn't have any indication and observations of any vascular rarities within these sites.

3.0 FLORA

3.1 Methodology

3.1.1 *Desktop Review*

Prior to undertaking the flora field assessment, a detailed desktop review of known flora observations and potential habitat for rare lichens within the Study Area was conducted. The desktop review process involved assessing the following: the ACCDC database results; the Nova Scotia Department of Natural Resources (NSDNR) predictive habitat mapping for boreal felt lichen (*Erioderma pedicellatum*); the Mersey Tobeatic Research Institute (MTRI) vole ears (*Erioderma mollissimum*) and extant boreal felt lichen population GIS databases; and the priority species list.

3.1.2 *Vascular Plant Field Surveys*

Vascular plant surveys took place in early summer and fall on June 24th and September 6th, 2019, thus capturing plant species with different flowering periods. Surveys were conducted by Mr. John R. Gallop and Mr. Chris Pepper.

Meandering transects were completed on foot and all major habitat types were assessed to create a species list of the general vascular species and communities present within the Study Area. The priority species list was referenced during the surveys and species on that list were targeted. Survey efforts were focused on wetlands and floodplain habitats as these habitats often have an increased potential for rarities due to richer conditions. The edges of the quarry clearings were also assessed with detail as priority species such as the variegated horsetail (*Equisetum variegatum*) are often associated with these habitats.

In the event that a species could not be identified in the field detailed photographs were taken to capture diagnostic features, and, if possible, specimens were collected and preserved for identification at a later time. All priority species observed were georeferenced, counted (when possible), photographed, and their habitat was recorded. When specimens were present in tufts or in large numbers and counting the individuals became a challenge, the areas of these clumps were measured (e.g. 10m x 10m). The following literature are 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); and,
- Flora of New Brunswick (Hinds, 2000).

3.1.3 *Lichen Field Surveys*

Dedicated surveys were completed by Mr. John R. Gallop and Mr. Chris Pepper on June 24th and September 6th, 2019; species were also documented incidentally during the suite of biophysical surveys completed during the 2019 survey period. Mature trees that are appropriate for hosting priority lichen species were visually inspected by focusing on tree trunks, branches and twigs. Boreal felt lichen (BFL) habitat polygons were visited to determine BFL presence and/or habitat suitability. The following information was collected for any priority lichen species identified during field surveys: site location, date, scientific name, count, size, habitat (substrate, general habitat), location (waypoint in UTM NAD83), along with a photograph and any relevant comments. Only priority lichen species were recorded. The following literature was referenced during the surveys and identification process:

- The Macrolichens of New England (Hinds & Hinds, 2007); and,
- Keys to Lichens of North American – Revised and Expanded (Brodo, Sharnoff, & Sharnoff, 2016).

3.2 **Results**

3.2.1 *Desktop Review*

The ACCDC report identified no vascular plant species and two priority lichen species within 5 km of the Study Area: fringe lichen (*Heterodermia neglecta*) and corrugated shingles lichen (*Fuscopannaria ahlneri*). No priority vascular plant species were identified by the ACCDC report as observed within 5 km of the Study Area. One BFL predictive habitat polygon was determined to be within the Study Area, however, according to the MTRI databases, no extant BFL populations are within 20 km and no vole ears lichen are within 120 km of the Study Area.

3.2.2 *Vascular Plant Survey Results*

A total of 175 vascular plant species were identified within the Study Area during the summer and fall surveys with no priority vascular plant species identified. Of the total vascular plant species observed, 17% (n=30) were exotics. See Appendix D for the complete list of vascular flora identified within the Study Area.

As described in Section 2.2.2, the Study Area is a mosaic of disturbed and intact forests, with the disturbances primarily consisting of open pit quarry and timber clear-cuts. In some areas, habitats were fragmented allowing weedy exotic species such as the invasive coltsfoot (*Tussilago farfara*) and other non-invasive exotic forbs such as bittersweet nightshade (*Solanum dulcamara*), and grass species such as hair fescue (*Festuca filliformis*) and hard fescue (*Festuca trachyphylla*) to grow in edge habitats and trails. The exotic species observed were isolated to the disturbed locations and were not observed in the intact forested portions of the Study Area.

Wetland habitats within the Study Area had the highest potential for vascular rarities and primarily consisted of treed swamps consisting of trademark swamp species such as three-seeded sedge (*Carex trisperma*), three-leaved Soloman's seal (*Maianthemum trifolium*), red maple and balsam fir and the vascular flora community types is described in detail in Section 7.0

No rare vascular plant species were observed and the relatively high percentage of exotics (17% of all species identified) is reflective of the largely disturbed habitat types. Potential for priority vascular plant species to exist was determined to be low.

3.2.3 *Lichen Survey Results*

Six priority lichen species were observed within the Study Area which include two SAR; blue felt lichen (*Pectenia plumbea*), Frosted Glass-whiskers (*Sclerophora peronella*) and four SOCI; fringe lichen (*Heterodermia neglecta*), powdered fringe lichen (*H. speciosa*), slender monk's hood lichen (*Hypogymnia vittata*) and corrugated shingles lichen (*Fuscopannaria cf. ahlneri*). For details regarding the locations and descriptions of these species see section 8.0 and Figure 9 (Appendix A)

As described in Section 2.2.2, the Study Area consists of disturbed, fragmented habitats with scattered intact mature forested wetlands and uplands. Forested swamps with mature hardwoods and softwoods, particularly canopies with balsam fir and red maple had suitable tree species and habitat for many priority lichen species such as blue felt lichen and frosted glass whiskers.

One BFL habitat polygon was identified within the Study Area during the desktop review, however, it was determined to be unsuitable habitat as this area is currently a clear-cut. Although there was some indication of BFL habitat within the Study Area by the presence of indicator species such as slender monk's hood and corrugated shingles lichen, the lands surrounding these habitats were fragmented and bordered by scattered historical clear-cut activities. These fragmented habitats have altered sun exposure and moisture regimes leading to a drying effect on forested edges and canopies/wetlands in close proximity (Rheault, Drapeau, Bergeron, & Esseen, 2003). Many lichens dependent on humid environments (including BFL) are often greatly negatively impacted by the presence of fragmented habitats (Rheault, Drapeau, Bergeron, & Esseen, 2003). As a result, despite the presence of species that often coexist with BFL, the proximity to clear cutting activities make the likelihood of BFL presence low.

4.0 TERRESTRIAL FAUNA

4.1 Methodology

4.1.1 *Desktop Review*

The GIS forestry database (NSDNR, 2015) was used to determine the forest cover types within and surrounding the Study Area. In addition, the Canada lynx range and the lynx buffer Special Management Practice (SMP) zone layers were used on the Nova Scotia Provincial Landscape Viewer to determine if Canada lynx (*Lynx canadensis*) buffers were within and/or in close proximity to the Study Area.

4.1.2 *Field Surveys*

Based on the desktop review of forest cover type, four 1-km transects were placed within and surrounding the Study Area. These transects were focused on land with habitat potential for lynx prey (i.e. snowshoe hare, American red squirrel), which is preferably dense immature forests comprising of spruce and balsam fir (Orr, 1982). See Figure 3, Appendix A for transect locations.

Surveys took place from morning to early afternoon on March 7th and May 5th, 2019. Ideally surveys took place in snow conditions suitable for tracking approximately 72 hours after a snowfall event with snow depths of approximately 2 - 12 cm. However, ideal snow conditions were not possible for the second survey. During the surveys, all wildlife sightings, tracks, and scat were recorded. If lynx observations or potential lynx evidence were identified, the scat or tracks were georeferenced, photographed (with a scale) and the surrounding habitat was described. Verification of potential lynx sign was achieved by referencing literature and/or contacting Wildlife Biologist, Mr. John Brazner from Nova Scotia Department of Lands and Forests (NSDL&F). The following literature was referenced:

- Mammal Tracks & Sign – A Guide to North American Species (Elbroch, 2003); and,
- Tracking & the Art of Seeing: How to Read Animal Tracks and Sign. 2nd ed (Rezendes, 1999).

In addition to the species-specific Canada lynx surveys, all incidental wildlife was recorded during the suite of biophysical surveys conducted in 2019.

4.2 Results

4.2.1 *Desktop Review*

The Study Area is within the Canada lynx range, and is within the lynx buffer SMP zones that are part of a provincial recovery effort where 100 metres is applied to all undisturbed, forested bogs (NSDNR, 2012). Open bogs are reliable producers of cones, the significant food source for American red

squirrels, as such, protecting the habitat of red squirrels protects this Canada lynx food source (NSDNR, 2012).

The SMP document states that 100 m buffers should be retained around all bogs; however, field surveys reveal that the SMP within the Study Area surrounds a wetland complex (corresponding to WL2) made up of predominantly swamp habitats. While it does contain some portions of bog, these sections are small and fragmented (see Section 7.2.2 for a description of the wetland).

The following have been observed historically within 100 km of the Study Area as per the ACCDC.

Table 4-1 SAR and SOCI terrestrial fauna species within 100 km as listed by ACCDC

Scientific Name	Common Name	COSEWIC	SARA	NSESA	ACCDC	Distance
Myotis lucifugus	Little Brown Myotis	Endangered	Endangered	Endangered	S1	3.5 ± 0.0
Glyptemys insculpta	Wood Turtle	Threatened	Threatened	Threatened	S2	8.7 ± 5.0
Chelydra serpentina	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	49.2 ± 10.0
Chrysemys picta picta	Eastern Painted Turtle	Special Concern			S4S5	87.7 ± 1.0
Lynx canadensis	Canadian Lynx	Not At Risk		Endangered	S1	2.1 ± 0.0
Sorex dispar	Long-tailed Shrew	Not At Risk	Special Concern		S2	33.1 ± 1.0
Hemidactylium scutatum	Four-toed Salamander	Not At Risk			S3	33.1 ± 1.0
Martes americana	American Marten			Endangered	S1	42.0 ± 1.0
Alces americanus	Moose*			Endangered	S1	31.1 ± 0.0
Vespertilionidae sp.	bat species				S1S2	8.4 ± 0.0
Microtus chrotorrhinus	Rock Vole				S2	33.2 ± 0.0
Asio otus	Long-eared Owl				S2S3	10.7 ± 7.0
Synaptomys cooperi	Southern Bog Lemming				S3	33.2 ± 0.0
Pekania pennanti	Fisher				S3	66.7 ± 0.0

**Included as reported by the ACCDC, though Moose on Cape Breton Island are not considered SOCI.*

4.2.2 *Field Surveys*

Two likely occurrences of lynx scat and tracks were observed within and beyond the Study Area both during a dedicated lynx survey and incidentally. What is believed to be tracks of Canada lynx were observed on Transect 3, north of the Study Area and scat was observed incidentally within upland habitat adjacent to WL11 during wetland assessments (Figure 7, Appendix A). Additionally, unidentifiable cat scat and tracks were observed on Transect 3 during the second lynx survey. These later specimens were older and weathered, making verification difficult. Basic morphology showed that these scat specimens were segmented, contained bone and hair, and had blunt ends, and could have belonged to either a Canada lynx, coyote or bobcat. However, due to the poor condition of these observations (old weathered material), MEL biologists were unable to confirm with certainty if it was

Canada lynx scat and as a result, observations were labeled as “possible Canada lynx”. See Figure 9 (Appendix A) for observation locations.

Within the Study Area, regenerative forest areas exist on the edge of quarry clearings in the south and in the north within old timber harvests. These habitats comprise of regenerative conifers that provide suitable habitat for Canada lynx prime prey: snowshoe hare (*Lepus americanus;* NSDNR, 2012). Sign of American red squirrel and snowshoe hare were both observed during the surveys indicating these Canada lynx food sources are available within and surrounding the Study Area (NSDNR, 2012). See Section 8.2.2.2 for further discussion on Canada lynx prey habitat.

While regenerative forest types are an important habitat type for snowshoe hare, intact mature forest corridors are important for Canada lynx movement (NSDNR, 2012). Within the Study Area, particularly in the southern portion, the active quarry and timber cut clearings do not provide ideal wildlife corridors for this species. The northern Study Area may provide some suitable habitat corridors due to the presence of varied tree-age stands; however, north of the Study Area a logging road exists that likely provides access to competitor species such as coyotes and bobcats. Coyotes and bobcats are generalist hunters, able to subsist on many different species while out-competing the lynx, a specialist hunter (Aubry, Koehler, and Squires, 2000; O’Donoghue *et al.,* 2001; Parker, G. 2001). It may have been that the “possible Canada lynx” scat observed on this northern road, was in fact coyote or bobcat. Further discussion of Canada lynx can be found in Section 8.2.2.2.

Table 4-2 describes all wildlife observed during the Canada lynx surveys as well as wildlife incidentals both during the full suite of biophysical surveys conducted in the spring, summer and fall of 2019.

Table 4-2. Wildlife Sign Observed during Canada Lynx Surveys and Incidental Observations*

Scientific Name	Common Name	SARA	COSEWIC	NSESA	ACCDC SRank
Lynx canadensis	Canada lynx	-	Not at Risk	Endangered	S1
Lepus americanus	Snowshoe hare	-	-	-	S5
Tamiasciurus hudsonicus	American red squirrel	-	-	-	S5
Mustela erminea	Short-tailed weasel	-	-	-	S5
Odocoileus virginianus	White-tailed deer	-	-	-	S5
Canis latrans	Coyote	-	-	-	S5

*Note: observations do not include avifauna observations, see Section 5.0 for incidental avifauna observations

5.0 AVIFAUNA

5.1 Methodology

5.1.1 *Desktop Review*

A review of the Canada Important Bird Areas (IBA) database, ACCDC, Maritime Breeding Bird Atlas (MBBA) Square 20PR55, old forest GIS database, and Canada Wildlife Service Migratory Bird Sanctuary (MBS) was completed to support bird survey design and methodology.

5.1.2 *Field Surveys*

Avian field monitoring programs were completed by expert birders, Mr. Chris Pepper and Mr. John Gallop (MEL biologist). The following surveys were conducted:

- Spring migration (May 5, May 23, and June 1, 2019);
- Breeding bird (June 15 and June 24, 2019);
- Fall migration (September 6, September 26, and October 15, 2019); and
- Common nighthawk (June 14 and June 23, 2019).

The following describes the methodology used for spring migration, breeding bird, and fall migration surveys. Additional information for breeding bird and common nighthawk surveys can be found in 5.1.2.1 and 5.1.2.2 respectively. Surveys took place at eleven point count (PC) locations within and beyond the Study Area in a variety of habitats including closed canopy forests, mature hardwoods, wetlands, and open areas (Figure 4, Appendix A). Surveys began at, or within, half an hour of sunrise and were completed within four-and-a-half hours or by 10:00 a.m., whichever came first. Ten-minute point counts were completed at each survey location. During each survey, weather conditions (i.e., precipitation and visibility) were monitored and 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 GPS unit was used to geo-reference the location. General observations including temperature, visibility, wind speed, date, start and end time were also recorded. Bearings were recorded for priority species observed during dedicated survey periods and incidentally.

Bird species were identified based on functional bird groups to understand how each group uses the Study Area. These functional groups include:

1. **Waterfowl**: Ducks, geese, or other large aquatic birds, especially when regarded as game;
2. **Shorebirds**: Waders, from the Order Charadriiformes;
3. **Other waterbirds**: Includes seabirds (i.e. marine birds), grebes (Order Podicipediformes), loons (Order Gaviiformes), Ciconiiformes (i.e. storks, herons, egrets, ibises, spoonbills, etc.), pelicans (Order Pelicaniformes), flamingos (Order Phoenicopteriformes), Gruiformes (i.e. cranes and rails), kingfishers, gulls and dippers (the only family of passerines considered waterbirds);
4. **Diurnal Raptors**: Birds within the families Accipitridae (i.e. hawks, eagles, buzzards, harriers, kites and old-world vultures), Pandidonidae (i.e. osprey), Sagittariidae (i.e. secretary bird), Falconidae (i.e. falcons, caracaras, and forest falcons), Cathartidae (i.e. new world vultures), and one species from the Order Strigiformes (i.e. hawk owl);
5. **Nocturnal Raptors**: Birds of the Order Strigiformes (i.e. owls; with exception of the hawk owl, which is a diurnal species of owl);

6. **Passerines**: Any bird of the Order Passeriformes, which includes more than half of all bird species. This is with exception of the dippers, which are a passerine considered a waterbird; and,
7. **Other Landbirds**: Birds within the Orders Galliformes (i.e. quail, pheasant, and grouse), Columbiformes (i.e. pigeons and doves), Cuculiformes (i.e. cuckoos), Caprimulgiformes (i.e. nighthawks and whip-poor-wills), Apodiformes (i.e. swifts and hummingbirds), and Piciformes (i.e. woodpeckers, flickers and sapsuckers).

5.1.2.1 Breeding Bird

The breeding status of the bird species observed during breeding bird surveys were also recorded. The surveyor noted on bird behavior observed, including distraction display, carrying food, and carrying nesting material. The following are the breeding status (MBBA, 2008) observed during the breeding bird surveys:

- **Observed** - species observed in its breeding season;
- **Possible** - species observed during breeding season in suitable nesting habitat or singing males or breeding calls heard, in suitable nesting habitat during breeding season;
- **Probable** - agitated behavior observed or the occurrence of an adult bird, at the same place, on at least two days a week during breeding season; and
- **Confirmed** - adult carrying food or distraction display.

5.1.2.2 Common Nighthawk

The common nighthawk (*Chordeiles minor*) prefers to nest in gravelly substrates and is best detected while foraging for insects shortly after sunset. Suitable habitat is available for this species within the Study Area (i.e. existing quarry area, clear-cuts, and roadside clearings), therefore dedicated surveys for the common nighthawk were conducted mid to late June at dusk, one hour before sunset to 30 minutes after sunset (MBBA, 2008). Three survey point count locations were surveyed twice by expert birders, Mr. Chris Pepper and Mr. John Gallop (MEL biologist) on June 14 and repeated on June 23, 2019 (Figure 4, Appendix A). The PC locations are situated just outside the Study Area and surrounded by forested, cut block, or existing quarry roads. Each PC survey 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 used by the Saskatchewan Ministry of Environment (2015).

5.2 **Results**

5.2.1 *Desktop Review*

The nearest IBA is the Basque Islands and Michaud Point IBA (IBA NS045), located approximately 35 km southeast of the Study Area (Bird Studies Canada, 2012). The habitats provided within this IBA are not consistent with habitat present within the Study Area. The IBA contains small, rocky islands with gravel and sand beaches and hosts nesting cormorants. No cormorants were observed in the Study Area, nor was their nesting habitat present.

The closest MBS is Big Glace Bay Lake Migratory Bird Sanctuary, which is located approximately 140 km northeast of the Study Area. This MBS is located on a lake containing salt marshes and intertidal flats. The habitats provided within this MBS are not consistent with habitat present within the Study Area. The MBBA 20PR55 square results are included in Appendix E.

A review of Nova Scotia's ecodistricts reveals that the Study Area falls within primarily tolerant hardwood forests with scattered softwood species (NSDNR, 2010). Review of the aerial images show a significant proportion of disturbance within the Study Area boundaries, as well as clear-cutting and logging roads in the surroundings. Habitat fragmentation currently on the landscape may have decreased habitat quality for avian species that rely on interior forest conditions. Interior forests areas are defined as an area within a forest that is sheltered from edge effects. There are no old forest polygons present within the Study Area

There are no significant water bodies within the Study Area that would attract large flocks of migrating birds. Mountain Lake (approximately 1 ha in size) and Hill Lake (approximately 38 ha in size) are respectively 175 m and 1.5 km west of the Study Area. Furthermore, the Study Area is not located along a ridge, valley, or coastline and thus a significant migratory pathway. Lastly, the habitats within the Study Area were not found to significantly concentrate foraging activities.

The ACCDC database identified seven avian SAR within 5 km of the Study Area. These are discussed further in Section 8.0. The ACCDC results are in Appendix F.

5.2.2 *Field Surveys*

Baseline bird surveys were completed from May to October 2019. During this time a total of 916 minutes (15 hours and 16 minutes) were spent on dedicated avian surveys, resulting in the observation of 725 individuals and representing 63 species. Including incidental observations, a total of 756 individuals representing 64 species were observed. Survey locations can be found in Figure 4.

5.2.2.1 Spring Migration

Three rounds of spring migration surveys occurred at 11 PCs, resulting in the observation of 316 individuals, representing 42 species, not including an unidentified woodpecker species. An additional five individuals were observed incidentally, four of which were species observed during dedicated surveys. One incidental species, a single gray jay (*Perisoreus canadensis*) has an ACCDC listing of S3. One avian SAR species (barn swallow) was observed during spring migration surveys, all avian priority species are discussed in Section 8.0.

Table 5-1. Spring Migration Species and Abundance

Species Code	Common Name	Scientific Name	S-Rank	#	PC# Observations	Bird Group
BARS	**barn swallow**	***Hirundo rustica***	**S2S3B**	**2**	**3**	**6**
AMGO	American goldfinch	*Carduelis tristis*	S5	6	3, 4, 5, 8, 11	6
AMRO	American robin	*Turdus migratorius*	S5B, S3N	12	5, 6, 7, 8, 10, 11	6
BAWW	black-and-white warbler	*Mniotilta varia*	S5B	17	2, 3, 4, 5, 7, 8, 9, 10, 11	6

Species Code	Common Name	Scientific Name	S-Rank	#	PC# Observations	Bird Group
BCCH	black-capped chickadee	*Poecile atricapilla*	S5	11	2, 4, 9, 11	6
BDOW	barred owl	*Strix varia*	S5	2	1, 9	5
BHVI	blue-headed vireo	*Vireo solitarius*	S5B	9	2, 6, 9, 10, 11	6
BLJA	blue jay	*Cyanocitta cristata*	S5	7	2, 3, 6, 7, 8, 9	6
BLPW	blackpoll warbler	*Dendroica striata*	S3S4B	1	9	6
BOCH	boreal chickadee	*Poecile hudsonica*	S3	5	6, 9, 10	6
BTNW	black-throated green warbler	*Dendroica virens*	S5B	9	3, 4, 6, 8, 9, 10, 11	6
BWHA	broad-winged hawk	*Buteo platypterus*	S5B	1	9	4
CAGO	Canada goose	*Branta canadensis*	SNAB, S4N	3	7, 10	1
COLO	common loon	*Gavia immer*	S4B, S4N	2	4, 6	3
CORA	common raven	*Corvus corax*	S5	2	5, 11	6
COYE	common yellowthroat	*Geothlypis trichas*	S5B	9	2, 4, 7, 8, 9, 11	6
DEJU	dark-eyed junco	*Junco hyemalis*	S4S5	26	1, 2, 3, 4, 6, 7, 8, 9, 10, 11	6
DOWO	downy woodpecker	*Picoides pubescens*	S5	4	2, 3, 4	7
FOSP	fox sparrow	*Passerella iliaca*	S3S4B	1	7	6
GCKI	golden-crowned kinglet	*Regulus satrapa*	S5	4	2, 8, 9, 10	6
HAWO	hairy woodpecker	*Picoides villosus*	S5	2	3, 11	7
HETH	hermit thrush	*Catharus guttatus*	S5B	20	1, 3, 4, 5, 6, 8, 9, 10, 11	6
LISP	Lincoln's sparrow	*Melospiza lincolnii*	S4B	3	2, 3	6
MAWA	magnolia warbler	*Dendroica magnolia*	S5B	9	2, 3, 7, 8, 9, 10, 11	6
MODO	mourning dove	*Zenaida macroura*	S5	3	5, 8, 9	7
NOFL	northern flicker	*Colaptes auratus*	S5B	5	1, 2, 4, 6	7
NOGO	northern goshawk	*Accipiter gentilis*	S3S4	1	8	4
OVEN	ovenbird	*Seiurus aurocapilla*	S5B	9	2, 8, 9, 10, 11	6
PAWA	palm warbler	*Dendroica palmarum*	S5B	3	5, 7, 8	6
PISI	pine siskin	*Carduelis pinus*	S2S3	8	1, 2, 5, 7, 10	6
PIWO	pileated woodpecker	*Dryocopus pileatus*	S5	1	7	7
PUFI	purple finch	*Carpodacus purpureus*	S4S5B, S3S4N	5	2, 6, 10, 11	6
RBNU	red-breasted nuthatch	*Sitta canadensis*	S3	3	2, 9, 10	6
RCKI	ruby-crowned kinglet	*Regulus calendula*	S3S4B	23	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	6
RUGR	ruffed grouse	*Bonasa umbellus*	S5	16	1, 2, 5, 6, 7, 9, 10, 11	7
SPGR	spruce grouse	*Falcipennis canadensis*	S4	2	6	7
SWSP	swamp sparrow	*Melospiza georgiana*	S5B	1	4	6
SWTH	swainson's thrush	*Catharus ustulatus*	S3S4B	4	8, 9, 11	6
TRES	tree swallow	*Tachycineta bicolor*	S4B	1	6	6
WIWR	winter wren	*Troglodytes troglodytes*	S5B	12	2, 3, 4, 5, 11	6
Wood-pecker sp	#N/A	*#N/A*	#N/A	1	9	7
WTSP	white-throated sparrow	*Zonotrichia albicollis*	S5B	23	2, 3, 4, 5, 7, 8, 10, 11	6

Species Code	Common Name	Scientific Name	S-Rank	#	PC# Observations	Bird Group
YRWA	yellow-rumped warbler	*Dendroica coronata*	S5B	28	3, 4, 5, 6, 7, 8, 9, 10, 11	6
	Total Species: 42	**Total Number: 316**				

*Notes: Incidental observations during the spring migration surveys 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. Species in **bold** are SAR.*

Passerines comprised 87% of all individuals observed, which is to be expected based on the forest habitat. The second most abundant species group was landbirds (such as woodpeckers, grouse, etc.), which made up 11% of all individuals. Yellow-rumped warbler (*Setophaga petechia*) was the most abundant species observed (n=28), followed by dark-eyed junco (*Junco hyemalis* ; n=26), ruby-crowned kinglet (*Regulus calendula*; n=23), and white-throated sparrow (*Zenotrichia albicollis*; n=23).

5.2.2.2 Breeding Bird

Two rounds of breeding bird surveys occurred at 11 PCs, resulting in the observation of 212 individuals, representing 38 species. An additional twelve individuals were observed incidentally, nine of which were species also observed during dedicated surveys. The three other incidentally observed individuals were a common loon (*Gavia immer*), merlin (*Falco columbarius*), and a red-tailed hawk (*Buteo jamaicensis*). One avian SAR species was observed Canada warbler), all priority species are discussed in Section 8.0.

Table 5-2. Breeding bird species and abundance

Species Code	Common Name	Scientific Name	S-Rank	#	Points Obs.	Bird Group	Breeding Status
CAWA	**Canada warbler**	***Cardellina canadensis***	**S3B**	**2**	**4**	**6**	**Probable**
ALFL	alder flycatcher	*Empidonax alnorum*	S5B	6	3, 4, 7, 8, 12	6	Probable
AMGO	American goldfinch	*Carduelis tristis*	S5	1	12	6	Possible
AMRE	American redstart	*Setophaga ruticilla*	S5B, S3N	2	11, 12	6	Possible
AMRO	American robin	*Turdus migratorius*	S5B, S3N	9	2, 3, 4, 5, 6, 7, 8	6	Probable
BAWW	black-and-white warbler	*Mniotilta varia*	S5B	11	2, 3, 4, 7, 9, 10, 11	6	Probable
BEKI	belted kingfisher	*Megaceryle alcyon*	S5B	1	2	3	Observed
BHVI	blue-headed vireo	*Vireo solitarius*	S5B	15	2, 3, 4, 6, 8, 9, 10, 11, 12	6	Probable
BLJA	blue jay	*Cyanocitta cristata*	S5	3	3, 6, 8	6	Probable
BTNW	black-throated Green warbler	*Dendroica virens*	S5B	18	2, 3, 4, 5, 6, 7, 8, 9, 10, 11	6	Probable
CORA	common raven	*Corvus corax*	S5	1	12	6	Possible
COYE	common yellowthroat	*Geothlypis trichas*	S5B	12	2, 4, 5, 7, 9, 11, 12	6	Probable

Species Code	Common Name	Scientific Name	S-Rank	#	Points Obs.	Bird Group	Breeding Status
DEJU	dark-eyed junco	*Junco hyemalis*	S4S5	15	2, 3, 4, 5, 7, 8, 9, 10, 12	6	Probable
DOWO	downy woodpecker	*Picoides pubescens*	S5	1	5	7	Probable
GCKI	golden-crowned kinglet	*Regulus satrapa*	S5	1	8	6	Probable
GRAJ	gray jay	*Perisoreus canadensis*	S3	1	8	6	Probable
HAWO	hairy woodpecker	*Picoides villosus*	S5	2	2, 12	7	Possible
HETH	hermit thrush	*Catharus guttatus*	S5B	14	5, 6, 7, 8, 9, 10, 11	6	Probable
LISP	Lincoln's sparrow	*Melospiza lincolnii*	S4B	2	2, 9	6	Probable
MAWA	magnolia warbler	*Dendroica magnolia*	S5B	18	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	6	Probable
MODO	mourning dove	*Zenaida macroura*	S5	3	6, 7	7	Probable
MOWA	mourning warbler	*Oporornis philadelphia*	S4B	3	4, 12	6	Possible
NOFL	northern flicker	*Colaptes auratus*	S5B	1	3	7	Probable
NOPA	northern parula	*Parula americana*	S5B	2	10, 12	6	Possible
OVEN	ovenbird	*Seiurus aurocapilla*	S5B	13	2, 3, 5, 6, 9, 10, 11, 12	6	Probable
PAWA	palm warbler	*Dendroica palmarum*	S5B	1	8	6	Probable
RCKI	ruby-crowned kinglet	*Regulus calendula*	S3S4B	6	2, 3, 4, 7, 8, 12	6	Probable
REVI	red-eyed vireo	*Vireo olivaceus*	S5B	1	12	6	Probable
RNDU	ring-necked duck	*Aythya collaris*	S5B	2	12	1	Observed
RUGR	ruffed grouse	*Bonasa umbellus*	S5	3	5, 6, 7	7	Possible
SOSP	song sparrow	*Melospiza melodia*	S5B	1	12	6	Probable
SPSA	spotted sandpiper	*Actitis macularius*	S3S4B	1	2	2	Probable
SWTH	Swainson's thrush	*Catharus ustulatus*	S3S4B	12	3, 5, 6, 9, 10, 11, 12	6	Probable
TRES	tree swallow	*Tachycineta bicolor*	S4B	1	12	6	Possible
WIWR	winter wren	*Troglodytes troglodytes*	S5B	1	12	6	Probable
WTSP	white-throated sparrow	*Zonotrichia albicollis*	S5B	13	2, 3, 4, 7, 9, 11, 12	6	Probable
YBFL	yellow-bellied flycatcher	*Empidonax flaviventris*	S3S4B	9	2, 3, 4, 5, 7, 9, 10	6	Probable
YRWA	yellow-rumped warbler	*Dendroica coronata*	S5B	4	7, 8, 10	6	Probable
	Total Species: 38		**Total Number: 212**				

*Notes: Incidental observations during the breeding bird surveys 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. Species in **bold** are SAR.*

Passerines made up 92% of all observed individuals during dedicated surveys. The second most abundant species group was landbirds, which made up 6% of all individuals. The most abundant species observed was the magnolia warbler (*Setophaga magnolia*; n=14), followed by black-throated

green warbler (*Setophaga virens*; n=13), blue-headed vireo (*Vireo solitarius*; n=9), and Swainson's thrush (*Catharus ustulatus*; n=9).

5.2.2.3 Common Nighthawk

No common nighthawk were observed during either specialized surveys or incidentally.

5.2.2.4 Fall Migration

Three rounds of fall migration surveys occurred at 11 PCs, resulting in the observation of 189 individuals, representing 41 species, not including an unidentified warbler species. An additional fourteen individuals were observed incidentally, twelve of which were species observed during dedicated surveys. The two other incidentally observed individuals were a mourning warbler (*Oporornis philadelphia*) and a spotted sandpiper (*Actitis macularius*).

Species Code	Common Name	Scientific Name	S-Rank	#	Points Obs.	Bird Group
AMCR	American crow	*Corvus brachyrhynchos*	S5	3	8, 11	6
AMGO	American goldfinch	*Carduelis tristis*	S5	1	11	6
AMKE	American kestrel	*Falco sparverius*	S3B	1	2	4
AMRO	American robin	*Turdus migratorius*	S5B, S3N	21	2, 3, 5, 6, 8, 9, 10, 11, 12	6
BAWW	black-and-white warbler	*Mniotilta varia*	S5B	3	11, 12	6
BBWA	bay-breasted warbler	*Dendroica castanea*	S3S4B	1	9	6
BCCH	black-capped chickadee	*Poecile atricapilla*	S5	6	5	6
BHVI	blue-headed vireo	*Vireo solitarius*	S5B	1	8	6
BLJA	blue jay	*Cyanocitta cristata*	S5	18	2, 3, 4, 5, 6, 8, 9, 11, 12	6
BLPW	blackpoll warbler	*Dendroica striata*	S3S4B	7	2, 4, 5, 6, 7, 8, 10	6
BOCH	boreal chickadee	*Poecile hudsonica*	S3	1	9	6
BRCR	brown creeper	*Certhia americana*	S5	2	6	6
BTNW	black-throated Green warbler	*Dendroica virens*	S5B	3	11, 12	6
CEDW	cedar waxwing	*Bombycilla cedrorum*	S5B	6	8, 11, 12	6
COLO	common loon	*Gavia immer*	S4B,S4N	1	3	3
CORA	common raven	*Corvus corax*	S5	6	4, 5, 9, 11, 12	6
COYE	common yellowthroat	*Geothlypis trichas*	S5B	6	8, 11, 12	6
DEJU	dark-eyed junco	*Junco hyemalis*	S4S5	3	9, 11	6
GCKI	golden-crowned kinglet	*Regulus satrapa*	S5	25	2, 3, 4, 5, 6, 8,9, 10, 11, 12	6
GRAJ	gray jay	*Perisoreus canadensis*	S3	7	3, 4, 6, 10	6
HAWO	hairy woodpecker	*Picoides villosus*	S5	1	4	7
HETH	hermit thrush	*Catharus guttatus*	S5B	1	5	6
LEFL	least flycatcher	*Empidonax minimus*	S4S5B	1	12	6

Species Code	Common Name	Scientific Name	S-Rank	#	Points Obs.	Bird Group
NOFL	northern flicker	*Colaptes auratus*	S5B	2	4, 12	7
OVEN	ovenbird	*Seiurus aurocapilla*	S5B	1	11	6
PAWA	palm warbler	*Dendroica palmarum*	S5B	2	3, 4	6
PIGR	pine grosbeak	*Pinicola enucleator*	S2S3B, S5N	1	10	6
PISI	pine siskin	*Carduelis pinus*	S2S3	1	9	6
PIWO	pileated woodpecker	*Dryocopus pileatus*	S5	1	11	7
PUFI	purple finch	*Carpodacus purpureus*	S4S5B, S3S4N	3	4, 9, 11	6
RBNU	red-breasted nuthatch	*Sitta canadensis*	S3	1	11	6
RCKI	ruby-crowned kinglet	*Regulus calendula*	S3S4B	3	5, 11, 12	6
REVI	red-eyed vireo	*Vireo olivaceus*	S5B	8	9, 11, 12	6
RTHA	red-tailed hawk	*Buteo jamaicensis*	S5	1	2	4
RUGR	ruffed grouse	*Bonasa umbellus*	S5	1	9	7
SAVS	savannah sparrow	*Passerculus sandwichensis*	SNA	1	12	6
SOSP	song sparrow	*Melospiza melodia*	S5B	3	12	6
SWSP	swamp sparrow	*Melospiza georgiana*	S5B	2	12	6
Warbler sp.	#N/A	*#N/A*	#N/A	16	3, 4, 5, 7, 8, 10, 11, 12	6
WIWR	winter wren	*Troglodytes troglodytes*	S5B	1	8	6
WTSP	white-throated sparrow	*Zonotrichia albicollis*	S5B	3	2	6
YRWA	yellow-rumped warbler	*Dendroica coronata*	S5B	13	3, 4, 6, 7, 9, 12	6
	Total Species: 41	**Total Number: 189**				

*Notes: Incidental observations during the fall migration surveys 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. Species in **bold** are SAR.*

Passerines made up 96% of all observed individuals during dedicated surveys. The second most abundant species group was landbirds, which comprised 3% of all individuals. Golden-crowned kinglet (*Regulus satrapa*) was the most abundant species observed (n=25), followed by American robin (*Turdus migratorius*; n=21), and blue jay (*Cyanocitta cristata*; n=18).

6.0 SURFACE WATER, FISH, AND FISH HABITAT

6.1 Methodology

6.1.1 *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 Study Area based on mapped systems, topography, and satellite imagery, while also identifying where the Study Area lies within primary and

secondary watersheds. This desktop review also served to identify potential fish habitat and fish species present in surface water features within and in proximity to the Study Area.

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 Study Area.

The Priority Species List, as defined in Section 8.0 was used to identify priority fish species that may occur in the Study Area. Information on confirmed and potential fish presence within the Study Area and surrounding surface water features was collected form the following sources:

- ACCDC Report (as presented in Appendix F);
- NSL&F Significant Species and Habitats database;
- Fisheries and Oceans Stock Status Reports;
- Description of Selected Lake Characteristics and Occurrence of Fish Species in 781 Nova Scotia Lakes (Alexander *et al*., 1986);
- Freshwater Fish Species Distribution Records (NSDFA, 2017); and,
- NSDFA Lake Inventory Maps.

6.1.2 *Field Surveys*

Watercourse delineation and characterizations were completed throughout the Study Area in conjunction with wetland delineation and evaluation July 28-30, 2019. The 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)*".

During the field evaluation, MEL used NSE guidance on watercourse determinations to identify watercourses (NSE, 2015). 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 the guidance provided by NSE, any surface feature that meets two of the criteria above meets the definition of a regulated watercourse. Using these criteria, regulated watercourses were mapped in the field using either a Geneq SX Blue II GPS (capable of sub-1m accuracy) or a handheld

GPS unit (capable of sub-5m accuracy). Watercourses were flagged using blue flagging tape, and a watercourse description form was completed for each representative reach of a watercourse.

Initial fish habitat characterization was completed by MEL biologists for all delineated watercourses July 28-30, 2019, during low flow conditions. The methods to complete habitat characterization were adopted from the Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador (Sooley *et al*., 1998), and the Adopt-a-Stream manual (NSLC, 2017). Watercourse characterization included a visual assessment of substrate, cover, riparian habitat, and physical channel measurements (depth, wetted and bankfull widths). Water quality parameters were measured *in-situ* using a calibrated YSI Professional Plus Multi-Probe at the time of the assessment. Parameters recorded include dissolved oxygen (DO), water temperature, pH, specific water conductivity (Sp.Con), and total dissolved solids (TDS). Observations were made on fish habitat quality and fish habitat potential for each identified feature, including a description of any potential barriers to fish access. Follow-up fish habitat characterizations were completed by MEL biologists on November 28, 2019 in an effort to describe watercourse conditions during high flow.

Throughout baseline watercourse mapping and fish habitat surveys, an assessment of potential fish passage barriers was completed. When a potential barrier was observed, biologists recorded the type of barrier, height and length of the barrier, depth of water, along with an estimate of slope where relevant. The contiguity and spatial relationships of discontinuous pools are described, with the intent of understanding a fish's ability to move and/or jump from one step-pool or isolated pool to another. When discontinuous pools, subterranean flow, or a general lack of surficial flow were observed, biologists walked and characterized the most obvious/highest potential for fish use flow path based on topography and hydrology indicators.

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 some species provide 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 barrier is anthropogenic in nature (i.e. improperly installed culverts (hung culvert)), the type of culvert is noted, along with any issues associated with installation that could be remediated to improve passage. The temporal nature of a barrier is noted as well, recognizing that natural and anthropogenic barriers can change with time (i.e. logjams or beaver dams) or remediation (i.e. culvert installation), while others limit passage seasonally (i.e. ephemeral or intermittent streams), and others are permanent barriers (i.e. some waterfalls). Where a barrier was identified but the temporal nature of it was uncertain or if it was dependent on flow regime, multiple site assessments were conducted to

confirm passability of a barrier. Except in extreme circumstances, logjams and beaver dams are not considered barriers to fish passage.

6.2 **Results**

6.2.1 *Desktop Review*

The Study Area is located entirely within the River Tillard secondary watershed (1FH-2) and positioned within the western headwaters of the 1FH-2-B tertiary watershed, which discharge southeast to the Atlantic Ocean at St. Peter's Bay via River Tillard (Figure 5, Appendix A).

No watercourses or waterbodies were identified within the Study Area in the Nova Scotia Topographic Database (NSTDB, see Figure 6 in Appendix A). The closest mapped watercourses lie 400 m east and 575 m south of the Study Area boundary, respectively, and drain southeast towards East River Tillard. The closest mapped waterbody to the Study Area is Mountain Lake, located approximately 175 m west of the Study Area boundary, draining west and away from the Study Area towards Hill Lake (Figure 5, Appendix A).

Drainage from existing quarry infrastructure is captured within a series of settling ponds located west of the quarry floor. A perched culvert at the end of the series directs overflow from the settling ponds southwest, towards a forested wetland. This is the predominant direction of overland flow within the lower (southern) half of the Study Area. In contrast, overland drainage within the top (northern) half of the Study Area follows natural topographic lows towards the southeast.

6.2.1.1 Fish and Fish Habitat

Based on ACCDC report (presented in Appendix F), the 100 km buffer around the Study Area contains 180 records of 7 fish species. No SAR (as defined in Section 8.0) were identified within the 100 km buffer.

The ACCDC report identifies the Scotts River drainage area as significant habitat for the Eastern Cape Breton Atlantic salmon population. This drainage area falls within 5 km of the Study Area but is isolated from the 1FH-2-B tertiary watershed and drains northeast to Bras d'Or Lake. This system is not hydrologically connected to surface water features found within the Study Area.

No other priority fish species were identified by ACCDC within 5 km of the Study Area. Atlantic salmon (*Salmo salar*; ACCDC S1), alewife (*Alosa pseudoharengus*; ACCDC S3), and brook trout (*Salvelinus fontinalis*; ACCDC S3) were reported to be within 20 km of the Study Area. American eel (*Anguilla rostrata;* COSEWIC Threatened, ACCDC S3) has been identified as having an elevated potential to be located within the Study Area based on generalist habitat preferences and broad geographic range. Details relating to habitat requirements for Priority Species identified within the Study Area are discussed in Section 8.0.

The Nova Scotia Freshwater Fish Species Distribution Records contains historic documentation of the following naturally-occurring species in waterbodies within the River Tillard secondary watershed (see

Table 6-1): brook trout, white sucker, golden shiner, three-spine stickleback, white perch, creek chub, and banded killifish (NSDFA, 2019).

Table 6-1. Nova Scotia Freshwater Species Distribution Records (NSDFA 2019)

Waterbody	Easting	Northing	Capture Date	Species	Capture Method	Origin
Cook Lake	664018	5062340	07/30/1974	brown trout	100 ft gill net	legal introduction
				white sucker	100 ft gill net	natural occurrence
				golden shiner	seine net	natural occurrence
				three-spine stickleback	seine net	natural occurrence
				banded killifish	seine net	natural occurrence
Cranberry Lake	664665	5061240	07/31/1974	brook trout	100 ft gill net	natural occurrence
				white perch	100 ft gill net	natural occurrence
				white sucker	100 ft gill net	natural occurrence
Long Lake	677822	5059280	07/18/1984	brook trout	100 ft gill net	natural occurrence
				white perch	100 ft gill net	natural occurrence
				creek chub	100 ft gill net	natural occurrence
				golden shiner	100 ft gill net	natural occurrence
				three-spine stickleback	minnow pail	natural occurrence
			08/05/1974	brook trout	100 ft gill net	natural occurrence
				white perch	100 ft gill net	natural occurrence
				golden shiner	100 ft gill net	natural occurrence
				banded killifish	seine net	natural occurrence
				tiger trout	100 ft gill net	Legal Introduction

White sucker, golden shiner, three-spine stickleback, white perch, and banded killifish inhabit lakes and slow-moving rivers for all or a significant portion of their lifecycles (Scott and Crossman, 1973). These types of surface water features are absent from the Study Area. Though likely present within the watershed, these species are not expected to frequent aquatic features within the Study Area.

Atlantic salmon – Atlantic salmon are divided into unique populations based on genetic distinction and range. The Eastern Cape Breton (ECB) population of Atlantic salmon has been assessed as endangered by COSEWIC (2010a) and is considered imperiled provincially by the ACCDC (ranked S1); this population is not currently protected under SARA or NSESA. For the purposes of this discussion, we are considering only the ECB population, as outlined by DFO in the Recovery Potential Assessment for the Eastern Cape Breton population of Atlantic salmon (DFO, 2014).

Atlantic salmon are an anadromous species with adults migrating from the ocean to spawn in freshwater rivers, generally in the same river where they were born. Salmon rivers or streams are

generally large, clear, and cool, with riverbeds composed of gravel, cobble and boulder substrates (DFO, 2009). River Tillard has been identified to historically support ECB Atlantic salmon (UINR, 2013), while recent electrofishing surveys for juvenile salmon within the River Tillard resulted in no catch of fry and low numbers of parr relative to other ECB rivers (DFO, 2017). ECB Atlantic salmon are not expected to inhabit watercourses evaluated within the Study Area based on the absence of suitable aquatic habitat (described further in Section 6.2.2).

Alewife – Like Atlantic salmon, alewife are anadromous fish that travel from the marine environment to freshwater to spawn. In the Maritimes, spawning occurs in lakes or slow-moving portions of rivers in late spring. Alewife are found mostly in larger rivers (DFO, 2016). Based on the location of the Study Area within the secondary watershed, and the lack of documentation of the species within the watershed, alewife are not expected to inhabit watercourses evaluated within the Study Area.

Brook Trout – Brook trout are known to inhabit a wide range of cool, freshwater environments, from small headwater streams to large lakes. Spawning sites are usually near groundwater upwelling or spring seeps and within a lake or stream with a gravel substrate (NSDFA, 2005). Optimal brook trout stream habitat that supports overwintering and rearing is characterized by abundant in-stream cover, stable water flow, and areas with slow, deep water (Raleigh, 1982).

Creek Chub – Creek chub are considered one of the most common stream minnows in eastern North America (Scott and Crossman, 1973). Like brook trout, creek chub are known to inhabit a range of freshwater environments, but are predominantly found in clear, rocky headwaters, creeks, and small rivers with alternating pool and riffle-run areas (Scott and Crossman, 1973; McMahon, 1982; Page and Burr, 2011). To spawn, creek chub require clean, gravel substrate and well defined riffles (McMahon, 1982). Deep pools and abundant cover in the form of large rocks, aquatic vegetation, woody debris, and undercut banks provide important habitat for overwintering and rearing.

American Eel – American eel was also considered as a potentially present Priority Species based on its broad geographic range. Found throughout Nova Scotia, the catadromous species spends most of its lifecycle in freshwater, returning to the Sargasso Sea to spawn. American eel are habitat generalists, showing no consistent preference for particular stream morphologies, physical characteristics, or temperatures in freshwater streams (Hawkins, 1995).

6.2.2 *Field Surveys*

Two watercourses were identified within the Study Area (Figure 7). The physical characteristics of each watercourse are summarized in Table 6-2. Representative photos of the watercourses are also shown below.

Watercourse 1 (WC1)

WC1 is a first-order, intermittent, headwater stream that originates from pockets of surface water that collect within the southern-most extent of WL2. During the low flow characterization (July 2019), the watercourse was channelized for approximately 45 m, before dechannelizing and dispersing as overland drainage through a natural, vegetated strip between the existing quarry footprint to the southeast and a clear-cut to the northwest. The drainage area was approximately 100m long. At the

time of the low flow assessment, this drainage area was completely dry. Based on NSE guidance on watercourse identification (NSE, 2015), no evidence of channelized flow indicating a regulated watercourse was identified. During the follow-up high flow assessment (November 2019), the extent of contiguous surface water was observed to have increased to approximately 120 m from the initial 45 m of channelized watercourse observed in July 2019. However, surface water was confirmed to disperse and dry in upland habitat. Following the most obvious flow path, no evidence of hydrological contiguity could be observed for approximately 25 m. Therefore, fish habitat within WC1 is limited to the channelized portion within WL1.

The watercourse re-channelizes in WL1 and continues within the wetland as an entrenched stream, while receiving drainage inputs from the northwest portion of WL1. The watercourse flows southwest for 250m, before exiting the Study Area at its southwest corner. It is anticipated that WC1 eventually drains into the mapped watercourse south of the Study Area (Figure 7).

Watercourse 2 (WC2)

WC2 is a first-order, intermittent, headwater stream that originates within the Study Area from pockets of surface water that collect within the southeast extent of WL2. From here, the watercourse is channelized for approximately 110m, before dechannelizing into a swamp east and outside of the Study Area. During the low flow assessment (July 2019), no surface water or channelized flow was observed to continue through this wetland, which was not delineated, but assessed for fish passage. During the follow-up high flow assessment (November 2019), the watercourse was confirmed to disperse into this swamp, approximately 70 m outside of the Study Area. Small, dispersed pockets of surface water were observed throughout the swamp, but no hydrological connection between these pockets were identified. No fish habitat is present within WC2.

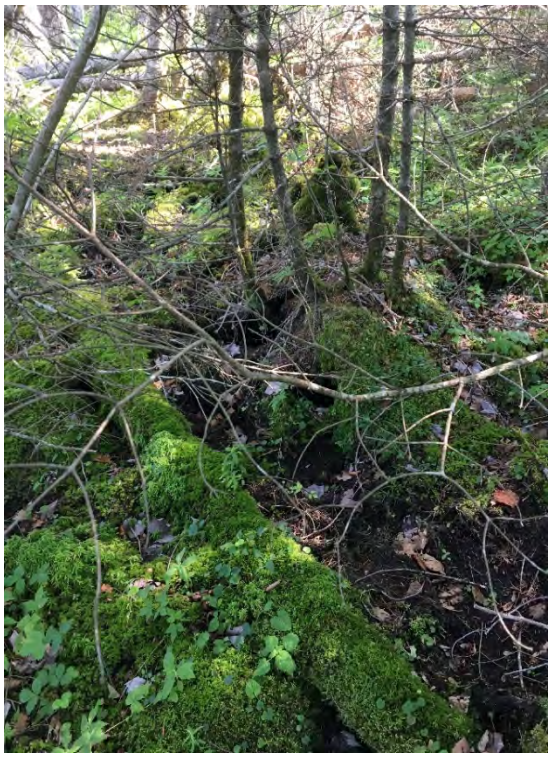

Photo 1. Drainage feature along WC1 (July 2019)

Photo 2. WC1 within Wetland 1

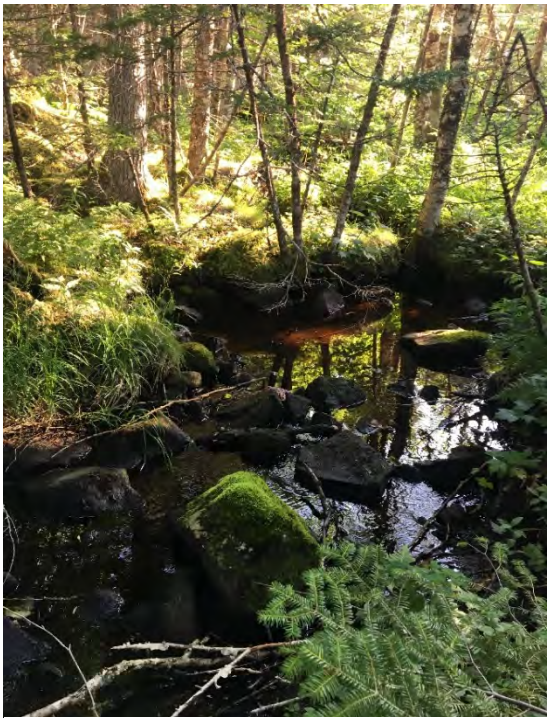

Photo 3. WC1 at southwest edge of Study Area

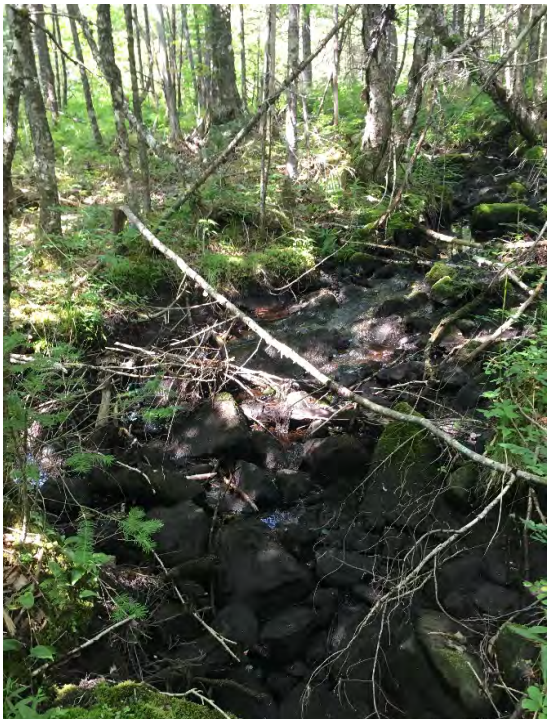

Photo 4. WC1 approximately 275 m southwest (outside) of Study Area boundary

Photo 5. Drainage feature along WC1 (November 2019)

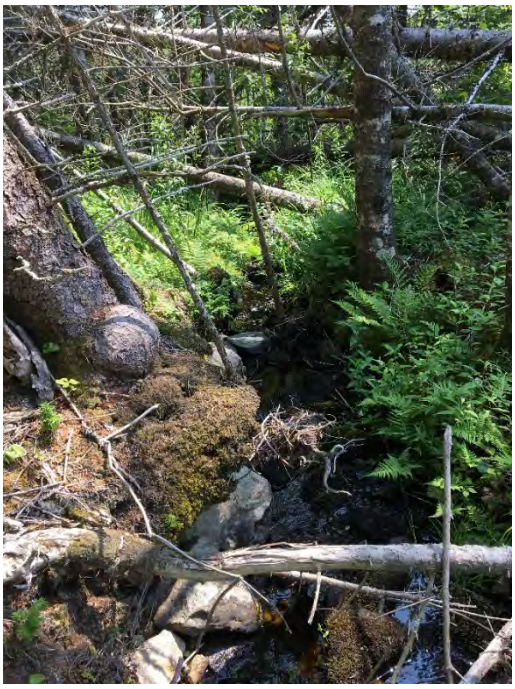

Photo 6. WC2

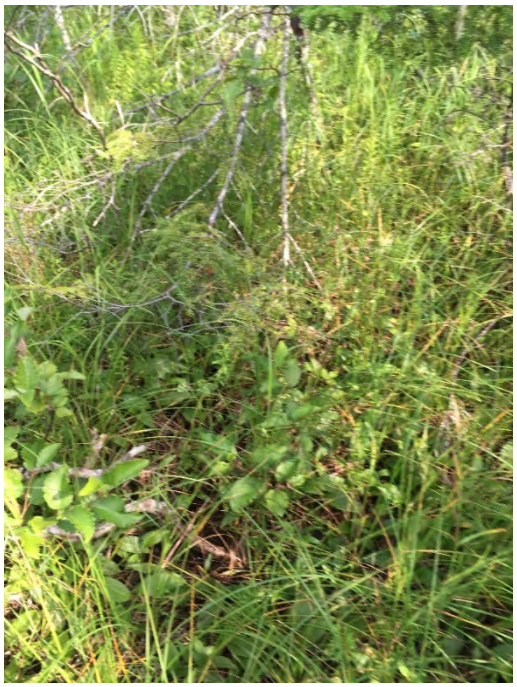

Photo 7. WC2 flows into wetland east (outside) of Study Area boundary (July 2019)

Photo 8. Pockets of surface water observed in off-site wetland downgradient of WC2 (November 2019)

Table 6-2: Watercourse Characteristics

WC ID	Reference UTMs (NAD 83 UTM Zone 20N)		Reach Length (m)	Stream Order	Flow Regime[1]	Velocity[2]	Gradient	Bankfull Width (m)	Depth Range (cm)	Bank Height (cm)	Substrate (%)	Cover (%)	Habitat (%)	Barriers
	E	N												
1	Upstream		290	1	Intermittent	L - No flow	3.0%	0.2-1.5	10-25	20	Boulder (20) Cobble (5) Muck (75)	Boulder/ Woody Debris (5)	Run (60) Flat (30) Pool (10)	• Seasonally isolated pools • Debris blockages/sediment wedges • Drainage/no visible channel
	657727	5062754												
	Downstream													
	657591	5062448												
2	Upstream		110	1	Intermittent	No flow	2.7%	0.4-1.1	5-15	15	Boulder (10) Cobble (15) Gravel (15) Sand (10) Muck (50)	Boulder/ Woody Debris (5)	Run (40) Flat (50) Pool (10)	• Seasonally isolated pools • Debris blockages/sediment wedges • Subterranean flow
	657971	5062932												
	Downstream													
	657999	5062831												

[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]L: Low flow rates (<0.15m/s). M: Medium flow rates (0.15-0.3m/s). H: High flow rates (>0.3m/s).

6.2.3 *Fish and Fish Habitat*

The potential for each watercourse and wetland to support fish and fish habitat was evaluated across the Study Area. Two watercourses and eleven wetlands were identified and evaluated by MEL. Fish habitat potential was determined at each location during field identification/evaluation, which included the collection of physical characteristics of each watercourse and wetland. Using information derived from biophysical characterizations, each watercourse and wetland was evaluated for fish habitat potential based on the habitat requirements for brook trout and creek chub, which are expected to be present within the watershed and surface water feature types available within the Study Area. American eel are habitat generalists and do not spawn in freshwater but are considered potentially present in any surface water feature that is accessible from the ocean.

No fish surveys (i.e. electrofishing, trapping) were conducted within the Study Area due to the intermittency of water within the aquatic features of interest and low water levels observed during low flow conditions. The presence and potential presence of fish in each aquatic feature has been evaluated based on visual confirmation of fish during field surveys, watercourse characterizations conducted during low and high flow conditions, and the desktop evaluation for fish species potentially present within the Study Area. Fish presence was assumed for all surface water features hydrologically connected to fish-bearing systems. Specific details related to fish habitat presence in WC1 and 2 are presented below.

<u>Fish Habitat – WC1</u>

During the initial assessment (July 2019), water within WC1 was predominantly confined to residual flats and pools to a maximum depth of 25 cm, with little to no flow documented between pools. Substrate was dominated by muck (decomposed organic material) with smaller amounts of cobble and boulder scattered throughout. A small amount of in-stream cover (comprising 5% of the total stream area) was provided by boulders and coarse woody debris. No in-stream vegetation was observed.

Multiple seasonal barriers to fish passage through the watercourse exist in the form of debris blockages and an overall lack of connectivity between residual pools. As such, downstream and upstream fish passage, including passage into potential fish habitat within the Study Area, was determined to be available only during moderate-high flow. The lack of hydrological connectivity documented during low and high flow conditions within the identified drainage section of WC1 (see Figure 7) has been assessed as a permanent barrier to fish passage to the uppermost 120 m of WC1. Based on this evaluation, the most upstream 120 m of WC1 does not support fish habitat. Fish habitat is only present in the channelized portion of WC1 within the boundaries of WL1.

Below the permanent barrier, WC1 does not provide any suitable spawning habitat for brook trout or creek chub, as both species require gravel substrate to spawn. Available rearing habitat for both species is extremely limited due to the amount of available in-stream cover, which has been further limited by the infilling effect of the dominant muck substrate. Overwintering habitat for both species is also absent due to a lack of in-stream cover, stable flow, and pools of sufficient depths. Overall, the quality of fish habitat within WC1 in the Study Area below the permanent barrier (approximately 250 m) has been evaluated as low.

No fish were observed in WC1 within the confines of the Study Area boundary; however, 2-3 individual brook trout were visually observed stranded in a residual pool approximately 275 m downstream of the

Study Area. It is presumed that these fish may be able to access the lower 250 m of WC1 within the Study Area during moderate-high flow.

Fish Habitat – WC 2

During the initial fish habitat evaluation (July 2019), all water within WC2 was confined to shallow, residual flats and pools to a maximum depth of 15 cm. Substrate was dominated by muck, with boulder, cobble, gravel, and sand present in smaller and relatively equal amounts. Like WC1, in-stream cover provided by boulders and coarse woody debris comprised approximately 5% of the total stream area.

As noted in Section 6.2.2, the watercourse disperses into a swamp east of the Study Area. No evidence of channelized water or other forms of hydrologically connectivity (i.e. sheet flow) were observed through the wetland during both the low flow (July 2019) and high flow (November 2019) assessments. In addition, there were no hydrological indicators of surface flow during seasonal high flow events, as made evident by the absence of surface scouring, the absence of trim lines and water marks, the presence of a thick moss as ground cover, and the presence of dense vegetation. As such, this barrier has been evaluated as permanent and therefore excludes fish from accessing the 110 m of watercourse channel year-round. Based on this evaluation, the watercourse does not support fish habitat.

Fish Habitat – Wetlands

No wetlands were identified to provide fish habitat within the Study Area (i.e. no surface water connectivity and/or open water present within the wetlands). Wetland 1 is the only wetland identified to contain a throughflow surface water feature (WC1); however, WC1 is entrenched within the wetland and as such, any potential fish habitat is confined to the channel of the watercourse.

6.2.3.1 Water Quality

Water quality measurements were recorded *in-situ* during watercourse delineation and fish habitat characterizations on July 31, 2019. A summary of water quality measurements is presented in Table 6-3. Where applicable, water quality parameters have been measured against the Canadian Council for Ministers of the Environment (CCME) Guidelines for the Protection of Aquatic Life (FWALs). Water quality results for WC2 are listed below, but are not discussed further in this report, as WC2 does not support fish habitat (see Section 6.2.2).

Table 6-3. Water Quality Measurements (recorded July 31, 2019)

Location	Coordinates (UTM, NAD83)	Temperature (°C)	pH	DO (mg/L)	Sp.Con (µS/cm)	TDS (mg/L)
WC1	657590, 5062445	19.0	6.72	7.49	50.1	32.50
WC2	657590, 5062833	18.4	**5.95**	**4.52**	37.4	24.05

Note: Values in bold indicate recorded water quality parameters below CCME guidelines for the protection of aquatic life.

While there are no CCME guidelines related to temperature and aquatic biota, water temperature preferences of fish have been well established for individual species. Brook trout, a cold-water species, have an optimal temperature range of 10-16°C, but can survive temperatures up to 23°C (Raleigh, 1982). American eel tolerate a broader temperature range and can tolerate temperatures from 4 to 25 ºC (Fuller *et al.*, 2019). Creek chub have an optimal temperature range of 12-24°C (McMahon, 1982), with an upper lethal temperature limit of 32ºC (Brett, 1944). Water temperatures recorded in WC1 fell within the tolerable temperature ranges for species expected within the Study Area.

The CCME guidelines for the Protection of Aquatic Life establish a minimum recommended concentration of DO of 5.5 mg/L to sustain any life stage of warm or cold-water fish species (CCME, 1999). The DO concentration recorded in WC1 is suitable for aquatic life according to the CCME guideline (7.49 mg/L).

The CCME water quality guidelines for pH indicate that a pH range from 6.5 to 9.0 is suitable for fish in freshwater habitat. Brook trout tolerate a relatively wide pH range of 4.0-9.5 (Raleigh, 1982). 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). A pH range of 6.0 to 9.0 is considered optimum for survival and growth of creek chub, though populations of creek chub have been reported in streams with pH as low as 5.4 (McMahon, 1982). The pH level recorded in WC1 fell within the CCME pH range for aquatic life (6.72) and is considered tolerable for fish species expected within the Study Area.

Conductivity is a measurement of the ability of water to conduct an electric current and is affected by the concentration of dissolved ions. Conductivity of streams is primarily affected by the geology of the surrounding landscape; due to this natural variability, there are no CCME guidelines related to conductivity and aquatic biota. Canada's Freshwater Quality in a Global Context (ECCC, 2017) provides a conductivity target of 500 µS/cm for freshwater systems. The conductivity of lakes and streams in Nova Scotia is generally low due to the abundance of resistant granite and metamorphic bedrock (Nova Scotia Museum, 1996). Conductivity measured in WC1 was well below (50.1 µS/cm) the ECCC conductivity target of 500 µS/cm

Total dissolved solids (TDS) is a measurement of inorganic salts, organic matter and other dissolved materials in water. TDS causes toxicity through 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, and most effects are not observed until >1000 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 2229 mg/L for brook trout, and 35% survival when exposed to 1395 mg/L). As such, TDS levels measured within WC1 are considered acceptable for aquatic life.

7.0 WETLANDS

7.1 Methodology

7.1.1 *Desktop Review*

A background information review of wetlands was completed using several GIS databases which include: Wet Areas database and the NSE Wetlands database. In addition, the NSE "Wetlands of Special Significance" (WSS) database was reviewed.

7.1.2 *Field Surveys*

Meandering transects were completed within the Study Area to confirm the potential presence of wetlands. This report adopts the terms defined by NSE under Section 105 of the *Environment Act*.

Wetlands are:
"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 boundaries were determined as described by the US Army Corps of Engineers, adapted for the Northcentral and Northeast Regions of the US (US 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 (water loving) vegetation;
- Presence of hydrologic conditions that result in periods of flooding, ponding, or saturation during the growing season; and
- Presence of hydric soils.

7.1.2.1 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 (Roland, 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.

7.1.2.2 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.

7.1.2.3 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.

Wetland boundaries and watercourse routes were recorded on a Garmin GPSMAP 64s and a SXBlue II GPS receiver unit with hand-held SXPad field computer. The delineated wetlands were flagged with pink flagging tape. Data points (upland and wetland) were completed in wetlands identified within the Study Area to determine wetland/upland boundaries.

General wetland and watercourse characteristics were recorded for the features identified during the field assessment and are presented in the results section of this report.

7.1.2.4 Wetland Functional Assessment

Wetland functional assessment was completed for each wetland using the Wetland Ecosystem Services Protocol - Atlantic Canada (WESP-AC) wetland evaluation technique. The WESP-AC process involves the completion of three forms; a desktop review portion that examines the landscape level aerial conditions to which the wetland is situated, and two field forms. The process serves as a rapid method for assessing individual wetland functions and values. WESP-AC addresses 17 specific functions that wetlands may provide (Table 7-1). 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 ecological, social, or economic benefits of the function. The highest functioning wetlands are those that have both high function and benefit scores for a given function. In the results section, scores are stated as “function/benefit”, for example, if a wetland scored Higher for function and Moderate for benefit, that score would be stated as “Higher/Moderate”. 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 7-1: 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

Grouped Wetland Function	Specific Wetland Functions
	Carbon sequestration
Aquatic habitat	Anadromous fish habitat
	Resident fish habitat
	Waterbird feeding habitat
	Waterbird nesting habitat
	Amphibian and turtle habitat
Terrestrial habitat	Songbird, raptor, & mammal habitat
	Pollinator habitat
	Native plant habitat

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

- Wetland condition; and
- Wetland risk.

The following individual functions are assessed to determine the benefit scores associated with these groups:

- Public use & recognition;
- Wetland sensitivity;
- Wetland ecological condition; and
- Wetland stressors.

For each wetland evaluated, the WESP-AC process calculates the overall score for the seven grouped wetland functions and the 17 specific wetland functions listed in Table 7-1 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 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

7.2 **Results**

7.2.1 *Desktop Review*

The results of the desktop review can be seen in Figure 6. A review of the NSE Wetlands Inventory Database identified five wetlands within or partially within the Study Area. An area in the southwest and central-east was identified using the Wet Areas Database as having predicted groundwater within 0.5 m of the surface. No WSS are present within 5 km of the Study Area.

7.2.2 *Field Surveys*

Field surveys resulted in the identification of 11 wetlands, which are characterized in Table 7-2 below and in Figure 7 (Appendix A). Nine of these were swamps (a mixture of mixedwood treed swamps, clear-cut swamps, and shrub swamps), one was a complex (comprised of mixedwood treed swamp, alder swamp, clear-cut swamp, and graminoid bog), and one was a marsh.

Table 7-2. Wetland characteristics

Wetland Number	Wetland Type	Wetland Size (m^2)	Water Flow Path	Landscape Position	Landform	SAR/SOCI Observed/ Habitat Potential
WL1	Mixedwood Treed Swamp	17,998	Throughflow via WC1	Lotic - Stream Entrenched	Basin	Corrugated shingles lichen (*Fuscopannaria ahlneri;* ACCDC S3) observed.
WL2	Complex – Mixedwood Treed Swamp, Alder Swamp, Clear-cut Swamp, treed/shrub bog, open bog, and disturbed cattail-dominated bog	46,055	Outflow via WC1	Terrene	Basin	Canada warbler (*Cardellina canadensis*; SARA & COSEWIC Threatened, NSESA Endangered, ACCDC S3B), gray catbird (*Dumetella carolinensis;* ACCDC S3B), ruby-crowned kinglet (*Regulus calendula;* ACCDC S3S4B), gray jay (*Perisoreus canadensis;* ACCDC S3), blackpoll warbler (*Dendroica striata;* ACCDC S3S4B), yellow-bellied flycatcher (*Empidonax flaviventris;* ACCDC S3S4B) observed. Suitable Canada warbler habitat observed.
WL3	Shrub Swamp	487	Isolated	Terrene	Basin	None
WL4	Open Water Marsh	319	Isolated	Terrene	Basin	None
WL5	Mixedwood Treed Swamp	105	Isolated	Terrene	Basin	None
WL6	Clear-cut Swamp	1,549	Isolated	Terrene	Sloped Basin	None
WL7	Clear-cut Swamp	709	Isolated	Terrene	Basin	None
WL8	Clear-cut Swamp	929	Isolated	Terrene	Basin	Suitable Canada warbler habitat observed.

Wetland Number	Wetland Type	Wetland Size (m^2)	Water Flow Path	Landscape Position	Landform	SAR/SOCI Observed/ Habitat Potential
WL9	Shrub Swamp	249	Isolated	Terrene	Basin	None
WL10	Mixedwood Treed Swamp	1,448	Isolated	Terrene	Basin	Suitable Canada warbler habitat observed.
WL11	Mixedwood Treed Swamp	25,117	Throughflow via Drainage	Terrene	Sloped Basin	Blue felt lichen (*Pectenia plumbea* [syn. *Degelia plumbea*]; SARA & COSEWIC Special Concern, NSESA Vulnerable, ACCDC S3) observed. Slender monk's hood lichen (*Hypogymnia vittata*; ACCDC S3S4) observed. Ruby-crowned kinglet, pine siskin (*Carduelis pinus;* ACCDC S2S3), Swainson's thrush (*Catharus ustulatus;* ACCDC S3S4B), yellow-bellied flycatcher, and blackpoll warbler were observed.

Swamps

Nine of the eleven wetlands identified within the Study Area are classified as a swamp: four are mixedwood treed swamps, three are clear-cut swamps, and two are shrub swamps.

The mixedwood treed swamps are dominated by yellow birch (*Betula alleghaniensis*) and balsam fir in the tree stratum. These species also dominated the shrub layer of these wetlands with speckled alder (*Alnus incana*). The herb strata was dominated by bristly-stalked sedge (*Carex leptalea*), cinnamon fern (*Osmundastrum cinnamomeum*), three-leaved Soloman's seal, and bluejoint reed grass (*Calamagrostis canadensis*).

The clear-cut swamps were wetlands that had been previously clear-cut, thus the tree layer was removed and deep skidder trails have eroded into water-filled ruts. These wetlands were dominated by vegetation in the herb stratum that included cinnamon fern, soft rush (*Juncus effusus*), cattail species (*Typha sp.*), and common woolly bulrush (*Scirpus cyperinus*).

The two shrub swamps were both isolated, terrene wetlands with balsam fir and yellow birch in the tree strata, and red maple and balsam fir in the shrub strata. Both wetlands had dense herb strata comprised of three-seeded sedge (*Carex trisperma*), cinnamon fern, and lesser amounts of bunchberry (*Cornus canadensis*), rough-stemmed goldenrod (*Solidago rugosa*), dwarf red raspberry (*Rubus pubescens*), and rough bedstraw (*Galium asprellum*).

The dominant water flow characteristic among the swamp habitat is a hydrologically isolated feature. These lack surface inputs and/or outputs. The only swamps not isolated were WL2, which has WC1 outflowing from it, and which dissipates into drainage. Watercourse 1 channelizes again as it extends through WL1. WL11 has drainage moving through its extent, none of it is channelized.

Complexes

One of the eleven wetlands is a complex; WL2 is comprised of mixedwood treed swamp, alder swamp, clear-cut swamp, treed/shrub bog, open bog, and disturbed cattail-dominated bog. Wetland 2 has WC1 running out of it as an entrenched stream. The remainder of the wetland is not impacted by surface water, making it terrene. Most of the wetland has the hydric soil indicator of organic soils over 33 cm, except the clear-cut swamp has a histic epipedon soil indicator (mineral soil that is light in colour). The bog sections of the wetland had the deepest soils: where organic peat was found at depths of 62 cm. Wetland hydrology was indicated by a high water table, saturation, sparsely vegetated concave surfaces, and surface water.

Marsh

One out of the eleven wetlands is a marsh: WL4 is an open water marsh. This wetland contained open, standing water and little vegetation; red maple, balsam fir, and common woolly bulrush were observed. Hydric soil was indicated by rock overlain by 18 cm of organic soil. Hydrologic indicators included surface water at a depth of 10 cm and saturation at the surface.

7.2.3 *Wetland Functional Assessment Results*

Table G1 and G2 in Appendix G show the numerically weighted scores for the eleven evaluated wetlands. It should be noted that function scores are not provided for the wetland condition and wetland risk function groups, as the WESP-AC calculator only considers these as benefits.

The average function and benefit scores for the eleven wetlands was Moderate. WESP-AC guidance states that the most valuable wetlands are those that possess high function and benefit scores; these wetlands perform well in their physical, chemical, and biological processes and have a high importance to societal needs (Adamus and Verble, 2016). Three of the eleven assessed wetlands scored Higher in both function and benefit in a single specific wetland function: WL1, 2, and 11 (pollinator habitat, songbird, raptor and mammal habitat and pollinator habitat respectively) however, overall these wetlands did not significantly differ from others on the landscape.

Additional analysis was completed on the grouped wetland functions provided by the WESP-AC results. The following sections provide results of this analysis on a per wetland functional group basis.

Hydrologic Group

The hydrologic 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.

Many wetlands scored Higher in this group, due to their isolation from surface water. The wetlands that scored Lower were WL1, 2, and 11 which either have wetland throughflow (WL1), outflow (WL2), or

throughflow via drainage (WL11). All wetlands scored Moderate in benefit, which may be due to the high elevation of these wetlands within the watershed; these wetlands may provide headwater storage and help to mitigate flooding further downstream.

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. Similar to 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.

Similar to the hydrologic group, many wetlands scored Higher in this group due to the lack of surface water. Without an outlet, these wetlands are highly effective at intercepting and retaining any water that enters them either through overland flow or precipitation. Wetlands 1 and 2 scored Lower, and WL11 scored Moderate within this group. All wetlands scored Lower or Moderate in benefit, except for WL11, which scored Higher. Wetland 11 scored a Moderate/Higher score in nitrate removal and retention, this could be related to the wetland's relative size within the catchment area, and the subsequent opportunity to purify and filter water.

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 a wetland's 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.

Most wetlands scored Moderate to Higher in function, except for WL9 which scored Lower. The highest scoring wetlands were those with surface water movement (WL1, 2, and 11).

Aquatic Habitat Group

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

Most wetlands scored Lower or Moderate within this group. The highest scoring wetlands were WL1 and 4 (Higher/Moderate). Wetland 1 contains WC1, providing habitat within the watercourse through shade, hydrologic flow, and nutrients. Wetland 4 is an open water graminoid marsh that is not connected to fish-bearing streams, however, it likely provides habitat for amphibians and reptiles in the area.

Terrestrial Habitat Group

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

This is the only group containing scores of Higher/Higher; WL1, 2 and 11 scored Higher for both function and benefit. The remainder of the wetlands scored Moderate in function and Lower in benefit. The highest scoring wetlands had priority species observations within them. Corrugated shingles lichen (SOCI) was observed in WL1. Canada warbler (SAR) and the following SOCI were observed in WL2: gray catbird, ruby-crowned kinglet, gray jay, blackpoll warbler, and yellow-bellied flycatcher. Blue felt lichen (SAR) and the following SOCI were observed in WL11: slender monk's hood lichen, ruby-crowned kinglet, pine siskin, Swainson's thrush, yellow-bellied flycatcher, and blackpoll warbler.

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 evaluated wetland and reference wetlands of the same type and landscape setting (Adamus, 1996).

Wetlands scored either Moderate or Higher for wetland condition indicating that currently these wetlands support relatively healthy vegetative communities. Wetland 9 scored Lower in this category, likely due to the historical logging evident within its boundaries.

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 model 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.

Wetlands scored either Moderate or Higher for wetland risk benefit, possibly due to their small size, close proximity to roads, and general lack of connectivity to water. Small wetlands run the risk of drying up, especially when they are not adjacent to a pond, stream, or other water body. Proximity to roads, even if they are unpaved, may introduce invasive species and/or human activities that may alter their functions.

It may be counterintuitive for a wetland to score high for wetland condition (i.e. the wetland has a rich vegetative composition) and high for wetland risk (i.e. low resiliency); this is because they measure different metrics. A wetland may have a variety of species and may even provide habitat to a SAR/SOCI, and therefore have a high wetland condition score, while at the same time have various traits that make it less resilient. These traits may include being far away from a ponded water source, which would cause slower recolonization following an impact (Adamus, 2016). The length of the wetland-upland edge also impacts the resiliency score: a wetland is more susceptible to invasive species the longer its wetland-upland edge (Adamus, 2016). Traits are outlined in more detail in the WESP-AC calculator available from NSE website (https://novascotia.ca/nse/wetland/education.asp).

8.0 PRIORITY SPECIES

8.1 Methodology

8.1.1 *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 list (provided in Appendix D) 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 1.0 Introduction for a definition of the following terms: priority species, SOCI, and SAR.

An in-text short list was created using the priority species list and the ACCDC report to outline those SAR with the highest potential of occurring within the Study Area, based on habitat. This list is provided in Section 8.2.1 below.

Databases provided by MTRI were assessed to identify the potential for priority lichen species including vole ears and boreal felt lichen. Additionally, the provincial government records of abandoned mine openings (AMOs) were reviewed as AMOs that are uncapped and unflooded may provide bat hibernacula. Lastly, the Nova Scotia Lands and Forestry significant species and habitats database was reviewed.

8.1.2 *Field Surveys*

Targeted priority species surveys included lichens, vascular plants, and Canada lynx surveys. Botanical surveys took place in the spring and summer of 2019, the methodologies for these surveys can be found in Sections 3.1.2 and 3.1.3. Lynx surveys took place on March 7, May 5, and November 28, 2019. All incidental priority species were noted during all other field surveys.

Canada Lynx

Four 1-km long transects were completed on March 7 and May 5, 2019 through land with lynx prey habitat potential (i.e. snowshoe hare and American red squirrel). Lynx prey habitat was defined as follows, using guidance provided by the Canada lynx SMP document.

Table 8-1. Canada lynx prey habitat requirements as per SMP document

Prey Species	Habitat Requirements
Snowshoe hare	Patches of mid-regeneration (15-35 years old) conifer dominated habitat
	Tree height above winter snow levels
Red squirrel	Bogs
	Adjacent mature/overmature softwood and mixedwood stands
	100 m buffer strip of unharvested forest

On November 28, 2019 a follow up survey was completed to determine the quality of Canada lynx habitat within and surrounding the proposed development area and capture representative photos of this area.

Verification of potential Canada lynx sign was achieved by referencing literature and/or contacting Lands and Forests Wildlife Biologist, Mr. John Brazner.

8.2 **Results**

8.2.1 *Desktop Review*

The ACCDC findings confirms the presence of several priority species in proximity to the Study Area (see Figure 8). The following records of SAR and SOCI were recorded within 5 km of the Study Area:

- 2 records of 2 nonvascular flora; and
- 64 records of 26 vertebrates.

The Department of Natural Resources considers a number of species "location sensitive". Concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in an ACCDC report. A bat hibernaculum was identified to be within 5 km of the Study Area however, the exact location of this feature was not provided. For more information regarding bat hibernacula and habitat see Section 8.2.2.3.

Of the ACCDC records, seven SAR were determined to have the highest potential of occurring within the Study Area. In the in-text short list below, a "*" indicates that the species or evidence of the species (i.e. scat, tracks, markings, etc.) were observed during MEL field surveys.

Table 8-2. SAR with elevated potential within the Study Area, based on ACCDC records

Scientific Name	Common Name	SARA	COSEWIC	NSESA	ACCDC S-Rank	Distance (km)
Riparia riparia	Bank swallow	Threatened	Threatened	Endangered	S2S3B	3.5 ± 7.0
Hirundo rustica	Barn swallow*	Threatened	Threatened	Endangered	S2S3B	3.5 ± 7.0
Cardellina canadensis	Canada warbler*	Threatened	Threatened	Endangered	S3B	3.5 ± 7.0
Contopus virens	Eastern wood-pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3.5 ± 7.0
Contopus cooperi	Olive-sided flycatcher	Threatened	Special Concern	Threatened	S2B	3.5 ± 7.0
Euphagus carolinus	Rusty blackbird	Special Concern	Special Concern	Endangered	S2B	3.5 ± 7.0
Lynx canadensis	Canada lynx*	Not at Risk	-	Endangered	S1	2.1 ± 0.0

Below are the habitat requirements for the SAR listed in the table above:

Bank swallow – The bank swallow nests in a wide variety of sites including natural and artificial areas that have vertical banks. Nest burrows are excavated in sand-silt substrates of riverbanks, bluffs, aggregate pits, road cuts, and soil piles. Foraging habitat for this species includes open areas such as meadows and fields. Threats to the bank swallow include loss of breeding and foraging habitat, vehicle collisions, pesticide use, and impacts of climate change (COSEWIC, 2013). **Soil piles adjacent to the**

existing quarry may provide nest burrow habitats, however, given the quarry activity levels this is currently unlikely. Should the quarry become inactive, these piles may become suitable bank swallow habitat.

Barn swallow – This species nests in human-made structures with nearby areas of open terrain used for foraging. Barn swallows feed aerially on flying insects over open land and water (COSEWIC, 2011). **While nesting habitat is not present within the Study Area, foraging habitat is present; additionally, the Study Area has a number of small lakes within 2 km which may provide feeding grounds especially during migration.**

Canada warbler – Breeding habitat for the Canada warbler consists of a variety of landscapes, but commonly comprises of moist forests with a dense deciduous shrub layer. Nests may be built on or near the ground on raised hummocks, within root masses, rotting tree stumps, clumps of grass, rock cavities, dens shrubs, and in regenerating forests (Environment Canada, 2016a). **WL2, WL8, and WL10 have dense shrub layers that may provide suitable breeding habitat for Canada warblers.**

Eastern wood-pewee – The eastern wood-pewee (SARA Special Concern; NSESA Vulnerable) in the Maritimes, is a bird of openings and edges more than of closed forest; they readily use well-spaced shade trees in rural and urban settlements. Their habitat is associated with broad-leafed trees (COSEWIC, 2012). **The Study Area contains broad-leafed canopies interspersed with open areas that could provide suitable foraging and nesting habitat.**

Olive-sided flycatcher – This species (SARA Threatened, COSEWIC Special Concern, NSESA Threatened) uses open coniferous or mixed coniferous forests with the presence of tall snags or branches often adjacent to open habitats (Environment Canada, 2016b). **Edge habitats are found throughout the Study Area, suitable for olive-sided flycatcher breeding and foraging.**

Rusty blackbird – The rusty blackbird (SARA & COSEWIC Special Concern, NSESA Endangered) generally breeds in riparian habitats, where nests can be built over or near water (COSEWIC, 2006). **This type of habitat can be found within the Study Area in WL1.**

Canada lynx – Lynx (NSESA Endangered, ACCDC S1) require deep snowfalls (>270cm per year) to create preferred habitat for their key prey: snowshoe hare (ISEC, 2017). Less dense understory helps provide higher visibility of hare (Fuller and Harrison, 2010). **This type of habitat can be found across the Study Area, especially in the north.**

MTRI databases did not identify any priority lichen species within the Study Area. No AMOs are located within the Study Area, therefore there is no potential for bats to be using uncapped and unflooded AMOs as hibernacula. No significant habitats are present within the Study Area. SAR and SOCI identified during field surveys are discussed in Section 8.2.2 below.

8.2.2 *Field Surveys*

8.2.2.1 Flora

No SAR or SOCI vascular plants were observed during either dedicated surveys or any other field surveys. Despite the observation of a higher nutrient regime at HAP5, the disturbance and fragmentation in the local landscape likely contributed to the lack of vascular rarities.

During the lichen surveys, six priority species were observed: two were SAR and four were SOCI. The following species were identified and are described further below:

1. Blue felt lichen – *Pectenia plumbea* (syn. *Degelia plumbea*) is listed by SARA and COSEWIC as Special Concern, NSESA Vulnerable, and ACCDC S3. Thirteen thalli were observed in four different locations across the Study Area. The habitats that this lichen was found in include upland, swamp, and on the edge of the quarry. Blue felt lichen is fairly common in Nova Scotia, however, in North America the range is restricted to the northeast and only found in New Brunswick, Nova Scotia, Newfoundland and Labrador (COSEWIC, 2010b).

2. Frosted glass whiskers lichen – *Sclerophora peronella* (Nova Scotia population) is listed by SARA and COSEWIC as Special Concern, and ACCDC S1?. Multiple individuals were observed in one location in the Study Area, within the heartwood of a yellow birch. This species can often be indicative of mature deciduous trees with consistent temperature and humidity (COSEWIC, 2005).

3. Fringe lichen – *Heterodermia neglecta* is listed by ACCDC as S3S4. The fringe lichen is a small light gray-green lichen with conspicuous long black rhizines (root like structures) and often associated with mature hardwood trees such as red maple and yellow birch and can also be found on balsam fir. This species is frequently associated with wetlands and watercourses however it also frequents upland habitat. Within the Study Area, this lichen was observed on the upland edge of a wetland.

4. Powdered Fringe lichen – *Heterodermia speciosa* is listed by the ACCDC as an S3. The powdered fringe lichen is similar to the above-mentioned species with the distinguishing feature between this species the above-mentioned species is the presence of white rhizines. This lichen was observed within WL11.

5. Slender monk's hood lichen – *Hypogymnia vittata* is listed by ACCDC as an S3S4.This species is similar to the other *Hypogymnia* species with the most distinguishing feature of this species being the brown medullary ceiling (Hinds & Hinds, 2007). This species prefers mature conifer upland and wetland habitats and often found on spruce and fir. Several large clusters were observed at five different locations around the Study Area in both wetland and upland.

6. Corrugated shingles lichen – *Fuscopannaria cf. ahlneri* is listed by ACCDC as S3. The corrugated shingles lichen is a cyanolichen often associated with mature and old growth forests within or in close proximity to swamps, rivers and lakes (Hinds & Hinds, 2007). Typically, this species is brown, scabrous (rough textured), has marginal soredia and forms rosettes on mature

hardwood and softwood tree species (Hinds & Hinds, 2007). Two thalli were observed at two different locations within the Study Area, both within swamps.

Priority species field results are shown in Figure 9.

8.2.2.2 Mammals

As presented in Table 8-2, the only mammal SAR include on the in the in-text short list was the Canada lynx.

Canada Lynx

Several occurrences of confirmed and potential lynx scat and tracks were observed within and beyond the Study Area both during dedicated lynx surveys and incidentally. Pictures of observed tracks were sent to Nova Scotia Department of Lands and Forests Wildlife Biologist Mr. John Brazner for verification in March 2019. Mr. Brazner confirmed that these tracks are most likely from Canada lynx. These confirmed tracks are located along a forestry access road, approximately 980 m northwest of the proposed quarry development area and outside of the Study Area. Potential lynx scat was also documented along this access road, but it was not confirmed based on the degradation and general poor state of the specimens. Additionally, multiple coyote signs were observed along this road, whose scat can be easily confused with Canada lynx, especially once weathered. The closest potential Canada lynx sign was scat located approximately 200 m north of the proposed quarry development area. **No lynx signs have been documented within the proposed quarry development area or within the existing active quarry footprint.** Locations of these findings are provided in Figure 9.

A focus of the Canada lynx field surveys was to assess the presence or absence of lynx prey species habitats, in particular snowshoe hare (primary prey) and American red squirrel (alternate prey). Wetland 2 and its adjacent uplands were identified as having potential prey species habitat, therefore it was re-assessed on November 28, 2019. The following table summarizes these findings:

Table 8-3. Canada lynx prey species habitat suitability presence/absence

Prey Species	Habitat Requirements	Availability within and surrounding Wetland 2
Snowshoe hare	Patches of mid-regeneration (15-35 years old) conifer dominated habitat	Yes, only small patches predominately located in northern extent of proposed quarry development area.
	Tree height above winter snow levels	Yes, only exists within small, suitable habitat patches
Red squirrel	Bogs	Yes, only 25% of wetland is bog habitat
	Adjacent mature/overmature softwood and mixedwood stands	No
	100 m buffer strip of unharvested forest	No, approximately one third of surrounding forest has been clear-cut

Wetland 2 is a wetland complex primarily characterized by mixedwood tree and shrub swamp habitat with a dense tree and shrub layer dominated by red maple, yellow birch, balsam fir, and various amounts of other shrub types such as speckled alder and mountain holly (*Ilex mucronata*). The primary ground

cover is comprised of mosses, the herbaceous layer is dominated by cinnamon fern, with lesser amounts of sedges and forbs.

Wetland 2 contains three bog-type habitat areas, which comprise deep peat soils (62 and 68 cm depth) and thick sphagnum moss ground cover. These three areas include a treed/shrub bog, open bog, and disturbed cattail-dominated bog. The treed/shrub bog is dominated by black spruce (*Picea mariana*) with red maple and mountain holly scattered throughout (see P12 in Figure 10, Appendix A and Appendix F). The herbaceous layer in this area is dominated by sheep laurel (*Kalmia angustifolia*), cottongrass (*Eriophorum sp.*), and cinnamon fern. This herbaceous layer is similar to that covering the open bog area, it also contained ground-covering lichens (*Cladonia sp.*) (see P13 in Figure 10, Appendix A and Appendix F). The third bog-type habitat was a disturbed cattail-dominated bog containing a dense layer of sphagnum moss and peat to a depth of >60 cm (see P14 in Figure 10, Appendix A and Appendix F). While bog habitat is present within Wetland 2, it only comprises 25% of the wetland by area and is disjoint in three separated regions.

The uplands surrounding Wetland 2 are classified by NSDL&F forestry GIS database as mixedwood cover types dominated by red maple and yellow birch with lesser amounts of balsam fir, white birch (*Betula papyrifera*), and white spruce (*Picea glauca*) (NSDNR, 2016). Softwoods make up 20-40% in the second story by volume (NSDNR, 2016). This classification was field verified and found to be accurate within the remaining, intact upland habitat surrounding Wetland 2: it is comprised of mixedwood canopy with dense, regenerating balsam fir in the second story (see P2-5 and P7-9 in Figure 10, Appendix A and Appendix F). The upland south of Wetland 2, within the proposed quarry development area, is largely clear-cut (see P1 and P6 in Figure 10, Appendix A and Appendix F). Vegetation within the clear-cut is dominated by regenerating red maple and lesser amounts of balsam fir and birch. Raspberry dominates the herbaceous layer. A few individual legacy birch trees and large snags are scattered throughout the clear-cut. Based on historical aerial imagery, this area was likely clear-cut in 2016. While patches of mid-regeneration, conifer dominated habitat exist within the upland surrounding Wetland 2, these patches are small and located predominately to the north of the wetland. The landscape south of the wetland is dominated by clear-cut. Furthermore, there are no adjacent mature stands, instead the landscape is highly reflective of the disturbance and fragmentation from historical activities.

Habitat for lynx prey is present within and surrounding Wetland 2, but not in ideal quantities. Snowshoe hare habitat is patchy but abundant throughout the upland habitat adjacent to Wetland 2 and concentrated to the north, and away from the proposed quarry development area. American red squirrel habitat was not documented in the upland areas surrounding the wetland, nor were ideal bog conditions identified within Wetland 2. No Krumholtz-type trees or mature, spruce-dominated stands surrounded the wetland. Additionally, the wetland lacks a 100 m buffer of unharvested forest due the clear-cut area.

Given the lack of ideal Canada lynx prey habitat within the Study Area, quality habitat conditions for Canada lynx within the proposed quarry development area is not present. Furthermore, the existing quarry likely acts as a deterrent to current Canada lynx use of the area and will continue to do so throughout the quarry operation. Additionally, the presence of the logging road north of the Study Area likely provides access to competitor species such as coyotes and bobcats who are generalist hunters, able to subsist on many different species while out-competing lynx, a specialist hunter (Aubry, Koehler, and Squires, 2000; O'Donoghue *et al.,* 2001; Parker, G. 2001).

No other mammal Priority species were identified during field surveys completed.

8.2.2.3 Bat Hibernacula

Bat hibernaculum were not observed in the field. No known critical habitat for little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*) and tri-colored bat (*Perimyotis subflavus*) are within 20 km of the Study Area (Environment Canada, 2015). However, the Study Area may provide roosting and foraging habitat for various bat species. Treed, forested habitat within the Study Area may provide roosting habitat, especially where there are increased snags and foraging habitat with a relatively closed canopy (Barclay and Kurta, 2007; Environment Canada, 2015; Jung *et al*., 1999). This type of habitat can be found in the northern section of the Study Area beyond the proposed quarry expansion area.

8.2.2.4 Avifauna

Seventeen priority avian species were observed during dedicated surveys and incidentally (see Table 8-4 below). Of these species, two were SAR and fifteen were SOCI. Please use Table 8-4 below and Figure 4 (Appendix A) to identify the locations of avian SOCI observed at dedicated survey point counts and those observed incidentally. See Figure 9 for avian SAR observed during surveys and incidentally.

Two avian SAR were observed within the Study Area: two barn swallows and three Canada warblers. All observations of these species occurred outside of the proposed quarry development area. The habitat within the proposed development area is mostly comprised of clear-cut, with only a slight area of intact mixedwood, upland forest and wetland complex being impacted. The proposed development area is largely impacted by the historical disturbance and fragmentation that has taken place on the landscape. Furthermore, none of the avian SAR listed in Table 8-2 have habitat solely within the proposed impact area.

Although no avian SAR and SOCI species were observed within the proposed quarry development area, they may still use this location. However, the area proposed for impact is not unique within the landscape: nearly identical regenerating cut-block is widespread throughout the Study Area. Given the mobile nature of avifauna, it is believed any displaced SAR and SOCI species will be able to utilize equivalent habitat if displacement occurs.

Table 8-4. Priority Avifauna Species Observed in the Study Area

Scientific Name	Common Name	SARA	COSEWIC	NSESA	ACCDC SRank	Survey Type[1]	Location (PC)	Total # Observed
Hirundo rustica	**barn swallow**	**Threatened**	**Threatened**	**Endangered**	**S2S3B**	**Spring**	**PC3 (n=2)**	**2**
Cardellina canadensis	**Canada warbler**	**Threatened**	**Threatened**	**Endangered**	**S3B**	**BBS**	**PC4 (n=2), PC9 (n=1)**	**3**
Accipiter gentilis	northern goshawk	-	-	-	S3S4	Spring	PC8 (n=1)	1
Actitis macularius	spotted sandpiper	-	-	-	S3S4B	BBS, Fall	PC2 (n=2)	2
Carduelis pinus	pine siskin	-	-	-	S2S3	Spring, Fall	PC1 (n=2), PC2 (n=1), PC5 (n=2), PC7 (n=1), PC9 (n=1), PC10 (n=2), PC11 (n=2)	11
Catharus ustulatus	Swainson's thrush	-	-	-	S3S4B	Spring, BBS, incidentally observed during wetland delineation	PC3 (n=1), PC5 (n=2), PC6 (n=1), PC8 (n=2), PC9 (n=3), PC10 (n=3), PC11 (n=3), PC12 (n=1), WL11 (n=1)	17
Dendroica castanea	bay-breasted warbler	-	-	-	S3S4B	Fall	PC9 (n=1)	1
Dendroica striata	blackpoll warbler	-	-	-	S3S4B	Spring, Fall	PC2 (n=2), PC4 (n=1), PC5 (n=1), PC6 (n=1), PC7 (n=1),	9

Scientific Name	Common Name	SARA	COSEWIC	NSESA	ACCDC SRank	Survey Type[1]	Location (PC)	Total # Observed
							PC8 (n=1), PC9 (n=1), PC10 (n=1)	
Dumetella carolinensis	gray catbird	-	-	-	S3B	Incidentally observed during wetland delineation	WL2 (n=1)	1
Empidonax flaviventris	yellow-bellied flycatcher	-	-	-	S3S4B	BBS	PC2 (n=1), PC3 (n=1), PC4 (n=2), PC5 (n=1), PC7 (n=1), PC9 (n=2), PC10 (n=1)	9
Falco sparverius	American kestrel	-	-	-	S3B	Fall	PC2 (n=1)	1
Passerella iliaca	fox sparrow	-	-	-	S3S4B	Spring	PC7 (n=1)	1
Perisoreus canadensis	gray jay	-	-	-	S3	Spring, BBS, Fall, incidentally observed during wetland delineation	PC2 (n=1), PC3 (n=1), PC4 (n=3), PC6 (n=1), PC8 (n=1), PC10 (n=2), PC11 (n=1), WL11 (n=1)	11
Pinicola enucleator	pine grosbeak	-	-	-	S2S3B,S5N	Fall	PC10 (n=1)	1
Poecile hudsonica	boreal chickadee	-	-	-	S3	Spring, Fall, incidentally observed during	PC6 (n=2), PC9 (n=3), PC10 (n=1)	6

Scientific Name	Common Name	SARA	COSEWIC	NSESA	ACCDC SRank	Survey Type[1]	Location (PC)	Total # Observed
						wetland delineation		
Regulus calendula	ruby-crowned kinglet	-	-	-	S3S4B	Spring, BBS, Fall, incidentally observed during wetland delineation	PC1 (n=1), PC2 (n=4), PC3 (n=4), PC4 (n=3), PC5 (n=3), PC6 (n=5), PC7 (n=4), PC8 (n=3), PC9 (n=2), PC10 (n=3), PC11 (n=1), PC12 (n=2), WL11 (n=1)	36
Sitta canadensis	red-breasted nuthatch	-	-	-	S3	Spring, Fall	PC2 (n=1), PC9 (n=1), PC10 (n=1), PC11 (n=1)	4

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

Bold denotes SAR designation

9.0 CONCLUSIONS

The Study Area investigated for this development was found to contain a mosaic of disturbed and intact forest. Disturbances were largely related to human activity, including an open pit quarry and forestry. The soils in the area were found to be generally moderate in richness. The presence of disturbance and lack of relatively rich soils is a likely contributor to the lack of rare vascular plant species. Several priority lichen species were observed within the Study Area including two Species at Risk (blue felt lichen (*Pectenia plumbea;* SARA & COSEWIC Special Concern; NSESA Vulnerable; ACCDC S3) and frosted glass-whiskers (*Sclerophora peronella;* SARA& COSEWIC Special Concern; ACCDC S1?) and four Species of Conservation Interest. None of these occurrences will be affected by the proposed quarry expansion.

Dedicated fauna surveys led to the identification of Canada lynx (*Lynx canadensis;* NSESA Endangered, ACCDC S1) confirmed and potential evidence (both scat and tracks) within and beyond the Study Area. Canada lynx habitat and their prey's habitat are both present within the northern section of the Study Area, albeit in small, lower quality patches. Given the poor-quality prey habitat, deterring qualities of the current quarry, and access to the area by competitor species, the Study Area does not present high quality habitat for Canada lynx. No other mammalian priority species were observed.

Four seasonal avian surveys were completed in the Study Area between May and October 2019: spring migration, breeding bird, fall migration, and common nighthawk surveys. A total of 916 minutes (15 hours and 16 minutes) were spent on dedicated avian surveys, resulting in the observation of 725 individuals, representing 63 species. Including incidental observations, a total of 756 individuals representing 64 species were observed. Seventeen priority avian species were observed, of these, two were Species at Risk (Canada warbler (*Cardellina canadensis*; SARA Threatened; COSEWIC Threatened; NSESA Endangered; S3B) and barn swallow (*Hirundo rustica;* SARA Threatened; COSEWIC Threatened; NSESA Endangered; S2S3B)), fifteen were Species of Conservation Interest. All of the species observed are native in this region; they are typical species commonly found within the Study Area habitat and its surroundings. No obvious concentrations of one particular bird group were observed, nor was an identifiable migratory pathway noted. None of the priority avian species observations occurred within the proposed quarry development area.

Two watercourses were identified and evaluated, and were found to be intermittent, headwater streams. The overall quality of fish habitat within Watercourse 1 that is accessible to fish was deemed to be low. Fish collection surveys (i.e. electrofishing and trapping) were not able to take place during low flow conditions due to the intermittency of water, however, 2-3 individual fish were observed approximately 275m downstream (outside of the Study Area) stranded in residual pools. While fish may be able to access the lower portions of Watercourse 1 within the Study Area (approximately 250 m of linear channel), a lack of hydrological connectivity was observed during low and high flow conditions that stops fish from being able to swim further north and into the quarry area. The second watercourse was deemed to not support fish habitat due to a lack of hydrologically connectivity with downstream, fish-bearing systems.

During wetland evaluations, a total of eleven wetlands were delineated within the Study Area. Nine of these were swamps (a mixture of mixedwood treed swamps, clear-cut swamps, and shrub swamps), one was a complex (comprised of mixedwood treed swamp, alder swamp, clear-cut swamp, and graminoid

bog), and one was a marsh. In general, wetlands within the Study Area have similar functions to each other and those within this region of Nova Scotia; they are not unique in their functional roles as analyzed by WESP-AC. There are historical disturbances evident within some wetlands, mostly from forestry practices, however this has not affected wetland functions in a major capacity.

Priority species were observed during targeted surveys and incidentally during other field surveys. In total no vascular plant priority species, six lichen priority species, seventeen avian priority species, and one mammalian priority species were observed. These include the following:

- Blue felt lichen (*Pectenia plumbea;* SARA Special Concern; COSEWIC Special Concern; NSESA Vulnerable; S3)
- Frosted glass whiskers lichen (*Sclerophora peronella*)
- Fringe lichen (*Heterodermia neglecta;* ACCDC S3S4)
- Powdered fringe lichen (*Heterodermia speciose;* ACCDC S3)
- Slender monk's hood lichen (*Hypogymnia vittata;* ACCDC S3S4)
- Corrugated shingles lichen (*Fuscopannaria cf. ahlneri;* ACCDC S3)
- Canada lynx (*Lynx canadensis;* NSESA Endangered; S1)
- Barn swallow (*Hirundo rustica;* SARA Threatened; COSEWIC Threatened; NSESA Endangered; S2S3B)
- Canada warbler (*Cardellina canadensis;* SARA Threatened; COSEWIC Threatened; NSESA Endangered; S3B)
- Northern goshawk (*Accipiter gentilis;* S3S4)
- Spotted sandpiper (*Actitis macularius;* S3S4B)
- Pine siskin (*Carduelis pinus;* S2S3)
- Swainson's thrush (*Catharus ustulatus;* S3S4B)
- Bay-breasted warbler (*Dendroica castanea;* S3S4B)
- Blackpoll warbler (*Dendroica striata;* S3S4B)
- Gray catbird (*Dumetella carolinensis;* S3B)
- Yellow-bellied flycatcher (*Empidonax flaviventris;* S3S4B)
- American kestrel (*Falco sparverius;* S3B)
- Fox sparrow (*Passerella iliaca;* S3S4B)
- Gray jay (*Perisoreus canadensis;* S3)
- Pine grosbeak (*Pinicola enucleator;* S2S3B, S5N)
- Boreal chickadee (*Poecile hudsonica;* S3)
- Ruby-crowned kinglet (*Regulus calendula;* S3S4B)
- Red-breasted nuthatch (*Sitta canadensis;* S3)

Most of the observed priority species are mobile species, they have home ranges within and beyond the Study Area that may be used at various times of the year (i.e. some areas are used only during breeding season). Avoidance of these timing windows may be incorporated into mitigation measures. None of the non-mobile species (i.e. the lichens) require legislated buffers, although a distance of 100m is recommended. Furthermore, quarry expansion is not proposed to affect the lichens priority species identified.

10.0 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:

- McCallum Environmental Ltd. 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 accuracy of information provided;
- There are a potentially infinite number of methods in which human activity can influence wildlife behaviors and populations and merely demonstrating that one factor is not operative does not negate the influence of the remainder of possible factors; and,
- The EA 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.

11.0 CERTIFICATE

This document has been prepared by the Environmental Scientists John R. Gallop (B.Sc., P.Biol), Emma Posluns (M.Sc) and Amber Stoffer (MREM) and reviewed by the undersigned. If you have any questions or require any more information, please feel free to contact me.

Thank you,

Andy Walter
Senior Project Manager
McCallum Environmental Ltd.

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