APPENDIX D
BIOPHYSICAL ASSESSMENT REPORT
(Envirosphere Consultants Limited, 2020)

Environmental Assessment Registration Document:
Welshtown Quarry Expansion
Shelburne, Municipality of the District of Shelburne
Nova Scotia

Biophysical Assessment: Welshtown Quarry Expansion 10740 Upper Clyde Road, Welshtown, Shelburne County, Nova Scotia – PIDs 80106826, 80106875, 80106867 & 80106925

September 2020

Prepared for:

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1 INTRODUCTION

Dexter Construction Company Limited, Bedford, Nova Scotia (Dexter Construction), is proposing to expand an existing quarry in the vicinity of Welshtown, Shelburne County, Nova Scotia. The quarry is presently operating under an industrial approval for quarries less than four hectares in size; an approval to expand the quarry beyond the current size is required under the Environmental Assessment Regulations of the Nova Scotia Environment Act. Dexter Construction contracted Envirosphere Consultants Limited of Windsor, Nova Scotia, to prepare a biophysical and socio-economic overview and assessment of the expansion in support of the approval application. This report contains the results of the overview and assessment. It presents a description of the methodology and scope, existing environment, environmental effects, cumulative effects, discussion, and conclusions. The assessment provides a sufficient level of detail to ensure that all information necessary to allow adequate review of the project is provided; to demonstrate how the assessment was conducted; and to document the information on which the conclusions were based.

2 INFORMATION SOURCES

Information for the biophysical and socio-economic overview and assessment was collected from various sources, including interviews with representatives of the Nova Scotia Department of Lands and Forestry (NSDLF), Nova Scotia Department of Aquaculture and Fisheries (NS DAF), and Fisheries and Oceans Canada (DFO); contacts with organizations, businesses and individuals in Welshtown and the Town of Shelburne area; review of published information including soil surveys, reports on geology, archaeology (CRM 2020), and natural history (e.g. *Natural History of Nova Scotia*); use of relevant websites and databases (e.g. Nova Scotia Open Data Portal; DNR Significant Habitat and Wetland Databases, Atlantic Canada Conservation Data Centre, and Nova Scotia Museum of Natural History); and use of maps, digital data on land use and property ownership, aerial photos, and 1:50,000 topographic maps. Site visits and walkovers by project personnel were carried out on October 7, 2019 and June 24 – 26, 2020 (fall and late spring/early summer botany surveys); June 9, 2020 (owls and breeding birds); July 8 – 9, 2020 (site reconnaissance); September 11-12, 2020 (supplementary wetland survey); and September 13, 2020 (lichen survey). Key project personnel included Patrick Stewart (M.Sc.), Hayley Doyle (B.Sc. Environmental Science), and Heather Levy (B.Sc. Hons. Environmental Science) (background review, site reconnaissance, wetlands, water quality & fish habitat assessment); Ruth Newell, M.Sc. (botany survey); Nick Hill, Ph.D. (supplementary wetland survey); Tom Neily (lichens); and Mr. Fulton Lavender and Mr. Richard Hatch (bird surveys).

3 SITE LOCATION AND STUDY AREA

The Welshtown Quarry in Shelburne County is located on Upper Clyde Road, approximately 2 km northwest of the Town of Shelburne, at approximately UTM Zone 20, NAD83, Easting 310276 and Northing 4849985. The site is shown in Google Earth satellite imagery from May 10, 2020. The study area for the assessment is shown on Figure 1 and Map A-1, Appendix A. The quarry is shown in Figures 2 to 5. The proposed quarry expansion area (35.3 ha) will be located entirely within the EA study area.

Figure 1. Project location shown on NTS 1:50,000 mapping (20P14).

Figure 2. West-facing aerial view of Welshtown Quarry, spring 2020.

Figure 3. View of Welshtown Quarry, facing southeast, July 9, 2020.

Figure 4. View of northwest corner of Welshtown Quarry, Spring, 2020.

Figure 5. Stockpile area on southeast end, July 9, 2020.

4 EXISTING ENVIRONMENT

4.1 PHYSICAL ENVIRONMENT

4.1.1 CLIMATE AND WINDS

The Welshtown Quarry study site is moderately exposed to winds originating from the ocean (located approximately 6 km from the Atlantic Coast) and has a low elevation 35 to 85 m. Proximity to the ocean leads to the occurrence of short cool summers and relatively mild, wet winters (Webb and Marshall 1999) while the climate also has inland influences leading to mild, early springs, cool summers and mild winters (Webb and Marshall 1999). Average daily temperatures are moderate[1], ranging from a low of -4.6 °C in January to 19.4°C in July and an annual average of 7.7°C (Canadian Climate Normals 2019 (Figure 6)). The area has a high annual average precipitation of 1486 mm (measured at Liverpool), about 12% coming as snow, mainly in January (Canadian Climate Normals 2019). Rain falls predominantly in March-April and secondarily in October-November. Extreme daily precipitation events can be expected, as in most parts of Nova Scotia, in particular due to a tendency for more extreme weather events to occur as a result of global climate change. Fog is common along the Atlantic Coast, associated with southerly winds, and is a major problem in coastal areas of Southwest Nova Scotia, particularly in summer (Environment Canada 2016). Wind patterns are similar to other locations on the south shore of Nova Scotia—generally strongest in winter, predominantly from the west to northwest (November-February), shifting to southwest in March and to south in April. Predominantly southwest winds in May to August-September shift back to the west to northwest for October to December (TDC Atlas 1991). In particular the site is potentially exposed to winds in strong north easterly gales which move along the Nova Scotia coast predominantly in winter.

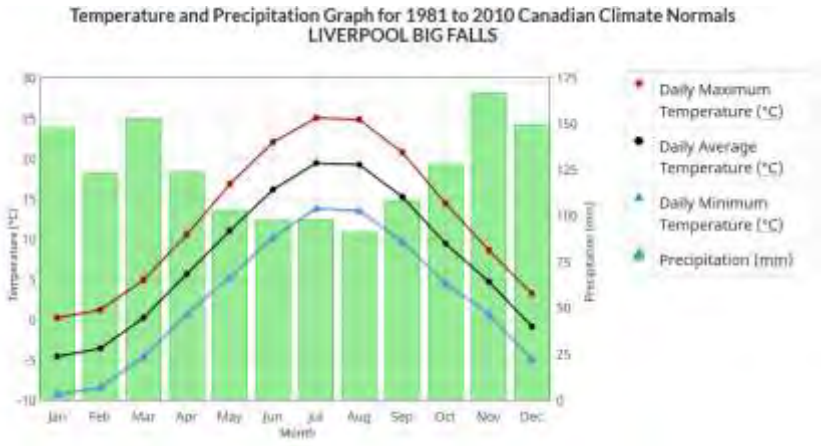

Figure 6. Annual precipitation and temperature cycle, Liverpool, Big Falls (1981-2010) (Canadian Climate Normals 2019).

1 Climate conditions are measured at Liverpool, Big Falls, and summarized for 1981 to 2010 (Canadian Climate Normals 2019).

4.1.2 TOPOGRAPHY AND GEOLOGY

Landscape

The Welshtown Quarry and associated study area is located at the south edge of a bedrock plateau, with resulting steep slopes around it descending southeast, south and west. To the east from the existing quarry, the land slopes gradually to the Roseway River (see Figure 45). To the south, land slopes steeply to a table-like plateau with irregular drainage that supports peatlands, and with a moderate slope to the west. Uplands at the site are characteristically regenerated mixed forest stands with some characteristic older and taller and iconic species such as White Pine, and swales and basins occupied by forested swamps (Figures 7 and 8). Topography at the site mainly follows the bedrock surface, which is characterized by bedrock prominences, the highest reaching an elevation of approximately 85 m in the north central part, and contains swales and several basins 20 m or more in depth. The study area lacks drumlins which are characteristic of areas both east and west (NSDLF 2019).

Figure 7. Forest landscape at Welshtown Quarry, October 2019.

Figure 8. Forested swamp in a topographic basin at Welshtown Quarry, June 2020.

Bedrock Geology

The Welshtown Quarry is located over a geological contact between igneous granites of the Shelburne Pluton and the metamorphic Goldenville Formation (Figure 9). The eastern half of the study site is Goldenville Formation, one of two bedrock groups that makes up the Cambrian-Ordovician-aged Meguma Supergroup. The lower Goldenville Formation, which occurs under the eastern section of the site, is composed of grey, laminated or cross-laminated metasandstone (greywacke, quartzite), locally imbedded with metasiltstone and slate, containing coarse-grained metasandstone and conglomerate (White et al.

2001; Mallinson 1988; White 2012) (Figure 9). The western half of the site is underlain by the Shelburne Pluton, a granite intrusion through the Meguma Supergroup that occurred in Southwest Nova Scotia. At the site, these consist of Middle-Late Devonian monzogranite, one of the two main groups that make up the Shelburne Pluton (Rogers and Barr 1988).

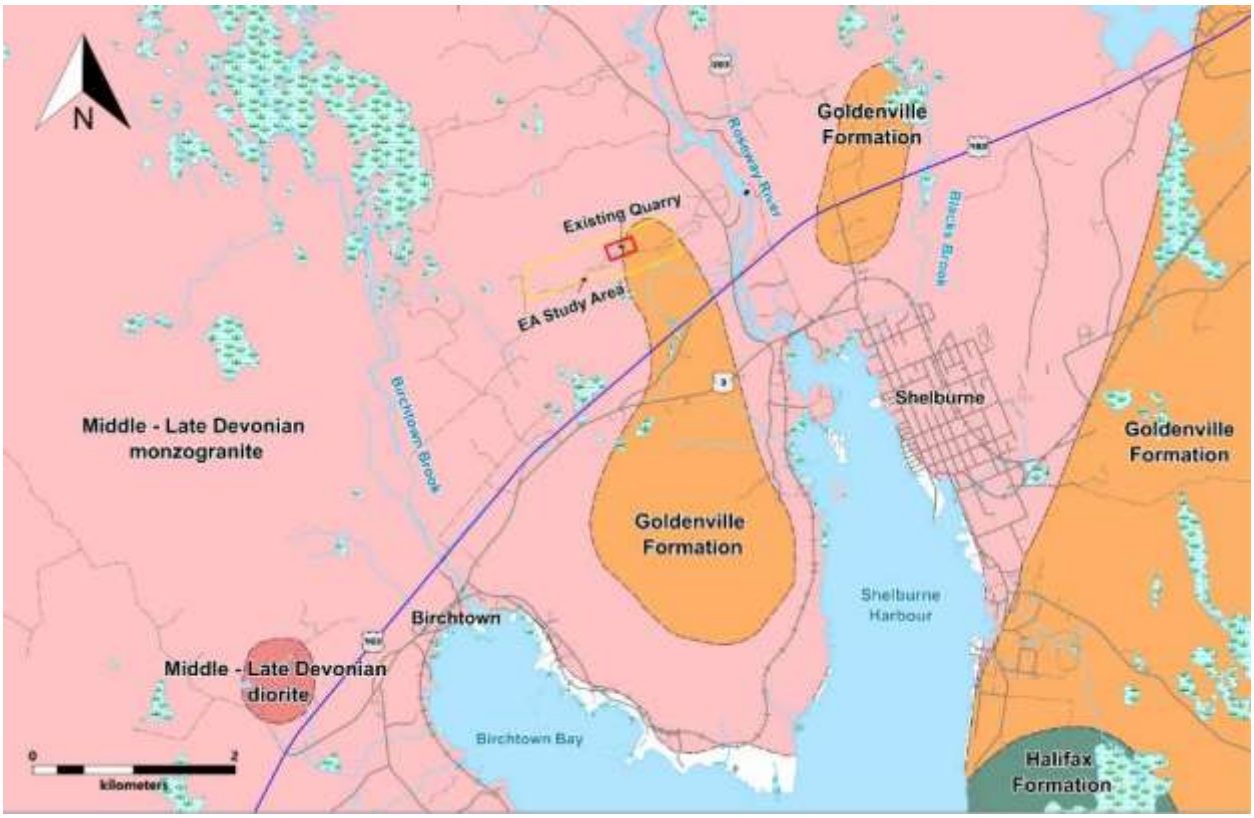

Figure 9. Bedrock formations in the vicinity of the Welshtown Quarry (Keppie 2000).

Surficial Geology

The Welshtown Quarry site is on a shallow till plain overlying a level to gradually sloping bedrock surface near the eastern end of the Shelburne Granite Plain (Davis and Browne 1997). Till is predominantly stony, sandy, and shallow, derived from local bedrock (Stea et al. 1992) (Figure 10). Bedrock exposures and boulders occur throughout the study area. Basins in bedrock with surface water accumulations have developed shallow peat deposits. The Shelburne Plain is characterized by poor drainage, shallow depth to bedrock, and hard pan development which leads to accumulation of surface water and development of peat (Davis and Browne 1997).

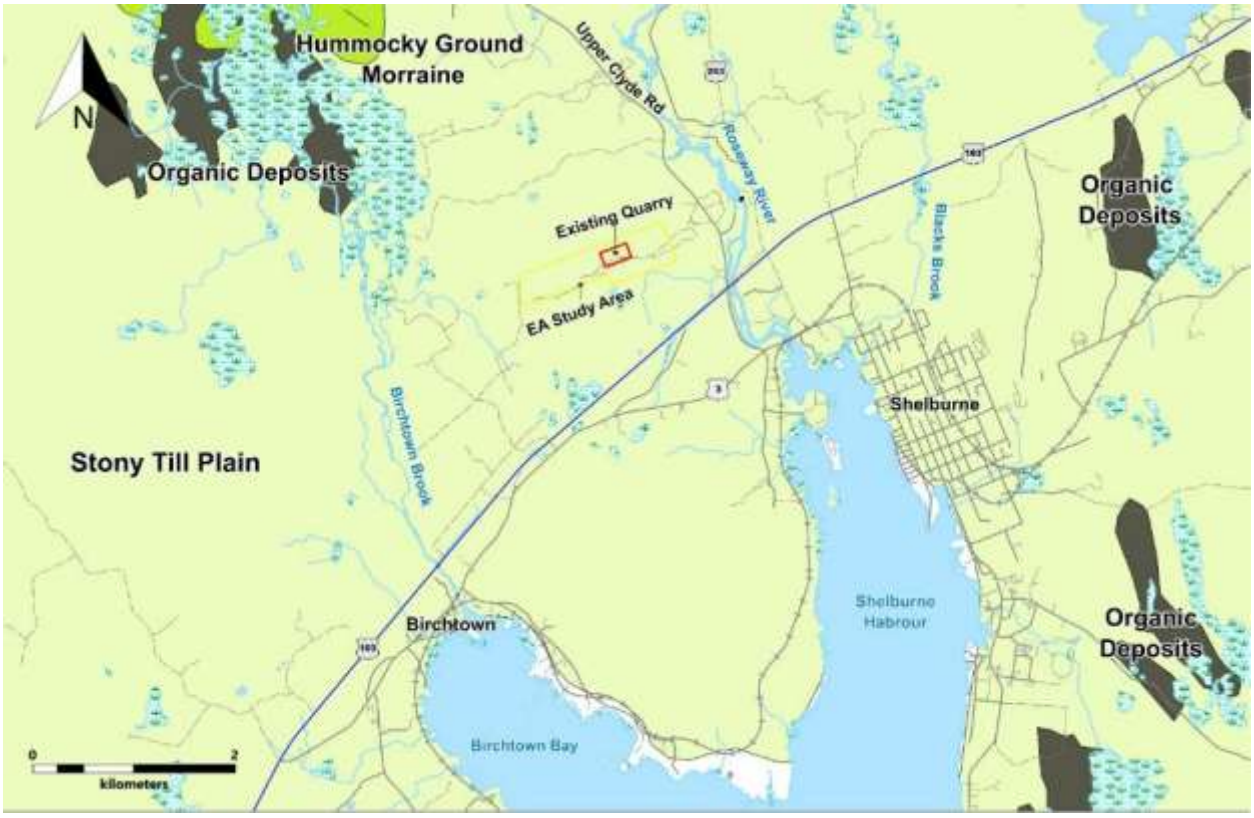

Figure 10. Surficial geology of the study area. From Stea et al. (1992) and digital version (2016).

4.1.3 AIR QUALITY, NOISE & LIGHT

The Shelburne area experiences moderate levels of artificial light, ambient noise, and moderate to high air quality. The Town of Shelburne is a major source of artificial light and would be seen as sky reflections from the quarry; ambient noise levels at the quarry reflect traffic along Highway 103, as well a lesser source from traffic and operations of the quarry; and air quality is expected to be good due to the rural location and predominantly forested setting.

Apart from light from the Town, house and yard lights as well as vehicle lights are the main sources of artificial light at the site. Residences along Upper Clyde Road near the site will contribute to light occurring at the site, though traffic traveling on Upper Clyde Road, are expected to be minor sources. Lights at the quarry, as well as 'skyshine' from operations when low cloud occurs, can probably be seen from Shelburne and offshore areas; however nearby residents of Upper Clyde Road interviewed noted that light from the quarry was not noticeable while it was in operation.

The Shelburne area is expected to have relatively high natural baseline air quality typical of areas with high percentage occurrence of natural landscape such as neighbouring forested wilderness areas, and also to open water such as the Atlantic Ocean on the south. Low levels of human activity, including vehicle traffic along Highway 103 and Upper Clyde Road, as well as that associated with quarry activities, have little impact on overall air quality at the site. Periodic dust and vehicle exhaust emissions from quarry

activities as well as regular residential vehicle traffic are the main contributors to particulates and exhaust emissions, which are expected to be at low levels.

The quarry and associated movement of trucks and equipment would continue to provide a minor and periodic source of noise in the area. Operations at the quarry are periodic in response to demand for product and are likely one of the main noise sources in the area. Blasting occurs typically one to two times per year; operation of a portable crusher and heavy equipment may take place periodically and temporarily add to noise levels when the quarry is in operation; a portable asphalt plant may operate at the site periodically; and trucks are used to transport product and move the portable equipment as required. Typical noise includes blasting and sounds from the crusher and other heavy equipment operations (e.g. motors, generators, back-up signals etc.). The scope of operations, including annual usage, for the quarry are not expected to change and ambient noise levels in general are expected to be localized. Due to the presence of other sources of noise and light, activities at the quarry are likely to be less noticeable than otherwise. All trucks leaving the site are required to follow Company best operational practices, as well as those established by Truckers Association of Nova Scotia (TANS) and the Nova Scotia Road Builders Association (NSRBA), to minimize emissions. Noise levels arising from the quarry in the future will continue to meet the limits established in the Pit and Quarry Guidelines and are expected to be consistent with those produced by the existing quarry operations at the site.

4.1.4 HYDROLOGY

The Welshtown Quarry is located on the divide between the 1EC-3 and 1EC-4 secondary watersheds that drain into the Roseway River on the east and Birchtown Brook to the west, respectively, and then into the Atlantic Ocean (Figure 11). Uplands have shallow to non-existent overburden and occasional bedrock exposures leading to rapid runoff after precipitation events down slopes or into intermittent watercourse channels or ravines, which are often dry. The lower portions of ravines support small, low-flowing watercourses. Basins and swales, however, accumulate water with overflow through some intermittent channels, and leading to development of pools and sphagnum moss and peat deposits. The west side of the Welshtown Quarry property drains into Birchtown Brook watershed while the eastern side drains into Roseway River watershed. Drainage down the south slope from the quarry enters a level plateau and disorganized drainage which supports an unnamed permanent watercourse that is a tributary to the Roseway River. This watercourse, although visible on Provincial mapping, is mainly subterranean and only occasionally visible at the surface.

Among the intermittent streams and flowages, as well as artificial drainage structures (i.e. ditches) found at the site, an intermittent stream in a small ravine crosses an access road in the center of the quarry property; and an intermittent stream flows west was found at the west end of the study site (Map A-4). The ravine for the first watercourse is formed by bedrock outcrops and drains into a small wetland (0.12 ha) (centre photo, Figure 12; Map A-4). The head of the ravine contained a wetland dominated by New York fern and occasional sphagnum moss, and was dry during the July survey. The wetland drains via a

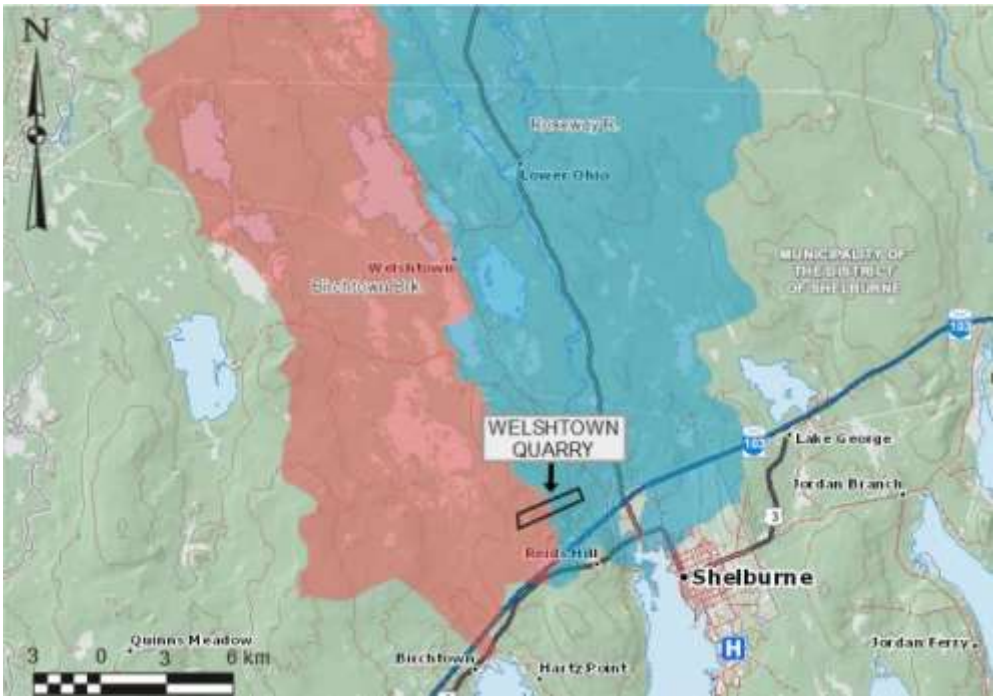

Figure 11. Welshtown Quarry property is divided by two sub-watersheds: Birchtown Brook and Roseway River.

Figure 12. Fern dominated ravine (left) that drains into sphagnum wetland with intermittent pools (center) and drains through a culvert under the main access road (right) located in the center of study area, Welshtown Quarry, June 24-26, 2020 & July 8, 2020.

culvert under the access road (Figure 12) into a wetland on the south side of the road. At this point the watercourse does not have a defined channel and no flow through the culvert was observed at the time of the July survey. All the runoff is directed into the wetland and presumably leaves the site in groundwater or shallow, near-surface flow.

Another intermittent stream was identified at the west end of the study site, where it originated in a red maple basin swamp just north of the access road (Figure 13, Map A-4) and led northwest to a second swamp at the west property boundary (Figure 13) from which it drains towards Birchtown Brook.

Figure 13. Red maple Swamp (left) and intermittent stream (center) that eventually drains into a hummocky wetland (right) at west end of study area, Welshtown Quarry, June 24-26, 2020 & July 8, 2020.

An analysis of surface water drainage patterns conducted using a digital elevation model (DEM) developed from local contours[2] showed disorganized drainage, supporting the flow pattern observed in the field (Figure 14). The active quarry site drains predominantly east along the prevailing downgradient. Surface runoff from the quarry floor first drains east and then transitions toward the south, exiting at the southeast corner via ditches, eventually flowing into the woods off the property and disappearing subsurface. A first order watercourse shown on Provincial mapping at the site was subterranean, with flow visible sporadically at the base of rocky depressions (Figure 15). Due to the prevailing slope, the source of this watercourse is predominantly from the west, and would only be influenced by drainage from the extreme western end of the quarry expansion area. This off-site stream becomes well defined, however, and emerges as a surface feature southeast of the quarry before it meets the Roseway River (Figure 16). Surface water drainage from the southwest end of the active quarry site drains toward the

2 The Multiple Flow Direction (MFD) method in ArcGIS's Raster Analysis tool box, was used to determine flow direction.

south and southwest where it enters a broad, low-lying peatland basin off the quarry property, which may drain to the unnamed tributary to the east. Some runoff also originates from precipitation reaching the outer slopes of berms and grubbings piles which surround the quarry and accumulates at the toe of slope, and also surface flow accumulates in ditches. In addition to surface water flow, some precipitation is expected to enter the water table by percolation through the quarry floor where it will continue to groundwater. Precipitation and associated surface and groundwater flows are expected to peak in the spring and winter periods with maximum flows estimated in May and December and minimum between July to September corresponding to the peaks in the regional runoff cycle (Figure 17).

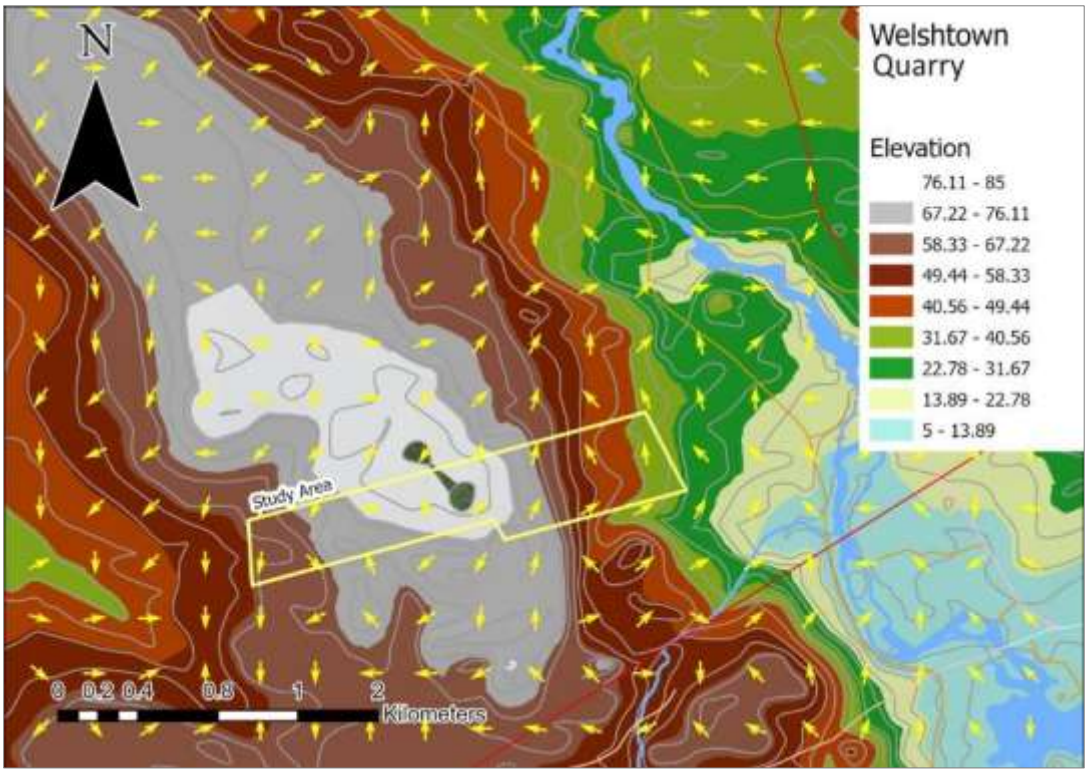

Figure 14. Modeled surface water flow direction analysis for Welshtown Quarry. Arrows show modeled flow direction.

Figure 15. Intermittent and subterranean flows of the unnamed tributary located south of the study area where the stream comes the closest to the Welshtown Quarry, July 8, 2020.

Figure 16. Unnamed tributary that becomes well defined before flowing through a concrete culvert under Upper Clyde Road and entering the Roseway River, July 8, 2020.

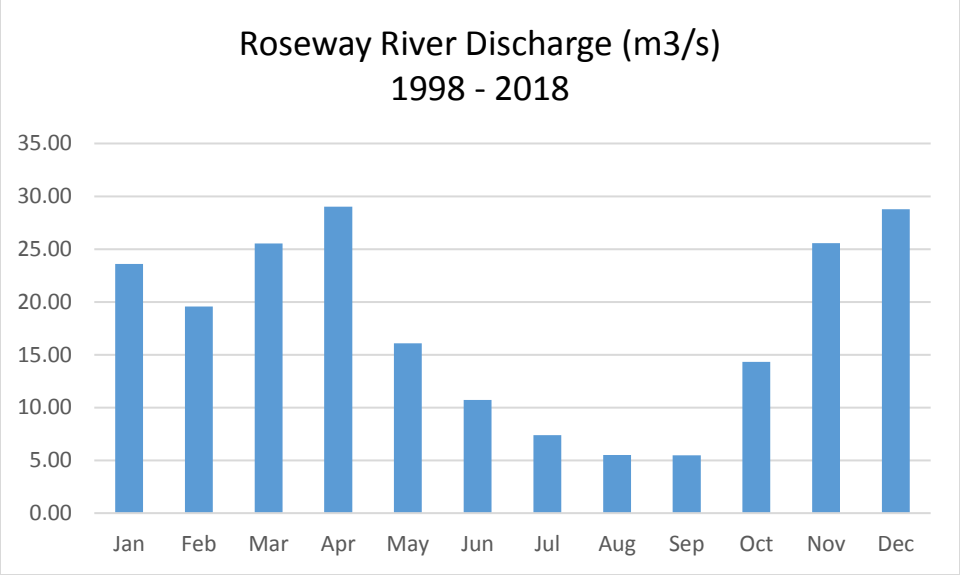

Figure 17. Annual pattern of surface water runoff in the vicinity of Welshtown. Roseway River flows measured at South Ohio, 1998 to 2018. Roseway River watershed area is 495 km^2.

4.1.5 HYDROGEOLOGY

The site is underlain predominantly by igneous and metamorphic bedrock, and groundwater develops predominantly subsurface in cracks and fractures, on horizontal surfaces between strata in bedrock, and in till which is shallow at the site. The water table at the site is below the floor of the quarry based on current drainage characteristics at the site. The actual depth of the bedrock water table at the quarry site is not known, but it has not been encountered during previous quarry operations, and it is not anticipated that the quarry expansion will reach the bedrock water table.

Surficial and shallow groundwater flow is anticipated to mirror the topographic slope, which although disorganized, flows west at the west end of the study area, south to southeast in central areas of the study area, and east to southeast at the east end.

Precipitation reaching the quarry floor infiltrates the floor or leaves via ditches and outflows into the surrounding forest; while some is expected to enter groundwater as seepage through cracks and fractures. Some areas of the site have small surface accumulations of water retained above bedrock in local depressions, however this is retained surface water and not an expression of the groundwater table.

4.1.6 SOILS

The site is located on Gibraltar soils – yellowish brown to brown sandy loams that are prone to drying and are developed from till derived from granite. Topography is undulating with low hills and ridges, and soils are well drained to dry on the high areas (Cann et al. 1961). These soils prominently feature excessive amounts of granite stones and boulders littering the surface. The stoniness and imperfectly drained soils are limiting factors in land use and such soils are not suited for agriculture. Small areas are used for mixed farming and small pastures, but much of the area is forested and consists of pine, spruce, hemlock, birch

and maple. Areas that have been swept by fires and remain forest barren consist of blueberry, crowberry, sweet fern, lambkill and wire birch (Cann et al. 1961).

4.2 BIOLOGICAL RESOURCES AND HABITAT

4.2.1 TERRESTRIAL ENVIRONMENT

The site is forested with predominantly medium aged White Pine, Red Spruce, Red Oak and Large-tooth Aspen at the highest elevations, mainly in the north central parts of the site. White Pine, Red and Balsam Fir, and Red Maple occupy slopes which extend to the west, south and southeast. Bases of several northeast- to southwest-trending swales are located centrally in the site; a basin occupying part of the west end; and the lower slope southeast of the site, are dominated by Balsam Fir, Black Spruce and Red Maple, associated with sphagnum slope or sphagnum basin swamps (Figures 18 to 24). This type of landscape is classified as Pine Oak Hills and Hummocks (NSDLF 2019). Forests at the higher elevations are drier and prone to fire disturbance. Higher elevations are characterized by exposed bedrock and bedrock prominences.

The study site is located in southwestern Nova Scotia near the Atlantic Coast where the damp and cool environment leads to the development of mixed and coniferous forests dominated by Balsam Fir, with a mix of understory plants including Cinnamon Fern (*Osmundastrum cinnamomeum*), Bunchberry (*Cornus canadensis*), Inkberry (*Ilex glabra*) and Red Maple seedlings (*Acer rubrum*), which are common throughout much of coastal Nova Scotia. Low relief and gradual slopes over poorly-drained soil lead to a patchwork of forest communities the characteristics of which are related to elevation and drainage, favouring development of wetlands in many areas (Davis and Browne 1997) (Map A-4). The terrain is gently rolling with subdued ridges separating poorly drained swamps and bogs in small, poorly-drained depressions (CEAA 2014). Forests in the vicinity of the quarry have largely been harvested at one time or another, and consist of regenerated stands of various ages.

Figure 18. Coniferous woodland with mosses dominating the forest floor (R. Newell, October 2019 botany survey).

Red Maple swamps occur in several areas on the study site and are dominated by Red Maple (*Acer rubrum*), Balsam Fir (*Abies balsamea*) and Sphagnum moss. Common herbaceous species and shrubs in the wetter portions of wooded swamps include New York Fern (*Thelypteris noveboracensis*), Cinnamon Fern (*Osmundastrum cinnamomeum*), Black Huckleberry (*Gaylussacia baccata*), Sheep Laurel (*Kalmia angustifolia*), Goldthread (*Coptis trifolia*), and Starflower (*Lysimachia borealis*), with Sphagnum (*Sphagnum* spp.) forming the dominant ground cover.

Figure 19. Red Maple swamp (W4 in Figure 36). Cinnamon Fern (*Osmundastrum cinnamomeum*) occurs in foreground (R. Newell, October 2019 botany survey).

Higher elevations on the property generally support patches of dry (mesic) woodland (Figure 18), with a mix of harvested stands – consisting of regenerated stands of various ages— and some apparently undisturbed. Dominant tree species include Balsam Fir (*Abies balsamea*), Red Maple (*Acer rubrum*), Red Oak (*Quercus rubra*), Red Spruce (*Picea rubens*), and White Pine (*Pinus strobus*) with Large-toothed Aspen (*Populus grandidentata*) and White Birch (*Betula papyrifera*) less common. Interspersed between the higher elevations are occasional small, low, damp, sphagnous areas often with dense patches of Cinnamon Fern (*Osmundastrum cinnamomeum*) (Figure 19). Other common species within the shrub layer include Black Huckleberry (*Gaylussacia baccata*), Witch-hazel (*Hamemelis virginiana*), Bayberry (*Morella pensylvanica*), Inkberry (*Ilex glabra*), Chokeberry (*Photinia* sp.) and Sheep Laurel (*Kalmia angustfolia*). Ground vegetation includes Starflower (*Lysimachia borealis*), Wintergreen (*Gaultheria procumbens*), Indian Cucumber-root (*Medeola virginiana*), Bracken (*Pteridium aquilinum*) and Wild Sarsaparilla (*Aralia*

nudicaulis). Some areas have dense shrub cover with sizeable boulders scattered throughout (Figures 20 and 21).

Figure 20. Mesic mixed woodland occurring at higher elevations (R. Newell, October 2019 botany survey).

Figure 21. Mesic mixed forest located south of the existing quarry. Dense shrub layer (left) with sizeable boulders are thinly scattered throughout this area (and elsewhere on the property) are often moss and lichen-covered with occasional ferns and flowering plants (right) (R. Newell, October 2019 botany survey).

Small exposed rock outcroppings occur locally (Figures 22 and 23), with commonly-occurring shrub species including Black Huckleberry (*Gaylussacia baccata*), Lowbush Blueberry (*Vaccinium angustifolium*), Sheep Laurel (*Kalmia angustifolia*) and Bayberry (*Morella pensylvanica*). These areas also supported various low shrubs (*"subshrubs"*) including several that were not observed elsewhere on the property including Golden-heather (*Hudsonia ericoides*) and Broom Crowberry (*Corema conradii*). Tree species on rock outcrops include Wire Birch (*Betula populifolia*), Red Oak (*Quercus rubra*), Red Spruce (*Picea rubens*) and White Pine (*Pinus strobus*), all of which are stunted, likely the result of limited soil and moisture. Various reindeer lichens (*Cladonia* spp.) are abundant on these outcrops (Figures 22 and 23).

Figure 22. Rock outcrop and associated plant communities (R. Newell, October 2019 botany survey).

Figure 23. Extensive beds of reindeer lichens (*Cladonia spp.*) (whitish ground cover) occurring on rock outcrops (R. Newell, October 2019 botany survey).

Small marshes and occasional damp sphagnous areas occasionally occurred across from or directly beside woods trails through the property (Figure 24). Disturbance and alteration of drainage associated with the construction of the trails may have led to the formation of these habitats, which are dominated by Cinnamon Fern (*Osmundastrum cinnamomeum*) and Black Huckleberry (*Gaylussacia baccata*), with occasional Steeplebush (*Spiraea tomentosa*), Atlantic Sedge (*Carex atlantica*), Canada Manna Grass (*Glyceria canadensis*), Common Woolly Bulrush (*Scirpus cyperinus*), Red Maple (*Acer rubrum*), Black Spruce (*Picea mariana*), Soft Rush (*Juncus effusus*), and Woodland Rush (*Juncus subcaudatus*) in the

various wetlands. A mix of native and exotic vascular plant species occurs in other dryer areas along the edges of woods trails as well as directly on the trails themselves. Commonly-occurring species in these areas observed during botany surveys include: Green Alder (*Alnus alnobetula* ssp. *crispa*), Sweetfern (*Comptonia peregrina*), Wire Birch (*Betula populifolia*), Pinweed (*Lechea intermedia*), Pearly Everlasting (*Anaphalis margaritacea*), Calico Aster (*Symphyotrichum lateriflorum*), Downy Goldenrod (*Solidago puberula*), Rough Bentgrass (*Agrostis scabra*), Canada St. John's-wort (*Hypericum canadense*), Poverty Grass (*Danthonia spicata*) and Fall Dandelion (*Leontodon autumnalis*).

Figure 24. Marshy part of a sphagnum basin swamp disturbed by a woods road (W8 in Figure 33) located near the east boundary of the study site and a boggy marsh habitat (W6 in Figure 33) (R. Newell, October 2019 botany survey).

The study area supports a comparatively diverse plant community, with 88 species recorded during botany surveys conducted in October 2019 and June 2020 (Appendix B). Four plant species of conservation concern were found during the surveys [3], but most did not occur in the proposed expansion area. These included Golden-heather, which was primarily restricted to rock outcroppings on the property and was relatively common in this particular habitat (listed as imperiled, S2) (Figure 25); Woodland Rush (listed as vulnerable, S3) was observed at one site; Southern Twayblade (Figure 26) (listed as a Vulnerable, S3) was found only in a Red Maple Swamp located at the west end of the property. Eastern Blue-eyed Grass (Figure 27) was observed along an overgrown logging road in the northeast corner of the survey and expansion area (listed as vulnerable to apparently secure, S3S4). The lichen *Fucscopannaria leucosticta* (S2/S3 status) was found near the south edge of the study area, but its location is not within the proposed expansion area of the quarry (Figure 38). Several other lichens with S3 status were also found at the site (Figure 38).

3 No species at risk (i.e. listed under federal or provincial legislation) were encountered in the study area.

Figure 25. Golden-heather (*Hudsonia ericoides*) was observed primarily on rock outcrops during the fall survey (R. Newell, October 2019 botany survey).

Figure 26. Southern Twayblade (*Neottia bifolia*) in Red Maple swamp at west end of the survey area (R. Newell, June 2020 botany survey).

Figure 27. Eastern Blue-eyed Grass (*Sisyrinchium atlanticum*) occurring along a damp, grown-in logging road in the upper east corner of the survey area (R. Newell, October 2019 botany survey).

4.2.2 AQUATIC ENVIRONMENT

The study site is located on a well-drained to dry headwater upland plateau where limited surface water can accumulate. The only surface water drainage features on site are flowages and intermittent streams originating around the margin of the plateau with no permanent, first-order streams on site. Flowages occur in the form of small ponds and channels and between rocks and outcrops along artificial structures such as roads. These flowages onsite are typically intermittent with occasional subterranean flows that move downslope (Figure 28). Several spring pools were identified in the northeast part of the study area (Figure 36, Map A-4). These deep pools were sporadic in the area and have formed in depressions where runoff accumulates on level surfaces during high runoff events.

Figure 28. Unnamed intermittent stream at WS1, July 8, 2020. For location see Figure 32.

Figure 29. Flow in ditch along access road at WS2, July 8, 2020. For location see Figure 32.

An unnamed, first order stream identified on Provincial NTS mapping is located in the vicinity of the study area about 100 m to the south (Figure 32, Map A-4). It sharply turns away from the quarry property toward the southeast and eventually drains into the Roseway River. The stream is small, typically less than 0.50 m in width and 10 cm deep near the quarry property (Figure 30) and widens as it nears the Roseway River

Figure 30. Unnamed permanent stream 100 m south of the EA study area(left) and at Upper Clyde Road (right), July 8, 2020.

(Figure 30). In the upper reaches near the quarry, bottom types range from sand to boulder and peat, with a high proportion of woody debris. The stream passes through a culvert at the Upper Clyde Road before it joins the Roseway River. Water quality of surface water that was sampled during the July site visit was high, showing high oxygen, low TSS and moderate pH (Table 1).

4.2.3 WATER QUALITY

Water quality measurements were made during the July 8 and 9, 2020 field survey at several locations, including: an intermittent stream at the west end of the study area (WS1); a ditch on the east end (WS2), Figure 32); in surface water in an artificial depression (WS3) (Figure 31; Map A-4); and in an unnamed tributary to the Roseway River south of the study area (WS4; Map A-4). A fifth site (WS5) represented water quality down gradient from the site, but with potential impact from the adjacent Upper Clyde Road. Overall, surface water quality at the Welshtown Quarry site is good. Surface waters sampled at WS1 and WS4 were typical of relatively undisturbed natural environments in upper watershed areas of southwestern Nova Scotia. WS2, WS3 represented water quality in disturbed parts of the site. Sites WS2 and WS5 were both collected near culverts under the main access road on the quarry site and the Upper Clyde Road, respectively, and showed high dissolved oxygen levels. Site WS3, an artificial surface water accumulation with no inlets or outlets also had high water quality. Conditions were typical of standing, shallow water bodies, and tadpoles were present, indicating use by local frog species.

Table 1. Water quality measurements from surface waters located at the Welshtown quarry and within the vicinity of Welshtown quarry. Site locations shown in Figure 32.

Site Location & Date	July 8, 2020				
	Welshtown Quarry			Welshtown Quarry Vicinity	
	WS1	WS2	WS3	WS4	WS5
Site Description	Unnamed stream on west end of study site.	Drainage Ditch	Surface Water Accumulation	Unnamed tributary to Roseway River South of study site	Unnamed tributary to Roseway River, Upper Clyde Road
Temperature °C	12.7	17.4	21.8	13.3	15.2
Dissolved Oxygen (mg/L)	5.7	8.0	3.3	4.8	10.2
Dissolved Oxygen (% saturation)	52.9	85.5	35.1	46.5	99.3
Conductivity (µs/cm)	0	35.8	24.8	28.9	83.0
Specific Conductivity (25°) (µs/cm)	0	42.2	26.4	37.4	101.1
pH	4.5	6.0	6.3	6.5	6.2
TSS (mg/L)	4.0	--[1]	16.0	9.0	<0.5
Colour	Clear, pale yellow-brown	Clear, pale yellow-brown	Clear, very pale yellow	Clear, pale yellow	Clear, pale yellow-brown
Sample Time	11:08 AM	6:44 PM	6:50 PM	6:15 PM	6:58 PM

1. Heavy growth of filamentous algae precluded TSS measurement. Note: TSS = Total Suspended Solids.

These surface waters showed moderate to high oxygen levels, slightly acidic conditions characteristic of headwaters, low conductivities, and generally low suspended sediment levels. Surface waters at the unnamed tributary to Roseway River showed high dissolved oxygen, and higher conductivity than the other streams, as expected due to its position lower in the watershed. pH levels were within guideline ranges for the protection of freshwater aquatic life at site WS4 while dissolved oxygen levels were acceptable at site WS1 (CCME 1999)(Table 1).

Figure 31. Surface water accumulation (WS3), July 8, 2020

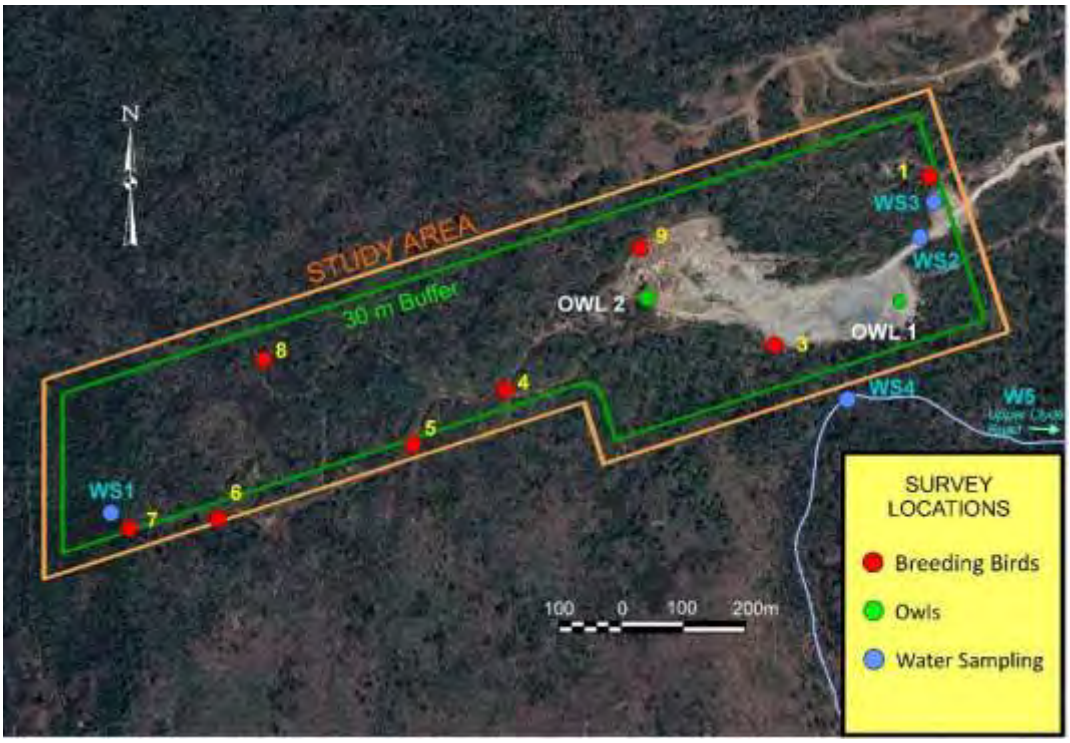

Figure 32. Locations for breeding bird and owl surveys (June 2020) and water sampling (July 8 to 9, 2020).

4.2.4 WETLANDS

Wetlands are areas of land that are periodically or permanently flooded and support particular types of vegetation which are adapted to life in such environments. Types of wetlands occurring at the site are predominantly sphagnum slope swamps, small and large sphagnum basin swamps, and spring pools or ponds[4]. In places, modified forms of these types occur, where forest overstorey has been removed, drainage has been blocked by roads and altered by use of logging equipment, prior to current quarry operations.

In the higher elevation plateau and on higher slopes predominantly in the northeast section of the site, several small sphagnum swamps have developed in shallow swales and small basins (Figure 33; Map A-4). Some have been disturbed by logging equipment and road construction. Spring ponds (small openings between bedrock and boulders with standing water) also occur here. These develop various vegetation types ranging from shrubs to sphagnum around the margins. Treed slope swamps occur at lower elevations near the base of slopes in the south central part of the study area where drainage is

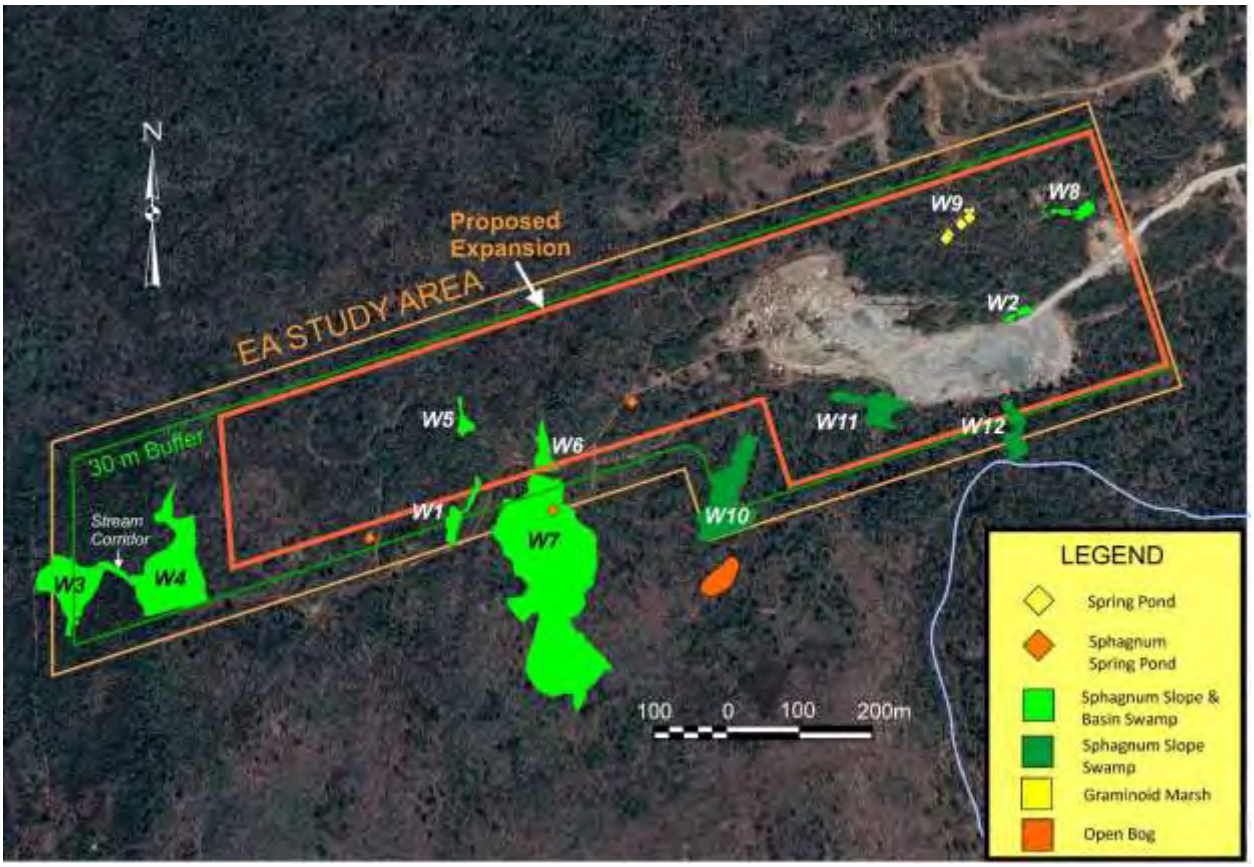

Figure 33. Wetlands at Welshtown Quarry.

4 National Wetland Working Group. 1997. The Canadian Wetland Classification System.

predominantly south and southeast; and along the southwest slope at the west end of the study area. Slope swamps grade into treed sphagnum basin swamps. This complex occurs in two deep swales on the west central part of the site; and at the west end of the site; and a large basin swamp complex is found at the extreme west end of the proposed expansion area. Wetlands in the study area are shown in Figures 34 to 36 and on Map A-4 and summarized in Table 2.

Figure 34. Spring pool located in the northeast part of the study site, July 9, 2020.

Figure 35. Spring pool north of current quarry footprint, July 9 2020.

Figure 36. Sphagnum swamp modified to a marsh / fen (W8 in Figure 33) by blocked downstream flow.

Table 2. Wetlands, Welshtown Quarry Expansion. Locations shown in Figure 33. Approximate boundaries and area within (and outside) the study area.

Identification	Area (ha)	Wetland Type and Comments
W1	0.12	Slope swamp basin swamp
W2	0.04	Disturbed basin swamp
W3	0.43 (0.07)	Sphagnum basin swamp and slope swamp
W4	0.91	Sphagnum slope swamp / maple basin swamp
W5	0.06	Basin swamp slope swamp marsh fen
W6	0.12	Disturbed basin swamp marsh
W7	0.40 (2.42)	Treed basin swamp
W8	0.01	Graminoid Marsh
W9	0.03	Disturbed Sphagnum Graminoid Swamp / Marsh
W10	0.57	Sphagnum slope swamp
W11	0.23	Sphagnum basin & slope swamp
W12	0.09 (0.06)	Sphagnum slope swamp

4.2.5 FISH & FISH HABITAT

No fish habitat occurs at the site—there are no streams or water bodies which could support fish. Watercourses at the site are all shallow, intermittent and occasionally subterranean and unconnected with fish-bearing waters. No direct runoff from the working area of the quarry enters ditches or ravines, which could impact directly on local fish habitat (e.g. Roseway River) (Figure 37). The unnamed tributary to the Roseway River nearest to the quarry (approximately 100 m from the south boundary of the study area) was intermittent and subterranean and therefore was not accessible or suitable for fish (Figure 38). This tributary eventually becomes more defined as it nears the Roseway River, although there, it is not accessible by fish due to a hanging culvert under Upper Clyde Road. The Roseway River system supports Brook Trout, and possibly Atlantic salmon in addition to other freshwater fish typical of the area, including Yellow Perch, and the introduced Chain Pickerel and Smallmouth Bass (NSDFA 2020).

Figure 37. Roseway River at Upper Clyde Road near outlet of the unnamed watercourse, looking downstream, July 8, 2020.

Figure 30.Outlet of culvert of unnamed tributary at Upper Clyde Road and Roseway River, July 8, 2020.

4.2.6 BIRDS

Birds are important in the ecosystem in the vicinity of the Welshtown Quarry. Breeding birds observed during the site survey are summarized in Table 3. One hundred species of birds have been recorded as potentially breeding in the study area (Maritimes Breeding Bird Atlas 2019, Lower South Shore Region 18, Table 4), but additional species may breed at the site from time to time. There were no rare species in Nova Scotia (listed federally or provincially) observed or heard at any of the sites during bird surveys, although a Red-Breasted Nuthatch, a species with vulnerable status in the province of Nova Scotia, was present at one site during bird surveys. Two Important Bird and Biodiversity (IBA) Areas (NS017 South Shore (Roseway to Baccaro) and NS004 South Shore (Port Joli sector)) occur approximately 15 km southeast and northeast respectively[5].

Habitat types in and around the study site include a mixture of forest types consisting of Red Maple, Black Spruce, Red Spruce, and White Pine as leading forest species. Surveys at the site included: a site walkover, a night owl survey and ten-minute dawn point-count surveys at seven sites on June 9, 2020 (Figure 32). A night survey for owls (0300 hrs to 0500 hrs) (observation sites shown in Figure 32) identified four Barred Owls in the approximate study area; one Saw Whet Owl in the distance; and four Barred Owls north of

[5] The *Important Birdlife and Biodiversity Areas Program Canada* (IBA) is a joint project of Bird Studies Canada and Nature Canada coordinated by BirdLife International.

the site. Thirty-two (32) species of birds were heard in the dawn survey, through 10-minute point counts from 0510 to 0825 hrs (Table 3).

The most common and abundant species at the study site observed in the point-count survey were Magnolia Warbler and Hermit Thrush, which occurred in all habitat types and were moderately abundant (5.3 and 5.8 per site per 10-min, respectively); however American Robin, Palm Warbler, Common Yellowthroat and Ovenbird also occurred at all sites, though in lower numbers (Table 3).

Relatively high abundances of several species, and highest number of species overall were observed at the softwood dominant Site 7 (19 species) (Table 3, Figure 32), where important species included Swainson's Thrush, Hermit Thrush, Magnolia Warbler, American Robin, Common Yellow Throat, Black-and-white Warbler and Ovenbird (Table 3). All birds were expected based on the Maritimes Breeding Bird Atlas (2019) records for the area.

Table 3. Bird species heard or observed during dawn point-count bird survey conducted June 9, 2020 between 0510 and 0825 hrs at the Welshtown Quarry study site. Survey locations shown in Figure 32).

Bird Species	Mixed White Pine, Red Spruce, Birch (Sites 1 & 3)		Mixed Red Spruce, Black Spruce, Red Maple, Trembling Aspen (Sites 4, 5 & 8)		Mixed Red Spruce, Black Spruce, Red Maple, Trembling Aspen (Site 7)		Mixed Red Maple and White Pine (Site 9)		Mixed Red Spruce, Red Maple, Trembling Aspen (Site 6)	
	Number of sites	Average /10 mins	Number of sites	Average /10 mins	Number of sites	Average /10 mins	Number of sites	Average /10 mins	Number of sites	Average / 10 mins
Passeriformes (Songbirds)										
Alder Flycatcher	2	2.0	0	0.0	0	0.0	0	0.0	0	0.0
American Crow	0	0.0	2	0.7	1	1.0	1	1.0	1	1.0
American Robin	2	1.5	3	4.0	1	2.0	1	2.0	1	2.0
Black-and-white Warbler	1	1.5	1	1.7	1	4.0	1	2.0	1	2.0
Black-capped Chickadee	1	0.5	1	1.0	1	2.0	0	0.0	1	2.0
Black-throated Blue Warbler	0	0.0	2	0.7	0	0.0	0	0.0	0	0.0
Black-throated Green Warbler	0	0.0	0	0.0	1	1.0	0	0.0	0	0.0
Blue-headed Vireo	1	0.5	3	1.3	1	1.0	0	0.0	1	3.0
Blue Jay	1	0.5	0	0.0	0	0.0	1	2.0	0	0.0
Cedar Waxwing	0	0.0	0	0.0	0	0.0	1	2.0	0	0.0
Common Yellowthroat	2	1.5	3	1.7	1	5.0	1	2.0	1	2.0
Dark-eyed Junco	2	1.5	0	0.0	1	1.0	1	2.0	0	0.0
Golden-crowned Kinglet	0	0.0	2	1.0	1	3.0	0	0.0	1	2.0
Hermit Thrush	2	2.0	3	3.3	1	19.0	1	3.0	1	10.0

Table 3. Bird species heard or observed during dawn point-count bird survey conducted June 9, 2020 between 0510 and 0825 hrs at the Welshtown Quarry study site. Survey locations shown in Figure 32).

Bird Species	Mixed White Pine, Red Spruce, Birch (Sites 1 & 3)		Mixed Red Spruce, Black Spruce, Red Maple, Trembling Aspen (Sites 4, 5 & 8)		Mixed Red Spruce, Black Spruce, Red Maple, Trembling Aspen (Site 7)		Mixed Red Maple and White Pine (Site 9)		Mixed Red Spruce, Red Maple, Trembling Aspen (Site 6)	
	Number of sites	Average /10 mins	Number of sites	Average /10 mins	Number of sites	Average /10 mins	Number of sites	Average /10 mins	Number of sites	Average / 10 mins
Magnolia Warbler	2	7.0	3	3.3	1	6.0	1	8.0	1	4.0
Mourning Warbler	0	0.0	0	0.0	1	2.0	0	0.0	1	2.0
Northern Parula Warbler	0	0.0	1	0.3	0	0.0	1	1.0	1	1.0
Ovenbird	2	3.0	3	4.0	1	4.0	1	3.0	1	2.0
Palm Warbler	2	4.0	2	4.0	0	0.0	1	3.0	1	3.0
Purple Finch	1	0.5	0	0.0	1	1.0	0	0.0	0	0.0
Red-breasted Nuthatch	0	0.0	0	0.0	1	2.0	0	0.0	0	0.0
Red-eyed Vireo	2	2.5	3	1.0	0	0.0	1	1.0	1	2.0
Scarlet Tananger	0	0.0	1	0.3	0	0.0	0	0.0	0	0.0
Swainson's Thrush	1	0.5	3	2.3	1	20.0	1	1.0	1	5.0
Tree Swallow	1	1.0	0	0.0	0	0.0	0	0.0	0	0.0
White-throated Sparrow	2	4.0	0	0.0	0	0.0	0	0.0	0	0.0
Yellow-rumped Warbler	1	0.5	2	0.7	0	0.0	0	0.0	0	0.0
Gaviiformes (Loons)										
Common Loon	0	0.0	1	0.3	1	1.0	0	0.0	1	1.0
Strigiformes (Owls)										
Barred Owl	0	0.0	0	0.0	1	1.0	0	0.0	0	0.0
Piciformes (Woodpeckers)										
Hairy Woodpecker	0	0	1	0.3	0	0.0	1	2.0	0	0.0
Northern Flicker	0	0	2	0.7	0	0.0	0	0.0	0	0.0
Yellow-bellied Sapsucker	0	0	1	0.3	1	1.0	0	0.0	0	0.0
SUMMARY										
AVERAGE ABUNDANCE PER SITE	**34.5**		**33.0**		**77.0**		**35.0**		**44.0**	
TOTAL SPECIES IN HABITAT	**17**		**16**		**19**		**15**		**16**	
AVERAGE NUMBER OF SPECIES PER SITE	**14.0**		**14.3**		**19.0**		**15.0**		**16.0**	

Table 4. Birds potentially breeding in the Welshtown/Shelburne area of the Lower South Sore (Maritime Breeding Bird Atlas-Online 2020).

Swans, Geese & Ducks (Anseriformes: Anatidae)	
Wood Duck ‡	Mallard
American Black Duck	Common Eider §
Pheasants, Grouse and Turkeys (Galliformes, Phasianidae)	
Ruffed Grouse	Ring-necked Pheasant
Loons and Grebes (Gaviidae and Podicipedidae)	
Common Loon	
Storm-Petrels, Cormorants, Wading Birds (Hydrobatidae, Phalacrocoracidae, Ardeidae)	
Double-crest Cormorant §	
Hawks & Falcons (Falconiformes: Accipitridae, Falconidae)	
Osprey	Red-tailed Hawk
Northern Harrier	American Kestrel
Sharp-shinned Hawk	Merlin ‡
Broad-winged Hawk	
Shorebirds Sandpipers & Snipes (Charadriiformes, Scolopacidae)	
Spotted Sandpiper	Wilson's Snipe
Willet	American Woodcock
Gulls, Terns, Kittiwake (Charadriiformes, Laridae)	
Herring Gull §	Great Black-backed Gull §
Pigeons & Doves (Columbiformes: Columbidae)	
Rock Pigeon	Mourning Dove
Owls (Strigiformes)	
Barred Owl	North Saw-whet Owl
Long-eared Owl †	
Swifts (Apodiformes, Apodidae) and Hummingbirds (Apodiformes, Trochilidae)	
Common Nighthawk †	Ruby-throated Hummingbird
Chimney Swift †	
Kingfishers (Coraciiformes, Alcedinidae)	
Belted Kingfisher	
Woodpeckers (Order Piciformes, Picidae)	
Yellow-bellied Sapsucker	Black-back Woodpecker ‡
Downy Woodpecker	Northern Flicker
Hairy Woodpecker	Pileated Woodpecker
Songbirds (Passeriformes)	
Olive-sided Flycatcher †	American Redstart
Eastern Wood-Pewee	Cape May Warbler ‡
Alder Flycatcher	Northern Parula
Least Flycatcher	Magnolia Warbler
Great Crested Flycatcher	Bay-breasted Warbler
Eastern Kingbird	Blackburnian Warbler
Blue-headed Vireo	Yellow Warbler
Red-eyed Vireo	Chestnut-sided Warbler
Gray Jay	Black-throated Blue Warbler
Blue Jay	Palm Warbler

Table 4. Birds potentially breeding in the Welshtown/Shelburne area of the Lower South Sore (Maritime Breeding Bird Atlas-Online 2020).

American Crow	Yellow-rumped Warbler
Common Raven	Black-throated Green Warbler
Tree Swallow	Wilson's Warbler
Cliff Swallow §	Chipping Sparrow
Barn Swallow	Savannah Sparrow
Black-capped Chickadee	Nelson's Sh.-tail Sparrow
Boreal Chickadee	Fox Sparrow
Red-breast Nuthatch	Song Sparrow
White-breast Nuthatch ‡	Swamp Sparrow
Brown Creeper	White-throat Sparrow
Winter Wren	Dark-eyed Junco
Golden-crown Kinglet	Northern Cardinal ‡
Ruby-crown Kinglet	Indigo Bunting ‡
Veery	Red-wing Blackbird
Swainson's Thrush	Common Grackle
Hermit Thrush	Purple Finch
American Robin	House Finch †
Gray Catbird	Red Crossbill †
European Starling	Pine Siskin
Cedar Waxwing	American Goldfinch
Ovenbird	Evening Grosbeak
Nashville Warbler	White-winged Crossbill
Common Yellowthroat	

This list includes all species found during the Maritimes Breeding Bird Atlas (1st atlas: 1986-1990, 2nd atlas: 2006-2010) in the region #18 (Lower South Shore).
Rare/Colonial Species Report Forms should be completed for species marked: § (Colonial), ‡ (regionally rare), † (rare in the Maritimes) or ¤ (rare in the Maritimes, documentation only required for confirmed records). Current as of 2/07/2019. 20 QR17 & 20QR18

4.2.7 MAMMALS

Various large and small mammal species, including game and furbearing species, are found in Shelburne County and may occur at the quarry site. Mammals expected to occur regularly or occasionally reflect the communities typical of the dominant terrestrial habitat in the surrounding area, which includes coniferous and mixed forest. White-tailed Deer, Snowshoe Hare, and Eastern Coyote occur in the general vicinity of the quarry, and occasional scat and sign were observed at the site on July 8 – 9, 2020. Moose and Canada Lynx (both provincially listed as Endangered) are known to occur in the general area of the study site. Other species likely to occur in the general area include carnivores such as American Fisher; as well as rodents and small mammals including foxes (Red Fox) and bats (Little Brown Myotis – federally and provincially listed as Endangered) (iNaturalist 2020; ACCDC 2020). Bat populations are diminished at present due to the White Nose Syndrome in North America. Some of the rocky outcrops at the study site may provide roosting areas for mammals although overwintering is unlikely.

4.2.8 REPTILES AND AMPHIBIANS

Some of the common Nova Scotian amphibians and reptiles are expected to occur at the site although there is little open water habitat present. The small ponds and intermittent streams and adjacent riparian areas likely support amphibian species such as Leopard Frog, Wood Frog, Green Frog, Pickerel Frog,

American Toad, Spring Peeper and salamanders (e.g. Red-spotted newt, Eastern Redback Salamander). An uncommon species, Four-toed Salamander has been observed within 11 km of the study site (ACCDC 2020; Nova Scotia Museum 2020). The species breeds in sphagnum mosses associated with pools; however such habitats at the site are likely too small, fragmented and isolated for the species to occur here. Tadpoles of unidentified amphibians were observed a surface water accumulation at the east end of the quarry (WS3, Figure 32). Lands around the quarry will support snakes, including the Eastern Garter Snake and Eastern Smooth Green Snake. Habitat is not present at the site for species of conservation concern such as Wood Turtle or Snapping Turtle, although have both been observed recently within 7 km of the study site. (ACCDC 2020; iNaturalist 2020). Small pits where rock and peat have been removed in previous times have formed both temporary and permanent ponds and would be suitable habitat for amphibians.

4.2.9 SPECIES AT RISK

Background: Species at Risk are plants or animals whose existence is threatened, or which are in danger of being threatened, by human activities or natural events. The Canadian Committee on the Status of Endangered Wildlife in Canada (COSEWIC) presently recommends species to be listed for legal federal protection under the federal *Species at Risk Act* (SARA). At the provincial level, the Nova Scotia Species at Risk Working Group completes assessments and recommendations for a species' status. Nova Scotia maintains a list of legally protected species under the *Nova Scotia Endangered Species Act*. A third status list is the *Nova Scotia General Status of Wild Species*, which is a provincial system used as a "first-alert tool" for identifying and prioritizing species potentially at-risk and does not provide legal protection. General status rankings are assigned by a provincial General Status Species Assessment process based on expert scientific evaluation of a set of criteria. Species listed as "Red" (any species known to be, or believed to be, at risk), and "Yellow" (any species known to be, or believed to be, particularly sensitive to human activities or natural events) are considered priority species. Species that may be at risk of extirpation or extinction are candidates for a detailed risk assessment by COSEWIC, or provincial or territorial equivalents.

Survey Results: Several plant species of conservation concern having an S2 or S3 ranking (imperiled or vulnerable status) were encountered during the various field studies for this project; however, with the exception of Eastern Blue-eyed Grass (*Sisyrinchium atlanticum*) (S2 rank), none are in the proposed expansion area. As per ACCDC records, species of conservation concern listed under federal or provincial legislation as well as with general status that occur within five kilometres of the Welshtown Quarry site include both animals and plants (Table 5). There are no animals *per se* of particular conservation concern in the study area, however, Canada Lynx, American Marten and Eastern Moose mainland population, which are all currently listed as "Endangered" under the *NS Endangered Species Act*, are of concern due to low numbers and may occasionally occur. Bird species of particular conservation concern occurring within 5 km of the study site include the Chimney Swift (listed federally as Threatened and listed provincially as Endangered) and the Common Nighthawk (listed as Threatened under the *Federal Species at Risk* Act and provincial *Endangered Species* Act and is listed as Special Concern by *COSEWIC*) (ACCDC 2020). Plant species of concern reported within 5 km of the study area includes, Graceful Felt Lichen also known as Vole Ears Lichen (*Erioderma mollissimum*), Boreal Felt Lichen (*Erioderma pedicellatum* [Atlantic population]) (both listed federally and provincially as Endangered), Black foam Lichen (*Anzia colpodes*)

(listed federally and provincially as Threatened), and Eastern Lilaeopsis (*Lilaeopsis chinensis*) (listed federally as Special Concern and provincially as Vulnerable) (ACCDC 2020; Nova Scotia Museum 2020). Boreal Felt Lichen (*Erioderma pedicellatum*), an endangered species with an S1 status in Nova Scotia has a high potential for occurring in the area, but was not observed during a dedicated survey for the species. A lichen species which commonly co-occurs with Boreal Felt Lichen—*Coccocarpia palmicola*—was observed at two locations, on mature balsam fir on which both lichens typically occur, but the habitat was not suitable for Boreal Felt Lichen. Several rare lichen species were observed on the site (Figure 38). They include Blue Felt Lichen (*Pectenia plumbea)*, Peppered Moon Lichen (*Sticta fuliginosa)*, Corrugated Shingles Lichen (*Fuscopannaria ahlneri)*, Rimmed Shingles Lichen (*Fuscopannaria leucosticte)* and Blistered Jellyskin (*Leptogium corticola)*. Other cyanolichen lichen species found at the site include: Fringed Kidney Lichen (*Nephroma heleticum*), Lungwort (*Lobaria pulmonaria*), Smooth Lungwort (*Lobaria quercizans*), Textured Lungwort (*Lobaria scrobiculata*), Yellow Specklebelly Lichen (*Pseudocyphelaria perpetua*), Mealy-rimmed Shingle Lichen (*Pannaria conoplea*), Brown-eyed Shingle Lichen (*Pannaria rubiginosa*), Tree Jelly Lichen (*Collema subflaccidum*), Blue Jellyskin Lichen (*Leptogium cyanescens*), and Black-bordered Shingle Lichen (*Parmeliella triptophylla*).

Figure 38. Important plant and lichen species found at the site during botany and lichen surveys, 2020.

Suitable habitat for both Chimney Swift and Common Nighthawk typically are found on the site. Chimney Swifts prefer wetland habitats, including areas with giant hollow trees for nesting sites; and Common Nighthawk are found in open areas with little ground vegetation including logged or burned over areas, forest clearings, rocky outcrops and peat bogs. Although no federally or provincially listed bird species were observed during the June 9, 2020 bird survey, a Red-Breasted Nuthatch, (conservation status of Vulnerable in the province of Nova Scotia), was present during the survey visit.

Other animals of conservation concern potentially occurring at the site include the Little Brown Myotis (*Myotis lucifugus*), Long-eared Myotis (*Myotis septentrionialis*), and the Eastern Pipistrelle or Tri-Coloured Bat (*Perimyotis subflavus*) (all are federally and provincially listed as Endangered). The Little Brown Myotis has been observed within 2.1 km of the study site along as well as other bat species (Vespertilionidae sp.) documented 3.3 km from the study site (ACCDC 2020). The Long-eared Myotis and Eastern Pipstrelle have not been documented within a 5 km radius of the study site, but the Eastern Pipstrelle has been observed within 100 km and all at risk bat species may intersect with the study site because it supports good bat feeding habitat as well as the possibility of the large outcrops being used as a hibernacula for hibernating bats. (ACCDC 2020).

Botany surveys of the site conducted in the spring and fall of 2019 (Appendix B) did not detect any of the federally or provincially listed rare species within 5 km of the study area, however four species of conservation concern within Nova Scotia were observed (Figure 38). Approximately 20 plants of Southern Twayblade (*Neottia bifolia*) were observed during the spring botany surveys and is currently listed by the Atlantic Canada Conservation Data Centre as an S3 species (i.e., Vulnerable) although the Nova Scotia General Status Rank is S4 (Apparently Secure/light green). Eastern Blue-eyed Grass (*Sisyrinchium atlanticum*) was also observed during the spring survey and in Nova Scotia is ranked as an S3S4 species (Vulnerable to Apparently Secure/yellow to light green). This species is considered Vulnerable in some areas of 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. Eastern Blue-eyed Grass may be considered Apparently Secure in other areas of the province due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors. Golden-heather (*Hudsonia ericoides*) was observed during the fall 2019 botany survey on rock outcrops within the study area. Both the Nova Scotia General Status Rank and the Atlantic Canada Conservation Data Centre subnational status designation for this species is S2 (Imperilled/orange). It is considered to be at high risk of extirpation in the province due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors. Woodland Rush (*Juncus subcaudatus*) was also observed during the fall survey in a small marsh within the study area. This species is ranked as S3 (Vulnerable/yellow) species, due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors (Newell 2019).

Vole Ears Lichen (also known as Graceful Felt Lichen) and Boreal Felt Lichen are both rare and endangered species of lichen in Nova Scotia and may occur in forested habitats in the Welshtown Quarry area (Figure 39). Both species of lichen are federally and provincially listed as Endangered and have been observed within 10 km of the quarry site, but were not observed on the study site during botany or dedicated lichen surveys (Table 5) (Figure 38 and 39). These provincially listed species have been observed within 10 km of the site (Figure 43). Vole Ears Lichen and Boreal Felt Lichen prefer cool, moist habitats, typically on north-

facing slopes dominated by Balsam Fir stands with sphagnum moss wetlands. Boreal felt lichen also was not expected to occur in the type of habitat at the site, based on modeled distributions (Mr. Brad Toms, Mersey Tobeatic Research Institute, personal communications, 2019). A list of plants and animals of concern within a 100 km radius of the study site is included in Appendix C.

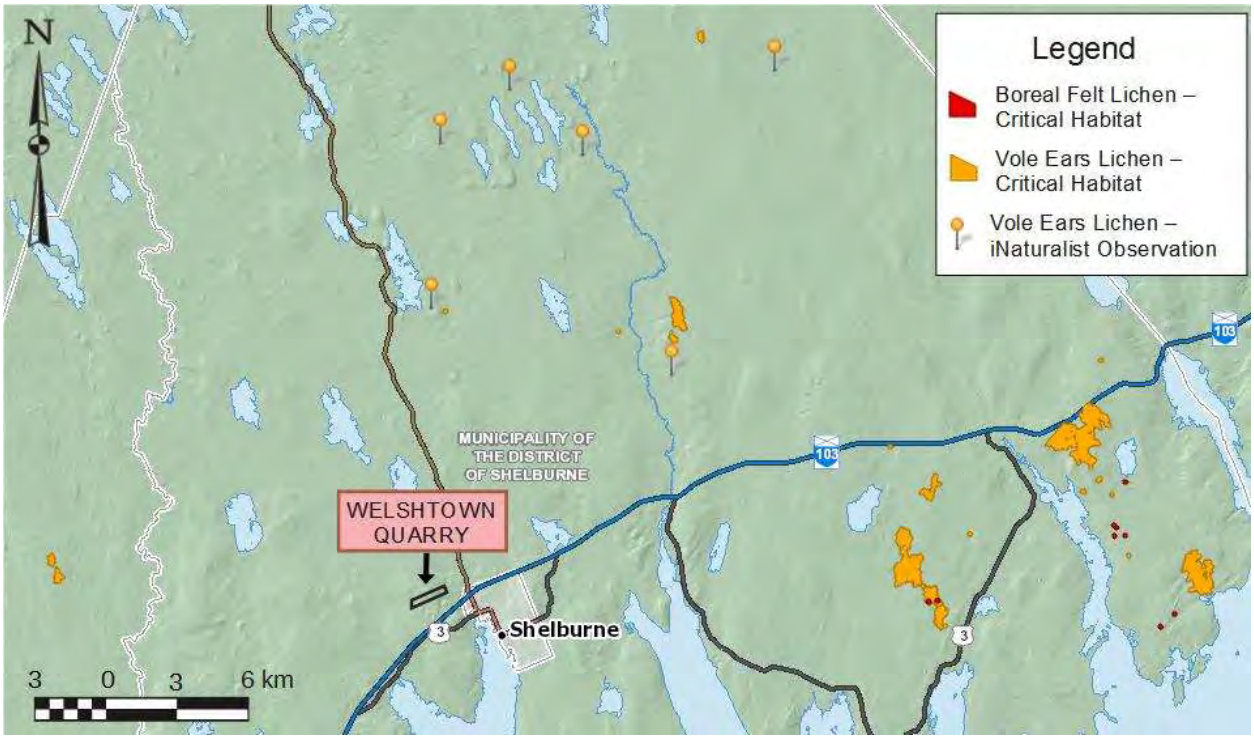

Figure 39. Lichen species at risk critical habitat and iNaturalist observations in Shelburne County.

Table 5. Records of species of concern within a 5 km radius of Welshtown Quarry, Shelburne County. Atlantic Canada Conservation Data Centre (ACCDC) Database, April 2020.

Family/Scientific Name		Common Name	Status/Rank				
			SARA	COSEWIC (NPROT[1])	NS ESA (SPROT[2])	General Status of Wild Species Rankings[3]	AC CDC[4] Rankings (GRANK, SRANK[5])
FLORA							
Apiaceae	*Lilaeopsis chinensis*	Eastern Lilaeopsis	Special Concern	Special Concern	Vulnerable	3 Sensitive	G5, S2
Caryophyllaceae	*Sagina nodosa*	Knotted Pearlwort	-	-	-	4 Secure	G5, S2S3
	Stellaria longifolia	Long-leaved Starwort	-	-	-	3 Sensitive	G5, S2
Coccocarpiaceae	*Coccocarpia palmicola*	Salted Shell Lichen	-	-	-	4 Secure	G5, S3S4
Cyperaceae	*Carex swanii*	Swan's Sedge	-	-	-	3 Sensitive	G5, S3
Lamiaceae	*Teucrium canadense*	Canada Germander	-	-	-	3 Sensitive	G5, S3

Table 5. Records of species of concern within a 5 km radius of Welshtown Quarry, Shelburne County. Atlantic Canada Conservation Data Centre (ACCDC) Database, April 2020.

Lobariaceae	*Sticta fuliginosa*	Peppered Moon Lichen	-	-	-	3 Sensitive	G3G5, S3
Nephromataceae	*Nephroma bellum*	Naked Kidney Lichen	-	-	-	3 Sensitive	G5, S3
Pannariaceae	*Moelleropsis nebulosi*	Blue-gray Moss Shingle Lichen	-	-	-	4 Secure	GNR, S3
	Erioderma mollissimum	Graceful Felt Lichen	Endangered	Endangered	Endangered	2 May Be At Risk	G4G5, S1S2
	Anzia colpodes	Black-foam Lichen	Threatened	Threatened	Threatened	3 Sensitive	G3G5, S3
Physciaceae	*Heterodermia neglecta*	Fringe Lichen	-	-	-	4 Secure	GNR, S3S4
Poaceae	*Piptatheropsis pungens*	Slender Ricegrass	-	-	-	3 Sensitive	G5, S2
Primulaceae	*Samolus parviflorus*	Seaside Brookweed	-	-	-	3 Sensitive	G5T5, S3
Rosaceae	*Potentilla canadensis*	Canada Cinquefoil	-	-	-	3 Sensitive	G5, S2S3
Schizaeaceae	*Schizaea pusilla*	Little Curlygrass Fern	-	-	-	4 Secure	G3G4, S3S4
Smilacaceae	*Smilax rotundifolia*	Round-leaved Greenbrier	-	Not At Risk	-	4 Secure	S3
ANIMALS-BIRDS							
Aeshnidae	*Boyeria grafiana*	Ocellated Darner	-	-	-	3 Sensitive	G5, S3
Apodidae	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	1 At Risk	G4G5, S2B,S1M
Caprimulgidae	*Chordeiles minor*	Common Nighthawk	Threatened	Special Concern	Threatened	1 At Risk	G5, S2B
Cardinalidae	*Passerina cyanea*	Indigo Bunting	-	-	-	5 Undetermined	G5, S1?B
Corduliidae	*Somatochlora tenebrosa*	Clamp-Tipped Emerald	-	-	-	4 Secure	G5, S3
Fringillidae	*Loxia curvirostra*	Red Crossbill	-	-	-	4 Secure	G5, S3S4
Libellulidae	*Nannothemis bella*	Elfin Skimmer	-	-	-	4 Secure	G4G5, S3
	Pantala hymenaea	Spot-Winged Glider	-	-	-	3 Sensitive	G5, S2?B
Nymphalidae	*Polygonia interrogationis*	Question Mark	-	-	-	4 Secure	G5, S3B
Sittidae	*Sitta canadensis*	Red-breasted Nuthatch	-	-	-	4 Secure	G5, S3
Vespertilionidae	*Myotis lucifugus*	Little Brown Myotis	Endangered	Endangered	Endangered	1 At Risk	S1

1. NPROT, National conservation status of species, as designated by COSEWIC.
Extinct (X) – A wildlife species that no longer exists.
Extirpated (XT) - A wildlife species that no longer exists in the wild in Canada but exists elsewhere.
Endangered (E) - A wildlife species facing imminent extirpation or extinction.
Threatened (T) - A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
Special Concern (SC) - A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.
Data Deficient (DD)- A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.
Not at Risk (NAR) - A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
2. SPROT=Provincial Rank/Status of Taxon.

Table 5. Records of species of concern within a 5 km radius of Welshtown Quarry, Shelburne County. Atlantic Canada Conservation Data Centre (ACCDC) Database, April 2020.

3. General Status of Wild Species Rank listed for Nova Scotia: 0.2=Extinct (Blue); 0.1=Extirpated (Purple); 1=At Risk (Red); 2=May be at Risk (Orange); 3=Sensitive (Yellow); 4=Secure (Green); 5=Undetermined (light grey); 6=Not Assessed (dark grey); 7=Exotic (Black); 8=Accidental (Aqua).
4. Atlantic Canada Conservation Data Centre (ACCDC).
5. GRANK, Global rarity rank of species, using CDC/NatureServe methods

G1 **Critically Imperiled**—At very high risk of extinction or elimination due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors.

G2 **Imperiled**—At high risk of extinction or elimination due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

G3 **Vulnerable**—At moderate risk of extinction or elimination due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

G4 **Apparently Secure**—At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.

G5 **Secure**—At very low risk or extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

GU **Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. NOTE: Whenever possible (when the range of uncertainty is three consecutive ranks or less), a range rank (e.g., G2G3) should be used to delineate the limits (range) of uncertainty.

GNR **Unranked**—Global rank not yet assessed.

G#G# **Range Rank**—A numeric range rank (e.g., G2G3, G1G3) is used to indicate the range of uncertainty about the exact status of a taxon or ecosystem type. Ranges cannot skip more than two ranks (e.g., GU should be used rather than G1G4).

Q **Questionable taxonomy that may reduce conservation priority**—Distinctiveness of this entity as a taxon or ecosystem type at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon or type in another taxon or type, with the resulting taxon having a lower-priority (numerically higher) conservation status rank. The "Q" modifier is only used at a global level and not at a national or subnational level.

C **Captive or Cultivated Only**—Taxon or ecosystem at present is presumed or possibly extinct or eliminated in the wild across their entire native range but is extant in cultivation, in captivity, as a naturalized population (or populations) outside their native range, or as a reintroduced population or ecosystem restoration, not yet established. The "C" modifier is only used at a global level and not at a national or subnational level. Possible ranks are GXC or GHC. This is equivalent to "Extinct" in the Wild (EW) in IUCN's Red List terminology (IUCN 2001).

T **Infraspecific Taxon** (trinomial)—The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T subrank cannot imply the subspecies or variety is more abundant than the species. For example, a G1T2 subrank should not occur. A vertebrate animal population, (e.g., listed under the U.S. Endangered Species Act or assigned candidate status) may be tracked as an infraspecific taxon and given a T-rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status.

SRANK, Sub-National (Provincial) Rarity Ranks

S1 Extremely rare throughout its range in the province (typically 5 or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation.

S2 Rare throughout its range in the province (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.

S3 Uncommon throughout its range in the province, or found only in a restricted range, even if abundant in at some locations (21 to 100 occurrences).

S4 Usually widespread, fairly common throughout its range in the province, and apparently secure with many occurrences, but the Element is of long-term concern (e.g. watch list). (100+ occurrences).

S5 Demonstrably widespread, abundant, and secure throughout its range in the province, and essentially ineradicable under present conditions.

S#S# Numeric range rank: A range between two consecutive numeric ranks. Denotes range of uncertainty about the exact rarity of the Element (e.g., S1S2).

SH Historical: Element occurred historically throughout its range in the province (with expectation that it may be rediscovered), perhaps having not been verified in the past 20 - 70 years (depending on the species) and suspected to be still extant.

SU Unrankable: Possibly in peril throughout its range in the province, but status uncertain; need more information.

SX Extinct/Extirpated: Element is believed to be extirpated within the province.

S? Unranked: Element is not yet ranked.

Table 5. Records of species of concern within a 5 km radius of Welshtown Quarry, Shelburne County. Atlantic Canada Conservation Data Centre (ACCDC) Database, April 2020.

SA	Accidental: Accidental or casual in the province (i.e., infrequent and far outside usual range). Includes species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range; a few of these species may even have bred on the one or two occasions they were recorded.
SE	Exotic: An exotic established in the province (e.g., Purple Loosestrife or Coltsfoot); may be native in nearby regions.
SE#	Exotic numeric: An exotic established in the province that has been assigned a numeric rank.
SP	Potential: Potential that Element occurs in the province, but no occurrences reported.
SR	Reported: Element reported in the province but without persuasive documentation, which would provide a basis for either accepting or rejecting (e.g., misidentified specimen) the report.
SRF	Reported falsely: Element erroneously reported in the province and the error has persisted in the literature.
SZ	Zero occurrences: Not of practical conservation concern in the province, because there are no definable occurrences, although the species is native and appears regularly. An NZ rank will generally be used for long distance migrants whose occurrences during their migrations are too irregular (in terms of repeated visitation to the same locations) or transitory. In other words, the migrant regularly passes through the province, but enduring, mappable Element Occurrences cannot be defined.

Table 6. Provincially listed species of concern with potential to occur in the vicinity of the project site (~10 km). Nova Scotia Museum records (A. Cross, NS Museum, personal communications, 2020).

Scientific Name	Common Name	SARA	COSEWIC (NPROT[1])	NS ESA (SPROT[2])	General Status of Wild Species Rankings[3]	AC CDC [4] Rankings (GRANK, SRANK[5])
Other						
Euthamia graminifolia	Flat-top goldenrod	-	-	-	5 Undetermined	G5, S5
Erioderma mollissimum	Vole ears lichen (Graceful felt lichen)	Endangered	Endangered	Endangered	2 May Be At Risk	G4G5, S1S2
Erioderma pedicellatum	Boreal felt lichen	Endangered	Endangered	Endangered	1 At Risk	G2G3, S1
Fuscopannaria sp.	Fungi	-	Threatened	-	2 May Be At Risk	S2S3
Lechea intermedia	Largepod pinweed	-	-	-	4 Secure	G5, S4
Rubus idaeus	Common red raspberry	-	-	-	4 Secure	G5, S5

1. NPROT, National conservation status of species, as designated by COSEWIC.
Extinct (X) – A wildlife species that no longer exists.
Extirpated (XT) - A wildlife species that no longer exists in the wild in Canada, but exists elsewhere.
Endangered (E) - A wildlife species facing imminent extirpation or extinction.
Threatened (T) - A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
Special Concern (SC) - A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.
Data Deficient (DD)- A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.
Not At Risk (NAR) - A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
2. SPROT=Provincial Rank/status of taxon & Provincial GS Rank.
3. National General Status of Wild Species Rank listed for Nova Scotia: 0.2=Extinct (Blue); 0.1=Extirpated (Purple); 1=At Risk (Red); 2=May be at Risk (Orange); 3=Sensitive (Yellow); 4=Secure (Green); 5=Undetermined (light grey); 6=Not Assessed (dark grey); 7=Exotic (Black); 8=Accidental (Aqua).
4. Atlantic Canada Conservation Data Centre (ACCDC).

Table 6. Provincially listed species of concern with potential to occur in the vicinity of the project site (~10 km). Nova Scotia Museum records (A. Cross, NS Museum, personal communications, 2020).						
Scientific Name	**Common Name**	**SARA**	**COSEWIC (NPROT[1])**	**NS ESA (SPROT[2])**	**General Status of Wild Species Rankings[3]**	**AC CDC [4] Rankings (GRANK, SRANK[5])**
5. GRANK, Global rarity rank of species, using CDC/Nature Serve methods; SRANK, Sub-National (Provincial) Rarity Rank.						

4.2.10 NATURAL AREAS & WILDERNESS

The Shelburne area where the quarry is located is a relatively remote and undeveloped location in Nova Scotia. Situated in Southwest Nova Scotia along the South Shore, the area has a relatively high proportion of wilderness and natural areas both inland and along its coast. Although settlement and consequent expansion and logging in the past changed the character of the landscape, much of the land has returned to forest in most areas, although logging activity is currently taking place in a recent stage of forest harvesting. A high proportion of Crown Land in the area has been devoted to protected and managed wildlife areas, leaving many natural and untouched areas, including the Roseway River Wilderness Area, Bowers Meadows Wilderness Area and Tidney River Wilderness area, as well as a number of nature reserves (Figure 41). Wild land allows preservation for wildlife, hunting and outdoor recreation which are important to locals and visitors to the area. People living in these areas are exposed to the natural environment day-to-day and appreciate the presence of, and access to, undeveloped land and nature, while accepting the usual activities needed to use the resources (e.g. aggregate quarries, forestry operations) on which many of them depend for their livelihood.

Shelburne County is also one of five counties that make up the Southwest Nova Biosphere Reserve (SNBR) (Figure 40). The SNBR is a UNESCO designated and internationally recognized unique region of natural and cultural heritage. It encompasses terrestrial and coastal ecosystems and promotes the conservation of

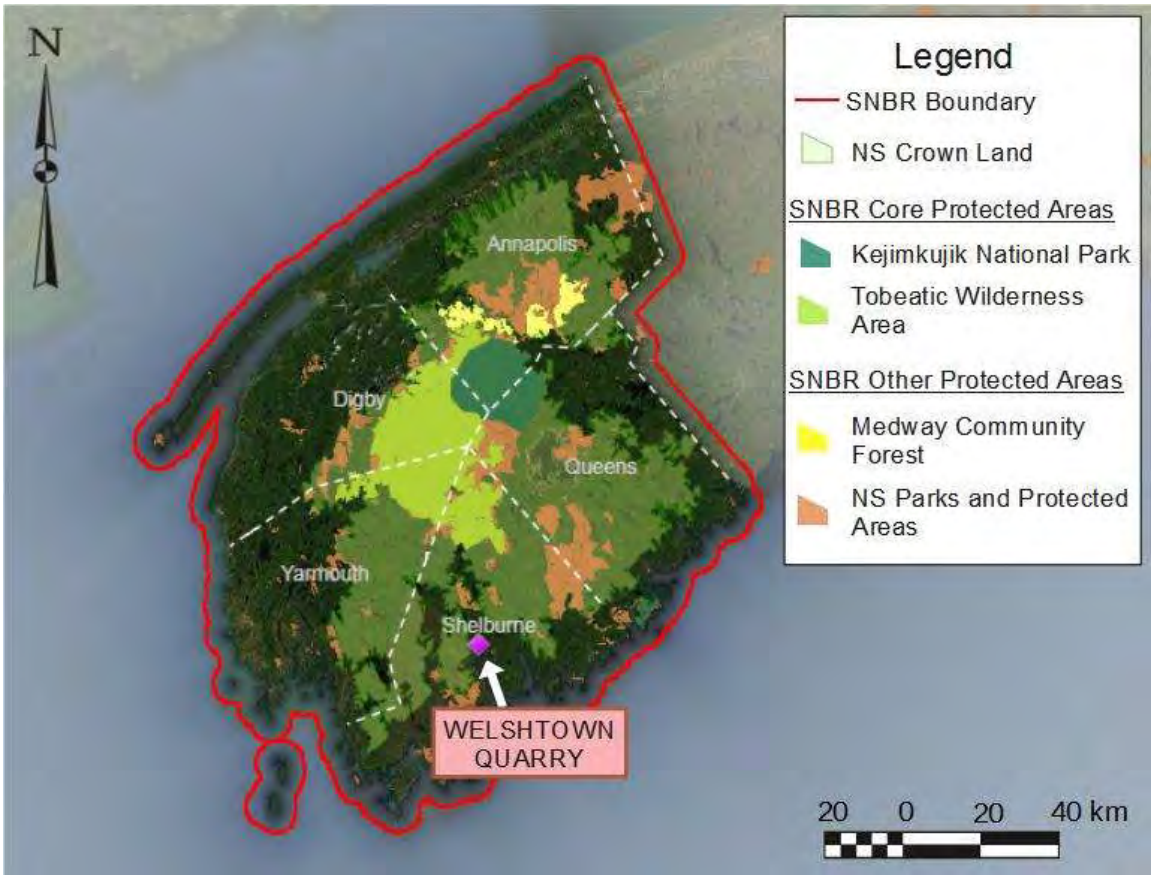

Figure 40. Southwest Nova Biosphere Reserve (SNBR).

biological diversity and contributes to the maintenance of healthy ecosystems. The bioreserve also provides an opportunity to learn about natural systems and how they are changing as well as traditional forms of land use through knowledge sharing and collaborative management (SNBR 2020). The Welshtown Quarry is located within the SNBR, however, is not on any specific protected areas within Biosphere.

4.3 HUMAN USES OF THE ENVIRONMENT

4.3.1 MI'KMAQ

The Mi'kmaq maintain aboriginal claim to all of the landmass of Nova Scotia, and the Province of Nova Scotia maintains a policy that proponents of industrial development projects engage with the Mi'kmaq concerning their activities. The nearest Mi'kmaq communities to the study site are Acadia First Nation and Bear River First Nation. Acadia First Nation's geographical composition spreads through the Southwestern regions of Nova Scotia spanning five counties from Yarmouth to Halifax and lands are accessed throughout the region for various uses such as hunting and fishing, as well as traditional ceremonial activities. The nearest Acadia communities to the study area are in Yarmouth and Queens Counties. The Yarmouth Reserve situated in Yarmouth County is approximately 100 km west of the study site. The Medway Reserve and Wildcat reserve are both in Queens County at a similar distance of approximately 100 km northeast

of the study site. In addition to the five separate reserves, Acadia First Nation has two separate land holdings, including one in the Town of Shelburne, where many Band members live off reserve. The sub-office located in Shelburne serves off-reserve members in the Lockeport, Shelburne, Barrington and surrounding areas. The Bear River First Nation is located in both Annapolis and Digby Counties and is situated approximately 100 km northwest of the study site.

The study area for Welshtown Quarry is in what was once was the Mi'kmaw territory known as Kespukwitk, meaning 'land eel territory' (CRM 2020). Lakes and watercourses in this area would have provided important transportation corridors and provided a resource base for the Mi'kmaq, their ancestors and predecessors prior to the arrival of European settlers. In particular, the Roseway River is part of an intricate system of waterways which facilitated travel and access to resources between the Bay of Fundy and Annapolis Basin to the Atlantic Ocean (Robertson 1983 from CRM 2020). Roseway River and Shelburne Harbour share the Mi'kmaq name *So'qmkiknuk*, meaning 'At the place where the pole us used to push (instead of paddling)' (Ta'n Weji-sqalia'tiek 2015 from CRM 2020). There are no registered Mi'kmaq archaeological sites within the study area perimeter, however the Roseway River Quartz Scatter Site, traditionally used for scattering quartz flakes, is within a one-kilometer radius. Three additional pre-contact sites within a five-kilometer radius are also associated with access to water: The Carlyle Bower Site, The Eel Weir Site, and a third unnamed site. These sites were traditionally used for general community activities, for fishing, and as a site of possible burial or historic field clearing activities, respectively (CRM 2020). Presently, no significant Mi'kmaq cultural activities occur in or around the study area although traditional fishing continues in the general area of Shelburne.

Two tribal councils exist in Nova Scotia: The Confederacy of Mainland Mi'kmaq (CMM) and Union of Nova Scotia Indians (UNSI). CMM is a not-for-profit organization incorporated in 1986, whose mission is to promote and assist Mi'kmaq communities. The UNSI, created in 1969, was formed *to provide a cohesive political voice for Mi'kmaq people.* The Native Council of Nova Scotia (NCNS) represents Mi'kmaq living off reserve. The NCNS is a self-governing agency located in Truro. The Office of Aboriginal Affairs in Nova Scotia estimates that approximately 35% of Mi'kmaq live off reserve. The goal of NCNS is "to operate and administer a strong and effective Aboriginal Peoples Representative Organization that serves, advocates and represents our community."

The Mi'kmaq Rights Initiative (Kwilmu'kw Maw-klusuaqn; KMK) also represent a number of the First Nations in Nova Scotia. The mission of KMK—whose name means, "we are seeking consensus"— is "to address the historic and current imbalances in the relationship between Mi'kmaq and non-Mi'kmaq people in Nova Scotia and secure the basis for an improved quality of Mi'kmaq life." KMK's objective is to negotiate between the Mi'kmaq of Nova Scotia whom it represents, the province and the Government of Canada, and operates from its main office in Millbrook. The Atlantic First Nations Environmental Network (AFNEN) is an environmental organization of Mi'kmaq communities and organizations. The CMM and UNSI are members of the AFNEN, with the Mi'kmaq Confederacy of PEI in Charlottetown currently the acting coordinator. The AFNEN includes a representative from each Mi'kmaq organization and community interested in environmental issues. The Network meets regularly during the year through meetings, conferences, and the Internet to discuss environmental matters or concerns. Two First Nations— Millbrook First Nation, and Sipekne'katik (Indian Brook) operate independently of these organizations. Millbrook is situated outside Truro and includes activities in Cole Harbour, Sheet Harbour, and Beaver

Dam. Sipekne'katik First Nation is one of 13 First Nations and is the second largest Mi'kmaq band in Nova Scotia. Sipekne'katik First Nation includes the communities of Indian Brook, New Ross, Pennal, Dodd's Lot, Wallace Hills and Grand Lake.

4.3.2 POPULATION AND ECONOMY

The Welshtown Quarry is located in the Municipality and District of Shelburne, the municipal unit occupying the eastern section of Shelburne County. Shelburne Municipality has a population of approximately 4,290, making it one of the smallest municipalities in Nova Scotia, and population has been declining slowly over the past several decades, dropping 2.7% between 2011 and 2016 (Statistics Canada 2017). The main population centers in the Municipality and District of Shelburne are in the Town of Shelburne (population 1,743 (2016)) and Lockeport (population 531 (2016)), supporting almost half of the municipality's total population (Statistics Canada 2017). The Town of Shelburne is the largest population center nearest to the study site.

Local economies in Shelburne County are tied primarily to fishing and forestry, and their communities face some of the similar challenges as elsewhere in Nova Scotia, including lack of economic growth and an aging population (NSDMA 2019). Lobster fishing dominates the marine fishing industry in Shelburne County, providing employment opportunities through year-round harvesting, processing and exporting of the species. Manufacturing, and shipbuilding and repair facilities also support the fishing industry in the area. As of 2018, Shelburne County accounted for almost half of all aquaculture production in the province with approximately 101 full- and part-time employees. Licensed seafood buyers in Shelburne County recorded the highest value of seafood purchases in 2017 with $230,315,328 for a total of 24,248,322 kgs of seafood of all species (Johnson 2018). Forestry is a common occupation inland, and has been for generations. Health care and social assistance is also a significant sector in Shelburne County providing important sources of income. The annual median family income of the Municipality and District of Shelburne is $28,535 – lower than the median of Nova Scotia ($31,813) (Statistics Canada 2017).

4.3.3 WATER SUPPLY AND RESIDENTIAL WELLS

Drinking water for the County of Shelburne is provided by both public and private water systems. The public water supplies are surface water sources originally developed to supply fish plants in the area and include the Town of Shelburne and the Town of Lockeport. The Town of Shelburne public water system is supplied by Rodney Lake and provides water to various commercial, industrial and institutional operations and approximately 10% (approximately 170 people) of the town residences (CBCL Limited 2015). Similarly the Town of Lockeport water supply is from Hayden Lake and provides water to three residential homes and twelve commercial, industrial and institutional facilities (Drage et al. 2016).

The majority of Shelburne County residents (approximately 99%) rely on private wells (Drage et al. 2016). Both drilled and dug wells are used as drinking water sources in the Welshtown and Shelburne area. Two homes on groundwater wells, are located within 1 km of the study area; however neither are within 800 m of the quarry. Of homes outside 1km, dug wells are used at 10761, 10721 and 10712 Upper Clyde Road, and a drilled well at 44 Powerdam Road.

4.3.4 LAND USE

Land in the vicinity of the quarry is predominantly wilderness and undeveloped forest land, with rural residential use concentrated along the Upper Clyde Road and in the coastal community of Shelburne (Map A-2). Two residences are located along Powerdam Road, a side street 150 m southeast of the entrance to the quarry site. There is limited forestry and commercial use (e.g. quarries) in the area and there are a few residences, small woodlots, and home-operated businesses found nearby. Travel routes are used by tourists and outdoor recreational enthusiasts. Hunting, trapping and commercial fishing based in Shelburne are important local activities. Land ownership in the vicinity is a mix of privately-owned land and Crown land (Map A-3).

4.3.5 HUNTING AND TRAPPING

Lands in the vicinity of the Welshtown quarry site support many of the common game and fur-bearing species characteristic of Nova Scotia in general, including some less common fur-bearing species, such as Canada Lynx and American Marten. Some hunting or trapping activity may take place in the general vicinity of the site, although trapping statistics indicate that the Shelburne County has a small harvest of most species. White-tail Deer are common; the County typically ranks among the highest for deer harvest in the province. The main furbearers trapped in the five-year period (2014 to 2018) were beaver, muskrat and mink. No lynx were reported trapped, however four American Marten were trapped incidentally. Snowshoe Hare and Ruffed Grouse are the most commonly hunted upland game (Table 7). Moose are not important for hunting in the area as the western region of Nova Scotia, including Shelburne County, is not zoned for moose hunting (NSDLF 2020).

Table 7. Five-year summary of wildlife harvested in Shelburne County and Nova Scotia (NSDLF 2020).

Animal	Shelburne County Reported Harvest	Provincial Reported Harvest	Percent (%) of total for province
LARGE MAMMALS			
Deer (Zone 101)	6,799	45,294	15.0%
Bear	35	1,780	2.0%
UPLAND GAME			
Snowshoe Hare	9,790	347,328	2.8%
Ruffed Grouse	1,356	206,282	0.7%
Ring-necked Pheasant	11	20,762	0.1%
FUR HARVEST			
Beaver	599	12,422	4.8%
Muskrat	1,770	43,133	4.1%
Otter	43	1,486	2.9%
Mink	420	4,167	10.1%
Bobcat	183	3,911	4.7%
Fox	20	1,962	1.0%
Racoon	167	5,147	3.2%
Skunk	0	160	0.0%

Squirrel	42	2,305	1.8%
Weasel	53	1,315	4.0%
Coyote	334	10,675	3.1%
Canadian Lynx*	0	14	0.0%
American Marten*	4	21	19.0%
Fisher	24	565	4.2%
Total Furbearers	**3,659**	**87,283**	**4.2%**
*Trapped incidentally. Trappers Association of Nova Scotia prepares incidental pelts for auction and all proceeds go to the NS Species at Risk Conservation Fund.			

4.3.6 FORESTRY & AGRICULTURE

Forestry and agriculture contribute to the mix of industries in the County of Shelburne, but the impact is relatively small compared with the rest of Nova Scotia. Small private woodlots comprise of nearly half (approximately 49.2%) of the total productive forest area of Western Nova Scotia including Kings, Annapolis, Yarmouth, Shelburne, Queens and Lunenburg Counties; public land accounts for 37%, private industrial lands, 6.3% and 7.7% is non-forested (WWSC 2020). A review of harvest volumes by county shows a consistent volume of non-industrial, private harvesting has occurred in Shelburne County, with no dramatic losses or increases between the years 2006 to 2016 (Williams 2018). In the vicinity of the Welshtown Quarry, there is an operating private woodlot located north of the quarry property.

Farming is not a large economic sector in Shelburne County, including in the immediate study area. Shelburne County farms reported a total of over $3 million in gross farm receipts in 2010, accounting for 0.56% of all receipts in Nova Scotia. Main agricultural activities include greenhouse, nursery and floriculture production, fruit and tree nut, and other animal production (NS Federation of Agriculture, online, 2017). Little agricultural activity in Shelburne County is largely due to the terrain and lack of agricultural land, although in the early days of settlement, local agriculture was more important.

4.3.7 RECREATIONAL, COMMERCIAL, AND MI'KMAQ FISHING

Commercial fishing takes place from the community of Shelburne. Continental Seafoods, a division of Clearwater Seafoods, employs approximately 90 people and operates two vessels out of the Town of Shelburne, primarily fishing sea scallops, and also operates a preparation and packaging plant that produces cured, salted, dried, and pickled fish as well as fresh or frozen shellfish and lobster and fish roe. Sandy Point Lobster Ltd and True World Foods Inc. of Canada are two wholesale seafood distributers in Shelburne County that mainly export live lobster and other fish, to Asia and the United States.

Recreational fishing provides an important resource and pastime for residents and visitors to Shelburne County and marine fisheries are the mainstay of coastal communities. The study area itself is not particularly important for freshwater recreational fishing but rivers and lakes in the area including Roseway River, Dexter's Lake, North and South Churchover Lakes, Round Bay, Lake George, Clam and Horseshoe lakes and Clyde River are fished recreationally for Chain Pickerel, Brook Trout, Smallmouth Bass, and Atlantic salmon, and Beaver Dam Lake supports ice fishing for Brook Trout and Rainbow Trout (NSDFA 2020). Locals and visitors to Shelburne also partake in recreational ocean fishing for Atlantic

Mackerel in Birchtown Bay or off the Gunning Cove government wharf in the Town of Shelburne. Mi'kmaq residing in the area likely use the recreational fishing resource as well. Other streams in the area are either too small, are not accessible, or have too steep a gradient to promote fishing.

4.3.8 HISTORICAL, ARCHAEOLOGICAL AND PALAEONTOLOGICAL RESOURCES

The study area is part of the greater Mi'kmaw territory known as *Kespukwitk* (CRM 2020). Mi'kmaq originally occupied the area, with Europeans settling around Shelburne Harbour in the late seventeenth century, despite earlier known European fishing operations. Between 1693 and 1722, the large, natural harbour was utilized by the Acadians and then by the New England privateers, whose attempt at a permanent fishing station was raided by the Mi'kmaq, and the area was then raided again by pirate Ned Low who commonly raided fishing fleets at harbours and fishing stations in Nova Scotia (CRM 2020).

The Town of Shelburne, approximately 2 km southeast of the study area, was settled by thousands of Empire Loyalists after the American Revolutionary War in 1783. The Empire Loyalists cleared lines for streets and town blocks and were granted a series of thirteen 50 acre lots located north of the town plot. Early census data shows approximately 16, 000 inhabitants of Shelburne at its peak in 1786, but then rapidly declined as a result of taxes and duties imposed by the government. Shipbuilding and boat building were Shelburne's primary industry in the 1820s. In 1818, a small group of settlers from Wales formed the community of New Cambria, later called Welshtown, situated approximately 6 km north of the study site.

The Black Loyalist community of Birchtown, approximately 3.5 km southwest of the study area, is associated with 27 archaeological sites. The Southerland Enclosure Site is the nearest registered archaeological site located approximately one kilometer southeast of the study site and consists of a five-sided rock wall enclosure (CRM 2020). There are four other sites that make up the Birchtown Complex of domestic and/or agricultural sites located between three and 5 km from the study site (CRM 2020).

Prior to the arrival of European settlers, Mi'kmaq would have used the streams, lakes and wetlands surrounding the study area as a means of transportation and resource base. The Welshtown Quarry site likely lacks the environmental features that would have been suitable for encampments and there are no registered Mi'kmaq archaeological sites within the study area. Several nearby areas, however, are registered archeological sites including the Roseway River Quartz Scatter site located approximately 740 meters to the east of the study site as well as Carlyle Bower Site (2 km), Eel Weir Site (5 km) and an unnamed burial or historic field clearing site (2 km). These areas are located along the Roseway River, which would have also been a historically important area as a resource base and transportation route (CRM 2020).

Archaeology database searches show no records of archaeological sites within the study area (CRM 2020). Based on the lack of evidence of historic land use in the vicinity of the Welshtown Quarry site; site reconnaissance and the absence of signs of settlement; and other limiting physical factors such as the numerous surface boulders and steep slopes, the study area is considered to have low potential for encountering precontact and/or early historic Mi'kmaq and/or Euro-Canadian archaeological resources (CRM 2020).

4.3.9 PARKS AND PROTECTED AREAS

The Province of Nova Scotia actively protects natural landscapes and promotes and supports nature-based recreation and conservation through its Provincial Parks and Wilderness Areas system, and through other management and protection means. Several wilderness and protected areas, and provincial parks, have been designated in the general area of the study site including five wilderness areas, four conservation lands, six nature reserves, four Provincial park and one bird sanctuary. There are also two managed areas with some level of protection for wildlife in the vicinity of the study site: the Granite Village/East Pubnico Rail Corridor and the Battery Point Spur Rail Corridor (ACCDC 2019) (Table 8, Figure 41). Types of parks and protected areas shown in Table 8 include:

Wilderness Areas are provincially-significant areas that protect representative examples of natural landscapes, native biological diversity, and outstanding natural features of Nova Scotia. They are used for scientific research, education and a variety of recreation and nature-tourism related activities such as hiking, canoeing, sea-kayaking, sport-fishing and hunting. These areas are designated under Nova Scotia's *Wilderness Areas Protection Act*.

Nova Scotia Nature Trust's Conservation Lands are protected areas that are safeguarded and stewarded for the purposes of nature conservation. The properties have come under the care of the Nature Trust through donation, part-donation, purchase, or conservation easement and protects Nova Scotia's rare, outstanding and unique natural areas while fulfilling landowner wishes to permanently protect the natural legacy that so many of them have proudly stewarded for generations.

Nova Scotia Nature Reserves are established to preserve and protect areas representative of natural ecosystems and associated plant and animal species. Scientific research and education are the primary uses of nature reserves and recreation is generally restricted. These areas are protected under the *Special Places Protection Act*.

Provincial Parks protect provincially or regionally significant natural heritage values such as coastlines and beaches, scenic views, diverse landscapes, forests, and lakes and rivers, for recreational use and general enjoyment by residents and tourists. Provincial Parks are important in conserving biodiversity as well as contributing to a high quality nature experience for users of the parks and economic development for nearby communities. Provincial Parks are established under the *Provincial Parks Act*.

National Wildlife Areas are created to conserve nationally significant habitat for wildlife, and to provide opportunities for research and interpretation. Environment and Climate Change Canada uses an ecosystem approach to manage and plan national wildlife areas and controls human activity in them to minimize impact. National Wildlife Areas are established under the *Canada Wildlife Act*.

Managed Areas are classified by the Atlantic Canada Conservation Data Center (ACCDC) as a variety of official sites which have some level of legal protection for wildlife within their boundaries.

Table 8. Parks and protected areas within a 20 km radius of Welshtown Quarry, Shelburne County. Province of Nova Scotia, Nova Scotia Environment Database, 2020.

Name of Site	Primary Type of Protection	Protection Status	Area (ha)
Battery Point Spur Rail Corridor	Managed Area	-	1 km in length
Bowers Meadows Conservation Lands	Land Trust Property	Considered Protected	241
Bowers Meadows Wilderness Area	Wilderness Area	Designated (1998)	4,120
Bowers Meadows Wilderness Area Addition	Wilderness Area	Pending Designation	30
Ghost Antler Nature Reserve	Nature Reserve	Designated (2015)	1,007
Granvite Village/Lower East Pubnico Rail Corridor	Managed Area	-	130 km in length
Harpers Lake Nature Reserve	Nature Reserve	Pending Designation	401
Hemeon's Head Conservation Lands	Land Trust Property *and* Conservation Easement	Considered Protected (2013)	130
The Islands Provincial Park	Provincial Park	Designated	54
Louis Head Provincial Park	Provincial Park	Pending Designation	7
Northwest Brook Nature Reserve	Nature Reserve	Designated (2016)	270
Northwest Brook Nature Reserve (subject to mineral interests)	Nature Reserve	Designated (subject to mineral interests)	130
Port L'Hebert Nature Reserve	Nature Reserve	Designated (2015)	691
Quinns Meadows Conservation Lands	Land Trust Property	Considered Protected (2009)	359
Quinns Meadows Nature Reserve	Nature Reserve	Designated (2004)	392
Roseway Beach Provincial Park	Provincial Park	Pending Designation	18
Roseway River Wilderness Area	Wilderness Area	Designated (2016)	1,691
Round Bay Conservation Lands	Land Trust Property	Considered Protected	102
Sable River Bird Sanctuary	Migratory Bird Sanctuary	Designated (1941)	260
Sable River Provincial Park	Provincial Park	Designated	54
Tidney River Wilderness Area	Wilderness Area	Designated (1998)	22,700
Tidney River Wilderness Area (subject to mineral interests)	Wilderness Area	Designated (subject to mineral interest)	113

Figure 41. Parks and protected areas in the general vicinity of the Welshtown Quarry.

4.3.10 RECREATIONAL/CULTURAL FEATURES

Residents and visitors to Shelburne County access natural areas for a wide range of outdoor recreation activities. In the Shelburne area, the predominant outdoor recreational activities are sightseeing, walking/hiking, birding, beachcombing, camping, boating (i.e., kayaking and canoeing), hunting and angling. There are frequently used hiking trails along the abandoned CN railway that has been converted into multi-use trails through the Rails to Trails Program including the Shelburne Rail Trail, Tom Tigney Trail, Footbridge Trail, Jordan River Trail, Roseway River Trail, and Woodland Multi-Use Trail. The Islands Provincial Park overlooks Shelburne Harbour and is frequented by locals and visitors for its wooded camp sites and beach access providing paddling and boating opportunities (Figure 42). Carleton River Beach's white sands are frequented by locals for dog walking, swimming, and exploring while the Roseway Beach offers ocean swimming from a breakwater, freshwater swimming, bird watching and surfing. The inland Welkum Municipal Park offers freshwater lake swimming and day-use picnic areas along Welshtown Lake (Figure 43). Shelburne Harbour Yacht Club and Marina offers guided boating excursions and rentals. Roseway River is a popular paddling route for sightseeing, angling and birding. (Boulder Cover Cottages, personal communication, July 2020).

Figure 42. The Islands Provincial Park located in Shelburne offers wooded campsites, an unsupervised beach and a boat launch (located approximately 2.5 km southeast of the Welshtown Quarry).

Figure 43. Local recreational beaches.

4.3.11 RESIDENTIAL USE

There are few residences in the vicinity of the Welshtown Quarry, located mainly along the Upper Clyde Road (Map A-3). Lot sizes are large and may include surrounding tracts of forested land. Lifestyles of the residents of the general area tend towards younger individuals engaged in economic activities such as fishing in the area (Boulder Cover Cottages, personal communications, July 2020), retirees maintaining

their homes and properties, and residents working locally. Residents use the area and backcountry for recreation such as walking or hiking, canoeing or kayaking, and use of ATVs and snowmobiles, as well as for access to natural resources (e.g. firewood). The quarry is approximately 2 km from the town of Shelburne, where residents can access various local services as well as recreational amenities such as coastal walking trails and ecotourism businesses (Candlebox Kayaking, Shelburne Sailing School Association, Geo Trail Adventure Geocaching).

4.3.12 COMMERCIAL/INDUSTRIAL DEVELOPMENT

No active commercial establishments are in the immediate vicinity of the study area, but logging occurs on private properties within the vicinity of the study site on Upper Clyde Road. Most commercial activity occurs in the towns of Shelburne and Birchtown and centres on tourism and fishing, including rental cottages (e.g. Roseway River Cottages located on the other side of the Roseway River, 47 Riverview Drive), a large garden centre (Spencer's Garden Center, 5 Ohio Road) and a fishing supply store (Vernon D'Eon Fishing Supplies Ltd, 42 Falls Lane).

The Roseway Hydro system, a hydroelectric dam on the Roseway River, is located at the end of Powerdam Road approximately 1 km east of the study site. The dam has not generated electricity since 2009. The system encompasses 524 km^2 of the Roseway watershed and features four dams with one powerhouse and a fishway for fish passage (NSPI 2018).

4.3.13 TOURISM AND VIEWSCAPE

Tourism is an important element in the economy in the vicinity of Welshtown and the Town of Shelburne, centred on nature and outdoor recreational activities, including angling and hunting, hiking, paddling, and beachcombing. The area was historically the home of the United Empire Black Loyalist, the largest free black settlement outside of Africa, and attracts tourists to the area. The Black Loyalist Heritage Centre in Birchtown showcases the site of the largest free Black settlement which occupied the area in the 1780's. The Centre includes historic buildings as well as presentations on the Black Loyalist journey from Africa to the American colonies then to Nova Scotia and back to Africa. Shelburne County Archives and Genealogical Society in the Town of Shelburne also offers resources for tracing family history or for conducting research on Nova Scotia's rich history. Many of the recreational attractions for locals (see Section 4.3.10) are also appealing to tourists. The area offers significant coastal views including from The Islands Provincial Park, on the shores of Shelburne's large, natural harbour and from several sand beaches along Water Street through the town of Shelburne and the coastal Sandy Point and Shore Roads.

Highways in the area pass through scenic forested landscapes or along the coast with ocean views. The quarry is not visible from the Upper Clyde Road (Figure 44) but may be visible in the distance from Highway 103 east of the site.

Figure 44. Welshtown Quarry entrance along Upper Clyde Road, facing west, June 9, 2020.

4.3.14 TRANSPORTATION

Comparatively low levels of truck and equipment traffic are expected to originate from the Welshtown Quarry, due mainly to the generally low level of industrial and economic activity and consequent need for aggregate in the area. Upper Clyde Road, which runs past the quarry site, is a local paved road that connects the communities along the west side of Roseway River (Welshtown and Upper Clyde) with Highway 3, the main coastal route in the area. Upper Clyde Road supports mainly traffic arising from the quarry and local traffic of residents in the area for local activities and to access the more populous areas including the Town of Shelburne. The intersection of Upper Clyde Road and Highway 3 is important as the highway is a busy local thoroughfare and most of the truck and equipment traffic from the Quarry passes through it. Local use of Highway 3 includes shipping fish products, pulp logs, and gravel operations in addition to the traffic associated with the quarry, which is typically seasonal. Roads in the area support moderate traffic in comparison to the Highway 103, the main, east-west highway from the city of Halifax to the south shore and Yarmouth. Traffic volumes for Highway 3 (Reids Hill to Birchtown) have ranged from 193 to 487 vehicles per day (annual average of 160 to 440 vehicles per day) in the 2006 to 2018 period. In contrast, traffic on Highway 103, the main provincial highway connecting Halifax to Yarmouth on the south shore, shows a much larger traffic volume. Average daily traffic ranges from 3,072 to 3,726 vehicles per day (annual average of 2,540 to 3,340 vehicles per day) travelling between the town of Shelburne and Birchtown (Exits 26 and 27) and 2,513 to 3,059 vehicles per day (annual average of 2,100 to 2,740 vehicles per day) travelling between the Town of Shelburne and the end of the Shelburne by-pass (Exits 26 and Exits 25 respectively) over a comparable period (Nova Scotia Open Data Portal 2020). When operating, the Welshtown Quarry contributes truck traffic and some heavy equipment traffic (e.g.,

trucks, crushers, asphalt trucks, etc.) in the vicinity of the site, typically in the summer and fall construction seasons. Most of the equipment leaving the quarry, and production equipment moved to the Welshtown Quarry, takes place along the Highway 3 to Ohio Road and on to Highway 103. Access to the quarry from Upper Clyde Road is unobstructed with good sight lines, and similarly the nearby intersection with Highway 3 is clear. Neither are expected to be hazardous (Figure 45).

5 ENVIRONMENTAL IMPACTS, SIGNIFICANCE, AND MITIGATION

5.1 ASSESSMENT APPROACH AND METHODS

Information for the assessment was obtained from consultants' personal knowledge, from reviews of available information, and knowledge of the purpose and proposed design of the project. The environmental assessment follows *Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia* (NSE September 2009) and uses assessment methodology typical for environmental assessment screenings of this kind. For this assessment a list of valued environmental components (VECs)[6] (also known as VCs)[7], and project activities and outcomes for the expansion of the existing quarry were developed, and the potential for interactions of these activities with VECs was identified. Where interactions were identified, and there was potential for significant impacts if mitigation was not undertaken, mitigating actions or activities have been suggested that will avoid the impact or reduce it to acceptable levels before the project proceeds. The process ensures that all potentially significant impacts on VECs are identified and all potential impacts on them have been considered, and sufficient mitigation planned.

5.2 VALUED ENVIRONMENTAL COMPONENTS

The list of Valued Environmental Components considered for the assessment, and interactions with project components, are presented in Table 7. The environmental effects and potential impacts of the project along with their significance and suggested mitigations are outlined in the following and are summarized in Tables 8 and 9.

6 Valued Environmental Components (VECs) are features or things in the environment, which are particularly important either ecologically, socially, economically or culturally. The environmental assessment addresses potential interactions of the project with each VEC identified and assesses potential impacts. The process followed involves identifying all the activities or outcomes of the project, which interact with each VEC, and then determining and rating the magnitude of the impact in a standard way, in this case in a manner guided by standard approaches that have been developed for environmental assessments.

7 Valued Environmental Components (VECs) and Valued Components (VCs) are equivalent. Use of the acronym VC was used in environmental assessments carried out under the federal environmental assessment process under the Canadian Environmental Assessment Act (2012) and is recommended to be used in assessments carried out under its replacement, the federal Impact Assessment Act (IAA) (2019).

Table 8. Valued Environmental Components (VECs) for Welshtown Quarry Expansion.

BIOPHYSICAL	SOCIO-ECONOMIC
Air Quality, Noise and Light	Mi'kmaq
Groundwater	Recreation, Tourism & Viewscape
Hydrology	Recreational, Commercial & Mi'kmaq Fishing
Water Quality	Archaeological, Cultural and Historical
Freshwater Aquatic Environments and Wetlands	Economy, Land Use and Value
Terrestrial Environments	Transportation
Fish & Fish Habitat	Residential Use
Flora & Fauna & Habitat	Commercial /Industrial Use
Species at Risk	Water Supplies & Residential Wells
Natural Areas & Wilderness	Parks & Protected Areas
	Forestry, Hunting & Trapping

5.3 SOCIOECONOMIC IMPACTS

5.3.1 MI'KMAQ

The Mi'kmaq maintain a general interest in all lands in Nova Scotia and claim they have never surrendered, ceded, or sold the Aboriginal title, and that they claim all of Nova Scotia. As co-owners of the land and its resources, they expect that any potential impacts to rights and title be addressed. Mi'kmaq occupied much of Nova Scotia prior to European contact, and lands were used to varying degrees for habitation, hunting and fishing, as noted in Sections 4.3.1 and 4.3.8. In more recent times, treaties made with the British and continued through Canadian law have maintained their rights. Coastal areas in the vicinity of Shelburne, and freshwater bodies such Welshtown and Courtenay Lakes and the Roseway River system may have been used by Mi'kmaq, including as a transportation route as Mi'kmaq moved throughout the Province; however, there is low potential for occurrence of Mi'kmaq archaeological resources at the quarry site (CRM 2020).

Operation of the Welshtown Quarry will use land that would otherwise be occupied by terrestrial ecosystems and would not likely be used for Mi'kmaq activities or by other residents for activities such as nature walks and hunting or fishing (either recreationally or for subsistence). Best management practices used at the site will reduce any potential impacts quarry activities may have on water quality and quantity. The land area affected is small in relation to the available wildlife habitat in the area, and would not likely affect wildlife or fish populations, potentially used by Mi'kmaq, and there are unlikely to be cumulative effects of other activities in the area; consequently none of these effects are considered significant.

5.3.2 RECREATIONAL ACTIVITIES

Recreational use and nature appreciation of the environment in the vicinity of the site consists principally of water-based recreation along the Roseway River, tourist cottages, walking/hiking, camping, hunting, fishing, and home-based recreation (e.g. gardening) concentrated around Shelburne and along Upper

Clyde Road. Only activities associated with Upper Clyde Road are likely to be affected by quarry activities—principally by truck traffic—and then principally when the quarry is operating. Operations at the quarry would be cyclic, likely occupying several weeks during the construction season during the years in which the site is active, and the facilities are well maintained. Although quarry operations could likely be heard and residents would experience truck traffic and other effects of quarry operations, the frequency and scope of the quarry is not expected to increase from past use, and any impact on normal activities of residents as a result of the proposed quarry expansion are expected to be negligible.

5.3.3 TOURISM AND VIEWSCAPE

Welshtown Quarry is not expected to impact tourism and viewscape. The property is located approximately 700 m from Upper Clyde Road and is not currently visible from there, although it may be visible in the distance from Highway 103 east of the site. Truck and equipment traffic accessing and exiting the site onto the Upper Clyde Road and at the intersection with Highway 3 is expected to be the main interaction with tourists. This traffic is expected be occasional, will be similar now as in the future, and would likely be only a minor impediment to tourist vehicle traffic in the area. Both intersections have good sightlines, are well maintained, and do not present a particular safety concern; however, use of signage (e.g. “Trucks Turning”) during periods of onsite activity, would improve safety by alerting travelers. Lights, if present, at the site can be seen from immediate residents, but would be controlled by proper environmental management practices at the site. Overall the impacts on viewscape and tourism are expected to be negligible.

5.3.4 RECREATIONAL, COMMERCIAL & MI’KMAQ FISHING

Although the Roseway River in the immediate vicinity of the Welshtown Quarry supports fish in recreational and Mi’Kmaq fisheries, the Quarry does not influence any surface waters which will result in significant changes in flow regime or water quality in waterways downstream of the site. A minimum 30 m buffer will be maintained between the quarry site and the property line, and the nearest surface watercourse is more than 100 m from the quarry. There is no direct runoff from the quarry into adjacent streams and surface waters at the site have high quality, including low turbidity and neutral pH, which would lead to good quality of waters downstream for fish. Overall a negligible impact of the quarry on recreational, commercial, and Mi’Kmaq fishing is expected.

5.3.5 ARCHAEOLOGICAL/CULTURAL/HISTORICAL

The land proposed for the quarry expansion has low potential for pre-contact and/or early historic native or European archaeological resources (CRM 2020). Despite early use of the Shelburne area by European fishers, the area was not settled by Europeans until late in the seventeenth century and was not intensely settled until more recently, and then generally along travel routes. The quarry is set back from the Upper Clyde Road, and the adjacent land has not been used for agriculture and likely was used only for resource removal such as logging, trapping and hunting. If an archaeological feature of significance is encountered during quarry activities, particularly evidence of Mi’kmaq occupation, the effects will be reduced by halting operations and consulting with experts in the field to ensure the artifact or feature is not disturbed and is adequately documented and preserved.

5.3.6 ECONOMY, LAND USE AND VALUE

The fishing industry based in Shelburne and activities which support it, as well as forestry, hunting and trapping, and tourism, as well as rural-residential activities, are the major economic activities in the vicinity of the site and the study area as a whole. The land on the site is not suitable for agriculture, and aggregate production is among the only potential commercial uses of the area. Land in the general vicinity of the site is also designated for conservation and wildlife management and contains habitat for game species such as White-tailed Deer, which support hunting—an important activity for locals, visitors and Mi'kmaq alike. The expanded quarry will remove only a small fraction of available land for these purposes in the area, and therefore won't have a significant impact on these uses. Areas not required for the quarry will be preserved if possible, to assist in maintaining forest ecosystems and wetlands for wildlife, and to buffer adjacent areas from quarry activities. Quarry activities are also not expected to impact existing residential, industrial or conservation and scientific use of nearby areas. As the scope and frequency of activities are not expected to change from past use, residential property values in the area are not expected to change significantly. The existing quarry has been operating at the site with little to no impact, while providing economic development and a source of aggregate for local construction projects.

5.3.7 TRANSPORTATION

Welshtown Quarry will generate a comparatively low level of truck traffic on highways in the area, but activity levels are not expected to increase significantly, and consequently the quarry is not expected to change the existing traffic volumes significantly. During periods of site operation, signage for truck and equipment operators, as well as the surrounding communities will be placed to help avoid dangerous situations at the quarry entrance.. Safe use of the road and avoidance of accidents is essential, both for human impacts and the potential impacts of vehicle accidents and spills on the local watercourses and environments. Warning signs and speed limits can be placed in areas leading to the quarry, in particular when the quarry is operating, to improve safety. Equipment and truck operators for the quarry will be given instruction on safe and environmentally acceptable procedures. With suitable foresight and care, overall the impact of the project on transportation and safety is expected to be minimal, will little / no charge from previous operations at the quarry.

5.3.8 RESIDENTIAL USE

Quarry activities can potentially interfere with normal use and enjoyment of nearby residential properties by creating background noise, and through truck and equipment traffic and dust, which some residents may find objectionable. The property is located approximately 2 km from Shelburne and is not visible, and there are few residents in the vicinity, located along Upper Clyde Road. Noise and dust from routine operations in the quarry will be within regulated limits and will not normally disturb residents living nearby; truck movements along Upper Clyde Road may result in periodic elevated noise levels. Mitigation measures such as maintaining appropriate operational buffers, controlling vehicle speed and engine braking, securing equipment to prevent banging (e.g. doors and chains), covering loads, wetting working areas, etc. will be practiced to ensure that quarry operations comply with noise and dust limits according to the Pit and Quarry Guidelines. Normal traffic noise on Upper Clyde Road would likely exceed any noise coming from the quarry for homes located nearby. Traffic volumes from the site would be moderate when the Quarry is in use, and a high frequency of truck traffic would be an irregular occurrence, depending on

the supply requirements for particular projects. Dust from operations may reach residential areas, and attention is expected to be given to dust management.

Quarry activities such as blasting, are not expected to impact residential water supplies, as homes are located at a significant distance from the site. All blasting events are expected to continue to be monitored for concussion and ground vibration to ensure blasting limits are achieved. A groundwater monitoring program for water supplies will be implemented to establish baseline groundwater quality and provide on-going monitoring to ensure that any possible effects of the quarry are identified.

Most operations at the site occur during daylight hours. On rare circumstances when they are undertaken at night, activities will involve minimal additional lighting and noise, and are unlikely to be a significant disturbance to residents. The quarry will include signage with phone numbers and contact persons should any members of the community wish to register complaints or concerns. A complaint resolution procedure will be put in place by Dexter Construction to address complaints and concerns.

5.3.9 COMMERCIAL/INDUSTRIAL USE

There are no businesses near the quarry which could be affected. The quarry contributes to net economic benefit in the community through supporting local trucking operations and providing access to aggregate and other quarry products.

5.3.10 WATER SUPPLIES AND RESIDENTIAL WELLS

Nearby residents use drilled wells and dug surface wells for potable water supply; however there are no wells within 800m of the quarry study area. Groundwater recharge generated by the quarry is likely to be of high quality (low conductivity and dissolved solids and neutral in pH). Best management practices surrounding blasting will be followed, established operational procedures for fueling will be followed, and a contingency plan will be maintained to mitigate reasonable impacts on aquifers at the site.

5.3.11 PARKS AND PROTECTED AREAS

Welshtown Quarry site is not expected to be visible by tourists traveling by road, and road traffic activity due to the quarry is not expected to be high enough in volume to disrupt tourist traffic. Occasional blasting may be heard locally along Upper Clyde Road and in Shelburne (e.g. at the Island Provincial Park) but occurrences are likely to be brief, and distant, and not likely to be a significant concern to visitors/users of those areas. The quarry will be restored at the end of its useful life. Expansion of the quarry will not affect the integrity of any nearby protected areas.

5.3.12 RESOURCE USE—FORESTRY, HUNTING & TRAPPING

Use of the land for a quarry will remove the potential for logging the site, at least until after the quarry is closed and rehabilitated in future; however the area occupied by the quarry is relatively small in relation to the available forest resources in the area, and the overall impact on economic return is expected to be small. The quarry will occupy a relatively small area of habitat for furbearing and game species and will not have a significant impact on hunting and trapping.

5.4 BIOPHYSICAL IMPACTS—IMPACTS OF THE PROJECT ON THE ENVIRONMENT

5.4.1 AIR QUALITY, NOISE, AND LIGHT

Quarry activities are not expected to change from the previous scope of operations, however various project activities have the potential to generate dust, combustion emissions, noise, and light. In particular, operation of heavy equipment (e.g. earth movers, crushers), rock drilling and blasting, as well as onsite routine operations contribute to increased dust and particulate levels. Dust may also impact adjacent wetlands, which are typically nutrient-poor ecological systems where sphagnum moss predominates; however the relative contribution of the quarry is expected to be small relative to other sources such as atmospheric deposition. Noise levels can impact human use and enjoyment of the environment. Dust emissions are expected to be localized and short term and are expected to be minimal from routine operations. Dust management will be undertaken, including use of water spray and covering working and laydown areas with blasted rock, dust suppression systems on crusher equipment, and reducing equipment and vehicles speeds. Monitoring of airborne particulate emissions will be conducted at the request of NSE and in accordance with the Pit and Quarry Guidelines and the Nova Scotia Air Quality Regulations. Industry standards and best practices will be followed during all phases of operations.

Exhaust emissions will occasionally be generated by the operation of vehicles and equipment and may be detected at a distance from the site and along Upper Clyde Road during transport of product. Vehicles and heavy equipment are expected to follow efficient operating procedures such as not idling unnecessarily when not in use. Given the relatively small size of the quarry and the scope of the planned operations, these emissions will be minimal (i.e. restricted to several pieces of heavy equipment, earth movers, trucks etc. as well as operation of crushers and asphalt plant) and will be localized and similar in type and amount to those produced during previous operations. Ambient air quality monitoring will be conducted at the request of NSE.

Noise levels from the expanded quarry are expected to be similar to those already produced at the site, since the operations are expected to be similar in size at a given time. Noise mitigation will include maintaining appropriate operational buffers, maintaining vehicles and heavy equipment in proper working order, and giving attention to traffic patterns around the site to reduce the need for heavy equipment to back up (thus reducing the frequency of backup beepers). The operator should ensure that heavy equipment does not exceed the noise limits specified in the Nova Scotia Pit and Quarry Guidelines. Blasting is expected to occur infrequently (1-2 times per year). All blasting events will be monitored for concussion and ground vibrations. Noise monitoring will be conducted at the request of NSE.

Occasional nighttime operations may be required. Light during nighttime operations— particularly during times of low-hanging cloud and fog—can attract migrating birds traveling over water towards the rest of the mainland of Nova Scotia. Measures can be taken to ensure use of directional lighting, which minimizes emanation of light upward and laterally over the horizon.

5.4.2 GROUNDWATER

Activities associated with the project including forest clearing, grubbing and removal of overburden, and blasting, influence groundwater flow locally in the vicinity of the quarry, but are not expected to influence groundwater aquifers over a broader area. The amount of recharge area involved in project activities is

moderate in relation to the overall size of the aquifers in the general vicinity; however the quarry floor will continue to add recharge in approximately the same amount as at present. A contingency plan is expected to be established to manage any spill or release occurrences potentially impacting groundwater in the area. A groundwater monitoring program will be established to determine baseline groundwater quality and provide on-going monitoring to ensure that any possible effects of the quarry are identified. Overall, the effect on overall groundwater flow patterns are expected to be negligible.

5.4.3 HYDROLOGY

Expansion of the quarry will modify the existing hydrology at the site, resulting in an artificial though managed regime of surface water movement and runoff at the site. The proposed expansion area is split between the watersheds of the Roseway River on the east; and Birchtown Brook on the west. Due to the topography, with the height of land in the approximate centre of the property, precipitation and groundwater intercepted by the quarry, however, has the potential to be channelled by quarry drainage systems to either watershed, and to the south, and consequently supply to surface waters in the vicinity is not expected to be disrupted significantly. Surface water runoff from the quarry is inherently intermittent however this will buffered by the drainage system and associated wetlands and is not expected to affect overall flow characteristics in downstream areas significantly. Runoff from the outside areas of the quarry such as the surrounding berms will be managed to ensure that it meets acceptable environmental standards. Dexter Construction will maintain the drainage management system which is currently in place and continue to manage the flow in a natural way and minimize damage to the local landscape.

5.4.4 WATER QUALITY

Water quality leaving the quarry is expected to be high, and is not expected to impact downslope areas, in particular the Roseway River. There are no watercourses within 100 m of the study area. Quality of water leaving the site and entering groundwater is high, due both to the onsite management and the low-contaminant characteristics of the bedrock. Quarry rock is within acceptable limits for sulphur and acid-generating potential. Blasting is not expected to result in groundwater quality changes, and, as is current practice, potential releases of chemicals such as nitrates used in blasting will be monitored. Forest clearing and grubbing activities can lead to releases of fines from the soil, resulting locally in elevated suspended sediment levels but little surface water flow from grubbed areas is expected off the site and sediments will be removed during flow through the adjacent landscapes. Possible release of other contaminants such as oils and lubricants from operating equipment is expected to be mitigated by normal precautions on equipment operations and fuelling locations. Contaminants arising from operations of the quarry are expected to be exceedingly low. All activities will conform to the Nova Scotia Erosion and Sedimentation Control Handbook (NSE 1988) and the Nova Scotia Pit & Quarry Guidelines (NSE 1999). Runoff from road surfaces potentially can lead to temporarily elevated suspended sediment levels in flows in ditches adjacent to them, although effects would be short term. Impact of the quarry on water quality in adjacent streams and other waters is expected to be negligible.

5.4.5 FRESHWATER AQUATIC ENVIRONMENTS AND WETLANDS

There are no permanent streams within 100 m of the study area. Wetlands around the fringes of the study area have been intentionally avoided in determining the proposed expansion area. Any wetland removal will be negotiated with Nova Scotia Environment following the normal wetland alteration approval process and all wetlands which are removed or altered will be compensated for as development proceeds. Because surface water leaving the quarry is expected to parallel the present regime, wetlands in adjacent areas downslope of the quarry are not expected to experience a significant change in the source or supply of water and therefore are unlikely to be affected. Quantities of runoff arising from the site in future from the outer slopes of berms and grubbings piles will be approximately the same as at present and will remain in the same watershed. The quarry is unlikely to generate significant quantities of contaminants or suspended sediments that could impact any freshwater habitat.

5.4.6 TERRESTRIAL ENVIRONMENTS

Proposed expansion will utilize areas which are mainly medium-aged softwood and mixed forest—types which are common in the general vicinity, and in particular locally at the site—and the quarry will not remove a large proportion of either type. Some of the features of the site and those associated with bedrock uplands in general, including exposed bedrock and its plant communities including Reindeer Lichen and Golden-heather have been avoided in determining the expansion area.

5.4.7 FISH AND FISH HABITAT

None of the proposed project activities will physically impact potentially fish bearing streams. Surface runoff from the site is distributed into the two watersheds headwaters spanned by the proposed expansion area, and the quarry will occupy a relatively small area in relation to both watersheds as a whole. Fish passage at the main outflow of a stream near the quarry into the Roseway River is blocked by a hanging culvert and there is not suitable upstream fish habitat. Water quality typically found in runoff from the quarry will be monitored and is expected to meet guidelines for maintenance of Freshwater Aquatic Life. All guidelines for activities and timing of blasting in the quarry will be followed. Overall the effects of the quarry construction and operations are expected to be negligible.

5.4.8 FLORA AND FAUNA AND HABITAT

Expanding the Welshtown Quarry will remove existing terrestrial ecosystem (plants and animals) in the footprint of the quarry. With time, areas no longer suitable for quarry operations will be remediated, through a site reclamation plan which will be established as a condition of quarry approval. Plant and animal communities that arise in remediated areas will likely differ to some degree from those at present; however, a goal of remediation will be to ensure that conditions (e.g. soil types and topography) are reasonably restored to pre-existing conditions, to allow natural communities to regenerate. During recovery and revegetation of abandoned areas, the forest succession will provide habitat for a moderate diversity of species. Removal of forest cover is a feature that quarry development shares with logging activities, which affects local ecosystems to a moderate degree, and is allowed in Nova Scotia. Normal management practices regarding forest clearing, such as avoidance of cutting or major clearing activities during critical breeding periods of songbirds from mid-April to mid-September, will reduce loss of nesting birds in forest areas. Expansion of the Welshtown Quarry will result in only a comparatively small change

in the coverage of natural and mature forest stands in the area and is expected to have comparatively small impact on interior forest birds and wildlife. During operations, modified areas of the quarry offer potential nesting sites for certain species of birds and other wildlife, including hunting spaces for species such as owls and nesting for ground nesting birds such as nighthawks. Quarry employees should be educated on the need to check areas for activity and nests including both ground- and tree-nesting birds, before undertaking activities which would disturb established surfaces. Night operations and use of lights have various effects, including attracting insects which otherwise would need darkness to mate and reproduce; light pollution is considered to be an important factor globally in decline of songbird populations, through declines in populations of some insects. Night operation lighting during migration periods (August – September) would attract migrating birds. Lighting used at the site should focus downward and below the normal horizon, to limit visibility by birds and insects from a distance.

5.4.9 SPECIES AT RISK

No federally or provincially-listed species at risk, or species more sensitive than S3 ranking (vulnerable), were found in the proposed expansion area. Moose and Canada Lynx (both provincially listed as Endangered) are known to occur in the general area of the study site. Red-breasted Nuthatch (status vulnerable) occurred during the site surveys. Common Nighthawk, a ground-nesting species, potentially could nest in grubbed and marginal but open areas of the quarry; employees should be made aware of the need to check areas for activity and nests before undertaking activities which would disturb established surfaces. Activities such as logging and site clearing should be scheduled outside the April to August nesting period for breeding birds such as Red-breasted Nuthatch. Lights during night operations during migration periods (April – June, August – September) would attract various bird species and insects, which could include species at risk. Lighting used at the site should focus downward and below the normal horizon, to limit visibility from a distance.

5.4.10 NATURAL AREAS & WILDERNESS

Natural areas in the vicinity of the site such as the Roseway River are appreciated by locals and tourists alike, and the Shelburne area is dominated by natural areas, including some of the most remote and wild areas of Nova Scotia. Residential use along the Upper Clyde Road, and in Shelburne, contrast with the undeveloped forested areas over much of the landscape in the vicinity of the quarry, and Welshtown Quarry affects a small proportion of the natural landscape at the site and has a limited effect on visitors to the area who are looking for nature experiences. Dexter Construction is committed to minimizing potential effects of the quarry, in particular to reduce traffic, noise, dust and light from operations. Restoration should also consider values important in conservation of biological communities and ecosystems, as well as changes in physical conditions that could affect those communities. Normal procedures such as dust control and light management will help to minimize impacts on natural and wilderness values at the site.

6 IMPACTS OF THE ENVIRONMENT ON THE PROJECT

The operating quarry will not be impacted in general by weather, including high rainfall and precipitation. Quarry design, which includes site water management, is required to account for extreme rainfall events. Aggregate and other rock products stored at the site are stable under varying conditions of rainfall and

Table 9. Potential interactions between project activities and operations and Valued Environmental Components (VECs) for Welshtown Quarry expansion.

General Category of VEC	Biophysical									Socioeconomic										
Project Component (potential interactions shown by ✓)	Air Quality, Noise and Light	Groundwater & Hydrology	Water Quality	Freshwater Aquatic Environments and Wetlands	Terrestrial Environments	Natural Areas & Wilderness	Fish and Fish Habitat	Flora & Fauna Species & Habitat	Species at Risk	Mi'kmaq	Cultural/Historical	Recreation, Tourism & Viewscape	Residential Use	Recreational, Commercial & Mi'kmaq Fishing	Water Supplies/ Residential Wells	Economy, Land Use, and Value	Transportation	Commercial /Industrial Use	Parks & Protected Areas	Forestry Hunting /Trapping
Construction																				
Site Acquisition, Use/Removal of Resources	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓
Site Clearing/Grubbing	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		✓				✓	✓
Drilling	✓	✓				✓			✓			✓	✓		✓				✓	
Blasting	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓		✓				✓	
Lights & Noise	✓					✓		✓	✓			✓	✓						✓	
Operation																				
Moving/Transporting Rock and Product	✓					✓		✓				✓	✓			✓	✓	✓	✓	
Crushing	✓					✓						✓	✓						✓	
Washing		✓	✓	✓			✓													
Lights & Noise	✓					✓		✓	✓			✓	✓						✓	
Site Runoff Management		✓	✓	✓			✓							✓	✓					
Portable Asphalt Plant	✓					✓		✓				✓	✓						✓	
Onsite Materials Storage			✓	✓											✓					
Accidents (Fires/Oil & Fuel Spills)	✓	✓	✓	✓		✓	✓	✓				✓	✓		✓				✓	✓

Table 10. Summary of impacts and mitigation on Valued Environmental Components, Welshtown Quarry Expansion.

VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
BIOPHYSICAL COMPONENTS						
Air Quality, Noise & Light	Construction	Noise and dust from heavy equipment during site clearing and grubbing.	Significant	Negative	Take steps to reduce noise sources such as engine braking. Maintain vehicles and equipment to reduce noise and emissions generated from worn parts.	Not significant.
		Drilling and blasting.	Significant	Negative	Monitor noise levels and undertake to avoid exceedances of regulatory levels.	Not significant.
		Light from the quarry can be seen in neighbouring areas.	Significant	Negative	Use directional lighting with downward and lateral focus to minimize light leaving the quarry during night operations.	Not significant.
	Operation	Noise from drilling and blasting; crusher; heavy equipment operation; dust.	Significant	Negative	Monitor noise levels and undertake to avoid exceedances of regulatory levels. Institute measures for dust control.	Not significant.
		Noise from engine breaking of trucks on Upper Clyde Road and at Hwy 3 intersection, Shelburne	Significant	Negative	Instruct truck operators to avoid use engine breaking leaving the quarry and in populated areas.	Not significant.
		Light from the quarry can be seen in neighbouring areas.	Significant	Negative	Use directional lighting with downward and lateral focus to minimize light leaving the quarry at night.	Not significant.
		Dust from crushing operations and site activities.	Significant	Negative	Water spray systems on crushing spreads to reduce dust. Water spray or other approved dust suppressant on quarry access road and working areas to reduce the resuspension of dust.	Not significant
Groundwater/ Hydrology	Construction	Forest and soil removal changes surface and ground water flow levels and patterns.	Negligible	Negative	Use site runoff management to minimize impacts. Likely changes in groundwater and runoff patterns will be small.	Not significant.
	Operation	Blasting fractures bedrock, disturbs till, and changes groundwater flow patterns. Drilled wells	Significant	Negative	Monitor groundwater quality and movement to determine changes.	Not significant.

Table 10. Summary of impacts and mitigation on Valued Environmental Components, Welshtown Quarry Expansion.

VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
		in bedrock and surface wells can be disturbed				
	Operation	Quarry and work areas change surface water flows. Increased peak stormwater flows. Washing product creates silt-laden surface flows.	Significant	Negative	Onsite water management to moderate extreme surface water runoff and suspended sediment levels; measures to maintain normal flow regime. Aggregate washing arranged in closed loop system to retain all wash water onsite.	Not significant.
	Operation	Accidental hydrocarbon spills and blasting residues contaminate groundwater.	Significant	Negative	Measures to minimize danger of spills; monitor and control nitrates from blasting; proper fuel handling strategies, onsite emergency numbers, spill kits etc.; Avoid refueling near watercourses.	Not significant.
Water Quality	Construction	Altered surface water flows and turbidity in watershed flowages from site runoff.	Negligible	Negative	Erosion and sedimentation controls in work areas. Onsite water management to moderate surface water runoff and suspended sediment levels.	Not significant.
	Operation	Dust & suspended sediment from operations potentially enters local watershed. Chemicals (e.g. nitrates) from explosives entering runoff.	Significant	Negative	Onsite dust control and water management to moderate surface water runoff and suspended sediment levels. Erosion & sedimentation controls. Closely monitor chemical residues after blasting.	Not significant.
	Operation	Water chemistry changes in runoff from stockpiles stored on site.	Negligible	Negative	Best management practice allows leaving piles exposed to the environment. Monitor settling ponds; storm-water management.	Not significant.
Natural Areas & Wilderness	Construction & Operation	Presence of quarry, emissions, dust etc., detracts from public perception of wild quality of area. Site is not near popular wilderness areas.	Negligible	Negative	Area affected is small in relation to remaining natural areas, and previous development and logging has occurred in the area, diminishing value of natural areas and wilderness. Attempt to minimize footprint and avoid damage to areas that contribute most to	Not significant.

Table 10. Summary of impacts and mitigation on Valued Environmental Components, Welshtown Quarry Expansion.

VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
					supporting the natural ecosystem and enhancing values. Manage releases of dust and light, and control noise.	
Freshwater Aquatic Environments	Construction	Potential for local high suspended sediments and nutrient levels from grubbings, road construction, and locally-diverted flows.	Negligible	Negative	Preserve wooded buffer areas for quarry. Onsite water management and sedimentation controls to moderate surface water runoff and suspended sediment levels.	Not significant.
	Operation	Surface runoff with dust, nutrients and contaminants. Residues from aggregate washing. Reduced water availability from evaporation from pit floor and exposed surfaces.	Negligible	Negative	Maintain forested buffers. Onsite water management. Sedimentation ponds and storage wash water during off peak season. Minimize unvegetated areas.	Not significant.
	Operation	Higher peak flows and suspended sediment during activities.	Significant	Negative	Onsite water management to store wash water. Preserve woodland in buffer areas of quarry.	Not significant.
	Operation	Releases of chemicals from blasting and runoff from materials stored on site.	Negligible	Negative	Isolate and treat runoff from work areas and stored materials piles.	Not significant.
	Construction & Operation	Accidental spills of hydrocarbons on site.	Significant	Negative	Provide pollution prevention and emergency measures.	Not significant.
Terrestrial Environments	Construction	Grubbing, road construction, pit preparation. Damage to natural forest ecosystem, and associated species.	Significant	Negative	Maintain property boundary buffers. Conduct species specific breeding bird surveys prior to development stages. Monitor species-at-risk birds. Conduct forest removal in small stages corresponding to site development and not in breeding period for birds.	Not significant.
	Operation	Dust, nutrient inputs from runoff, changes to environment and	Negligible	Negative	Maintain property boundary buffers. Conduct species specific breeding bird surveys	Not significant.

Table 10. Summary of impacts and mitigation on Valued Environmental Components, Welshtown Quarry Expansion.

VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
		functioning of forest communities.			prior to excavation. Be aware of critical times for rare species which might occur.	
Fish & Fish Habitat	Construction	Change runoff patterns at site in local and adjacent watersheds.	Negligible	Negative	Runoff management to maintain flow to natural watersheds and to avoid sudden runoff events.	Not significant.
	Operation	Site runoff management and water use affects hydrological and groundwater regime.	Negligible	Negative	Ensure the runoff from the site is managed to avoid sudden runoff events.	Not significant.
	Construction & Operation	Small releases of oils, hydraulic fluids etc. from operating equipment. Accidental spills of hydrocarbons on site.	Negligible	Negative	Maintain equipment to minimize loss of lubricants and fuels. Provide pollution prevention and emergency measures.	Not significant.
	Operation	Accidental spills into watercourses due to vehicle accidents on roads in area.	Negligible	Negative	Recommend safe driving practices for truckers and staff and reduce speed in vicinity of quarry key intersections. Provide pollution prevention and emergency measures.	Not significant.
Terrestrial Flora & Fauna & Habitat	Construction	Removal of Existing Forest Communities	Negligible	Negative	Restore damaged and unused parts of the site (e.g. grubbings and waste rock piles) as soon as possible. Long-term site rehabilitation plan developed with NSE. Cut forest short term only as needed to expand quarry. Conduct species specific breeding bird survey in northeast part the property prior to excavation.	Not significant.
	Construction & Operation	Accidental contaminant releases, contamination of habitat.	Significant	Negative	Provide pollution prevention and emergency measures & response capability. Remediate areas affected by spills.	Not significant.
		Artificial light from operations influences movements of birds and insects.	Significant	Negative	Use directional lighting with downward focus to minimize light leaving the quarry.	Not significant.
		Removal of potential forest and wildlife	Negligible	Negative	Small area affected relative to total available. Minimize footprint of	Not significant.

Table 10. Summary of impacts and mitigation on Valued Environmental Components, Welshtown Quarry Expansion.

VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
		resource (i.e. wildlife habitat)			quarry. Restore and rehabilitate areas not used. Leave mature standing trees where possible as nest cavities.	
		Quarry affects wildlife movement patterns and connectivity of habitats.	Significant	Negative.	Restoration should include consideration for wildlife movement through the restored site.	Not significant.
Species at Risk	Construction	Red-breasted Nuthatch occurs in forest at the site.	Significant	Negative	Survey for additional occurrences of species. Develop management plan. Minimize footprint and maintain as much natural (uncut) natural vegetation as possible.	Not significant.
		Removal of potential habitat for Moose and Canada Lynx	Negligible	Negative	Small area affected relative to total available. Minimize footprint of quarry.	Not significant.
	Operation	Sound from blasting can harm bats and birds.	Negligible	Negative	Minimize blasting activity and concentrate in spring and fall (outside breeding and migratory periods) when species are absent.	Not significant.
		Light influences movements of species at risk birds migrating overland.	Significant	Negative	Use directional lighting with downward and lateral focus to minimize light leaving the quarry.	Not significant.
		Open and revegetated areas and grubbings piles may be occupied by nesting species such as nighthawks.	Significant	Negative	Educate personnel to look for bird life prior to activities; periodically conduct nesting bird survey at site to identify bird issues.	Not significant.
SOCIOECONOMIC COMPONENTS						
Mi'kmaq	Construction and Operation	Any land use conflicts with Mi'kmaq Right to Use land	Significant	Neutral	Consult with Mi'kmaq in developing quarry.	Not significant.
		Contamination of surface waters may affect fish populations in Roseway River potentially used by Mi'kmaq.	Negligible	Negative	Employ surface water monitoring program. Use Best Management Practices for quarries. Avoid accidental releases of contaminants. Avoid vehicle accidents on Upper Clyde Road.	Not significant.
Archaeological, Cultural and Historical Significance	Construction	Expansion may affect undiscovered artifacts.	Not significant	Negligible	Unlikely that artifacts occur at site. Stop work and report discoveries.	Not significant.

Table 10. Summary of impacts and mitigation on Valued Environmental Components, Welshtown Quarry Expansion.

VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
					Minimize project footprint.	
Recreation	Construction & Operation	Quarry traffic & activities affects local low impact recreation (e.g. walking and ATVs along Upper Clyde Road; canoeing on Roseway River).	Not significant	Negative	Users will be aware of activity at quarry but will not be otherwise impacted by it. Signage of truck use, dangers, and quarry activity.	Not significant.
Tourism and Viewscape	Construction & Operation	Presence of quarry affects public perception of wilderness values.	Negligible	Negative	Quarry cannot be seen from a distance. Dust & noise control. Maintain a clean operation. Rehabilitate areas no longer needed for activity and future development.	Not significant.
Residential Use	Construction & Operation	Noise; light pollution; dust; odours; operation of trucks and transportation of heavy equipment.	Significant	Negative	Use best management practices to reduce disturbance to nearby residents. Inform residents about quarry operations. Provide community with safety information for truck traffic and quarry operations.	Not significant.
Recreational and Mi'kmaq Hunting and Fishing	Construction & Operation	Accidental hydrocarbon spills and blasting residues contaminate surface waters.	Negligible	Negative	Not an important local activity. Provide pollution prevention, emergency measures & response capability. Identify and control contaminant releases.	Not significant.
	Construction	Loss of forested area under quarry footprint.	Not significant	Negative	Rehabilitate areas no longer needed for activity and future development. Minimize cutting outside quarry footprint.	Not significant.
Water Supplies & Residential Wells	Construction and Operation	Blasting potentially impacts local aquifers.	Significant	Negative	Develop groundwater-monitoring plan in consultation with NSE. Monitor local wells.	Not significant.
Economy, Land Use and Value	Construction & Operation	Removal of potential forest and wildlife resource (e.g. forestry & trapping).	Not significant	Negative	Small area affected relative to total land available. Minimize footprint of quarry. Restore and rehabilitate areas not used.	Not significant.
Transportation	Operation	Wear on highway	Negligible	Negative	Current levels low and will not increase.	Not significant.

Table 10. Summary of impacts and mitigation on Valued Environmental Components, Welshtown Quarry Expansion.

VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
	Operation	Collisions with trucks and equipment on Upper Clyde Road and Highway 3.	Not significant	No Change	Use good signage, have speed policy in vicinity of quarry. Safety training for truck drivers.	Not significant
Industrial & Commercial Use	Operation	No businesses nearby.	Negligible	Neutral	Quarry helps to maintain access roads to site for future development.	Not significant.
Resource Use Forestry, Hunting & Trapping	Construction & Operation	Removes woodland; game habitat.	Not significant	Negative	Relatively small area is used. Minimize footprint.	Not significant.
Parks and Protected areas	Construction & Operation	Noise and blasting can be heard from Shelburne and other parks and nature areas in the general viicnity.	Not significant	Neutral	Employ best management practices for all aspects of quarry operation, in particular control of noise, light, & dust.	Not significant.

wind. Integrity of any runoff management structures at the site must be maintained and appropriately designed to remove the possibility of catastrophic failure. Changing climate may increase the operating season for transportation projects, and the need for aggregates produced by the quarry.

7 CUMULATIVE EFFECTS

Because of the remoteness of the location, all the potential impacts of the quarry operation (dust, noise, lights, blasting, traffic volume, etc.) are unlikely to be compounded by other development or human activity. Since site operations are not expected to increase in frequency or scope from past use, the cumulative effect of other local human activity is not expected to increase from past levels.

8 MONITORING

In accordance with the Pit and Quarry Guidelines under the NS Environment Act and the Industrial Approval for the quarry site, Dexter Construction is required to implement surface and groundwater monitoring programs to monitor hydrological conditions and water quality. All blasting events will be monitored for concussion and ground vibration. Routine monitoring of noise levels and particulate levels will be conducted at the request of NSE. Additional monitoring for select species and/or environmental features will be conducted when necessary.

9 PUBLIC CONSULTATION

Informing the public and Mi'kmaq about proposed industrial activities which potentially affect them is an important part of environmental and project management. Potential benefits include exposure to local knowledge, which may improve environmental performance, and overall operations of the project; and

public involvement and support in subsequent operations. In addition to contacts already made in developing this assessment and in conducting operations in the Shelburne and Welshtown areas, Dexter Construction will be undertaking consultations with the local community through public notices, contacts with municipal and provincial government officials, and engagement with the Mi'kmaq about the project and its implications; as well as the plans for using the resources at the site in an environmentally acceptable manner.

10 PERSONAL COMMUNICATIONS

Boulder Cove Cottages, July 2020

Mr. Robert Davis, Resident of Welshtown, July 2020.

Mr. Gordon Williams, Resident of Welshtown, September 2020

Mrs. Waterine Faye, Resident of Welshtown, September 2020

Mr. Lee Hartley, Resident of Welshtown, September 2020

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12 LIMITING CONDITIONS

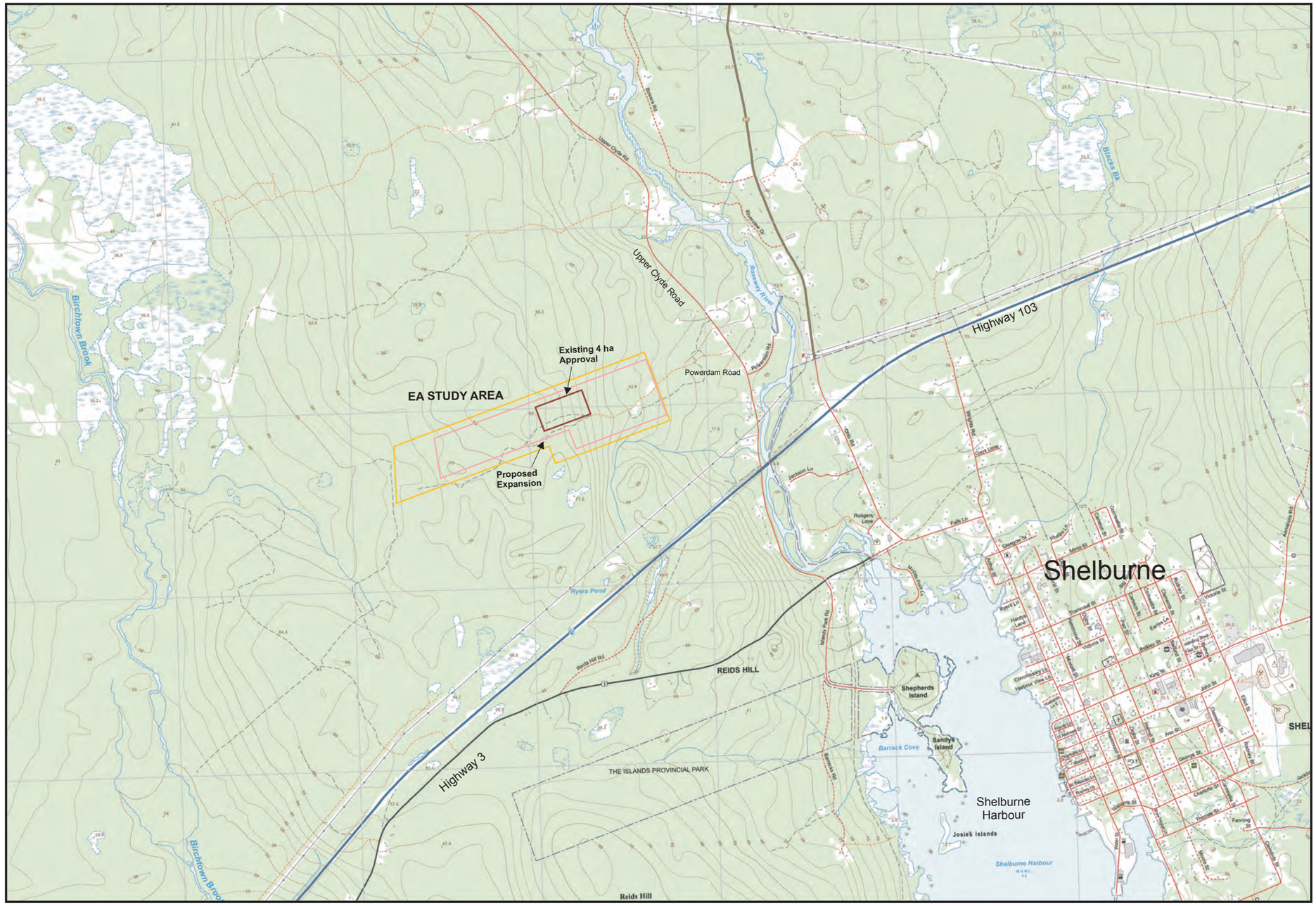
The American Society for Testing and Materials Standards of Practice and the Canadian Standards Association state that no environmental assessment can wholly eliminate uncertainty regarding the recognition of potential environmental liabilities. The intent of the assessment is to reduce, but not eliminate, uncertainty regarding projects, giving reasonable limits of time and costs.

The conclusions of this report are based in part on the information provided by others, which is assumed to be correct. The potential exists that unexpected environmental conditions may be encountered at the site and with the project, not specifically investigated. Should this occur, the proponent and regulatory authorities must be notified so that we may decide if modifications to our conclusions are necessary.

The findings of this investigation are based on research and investigations carried out in October 2019 – September 2020 and the generally accepted assessment practices of our industry. No other warranty is made.

APPENDIX A

MAPS



THE MUNICIPAL GROUP OF COMPANIES

DEXTER CONSTRUCTION COMPANY LTD.

WELSHTOWN QUARRY EXPANSION

Welshtown,
Nova Scotia

Site Location and Features

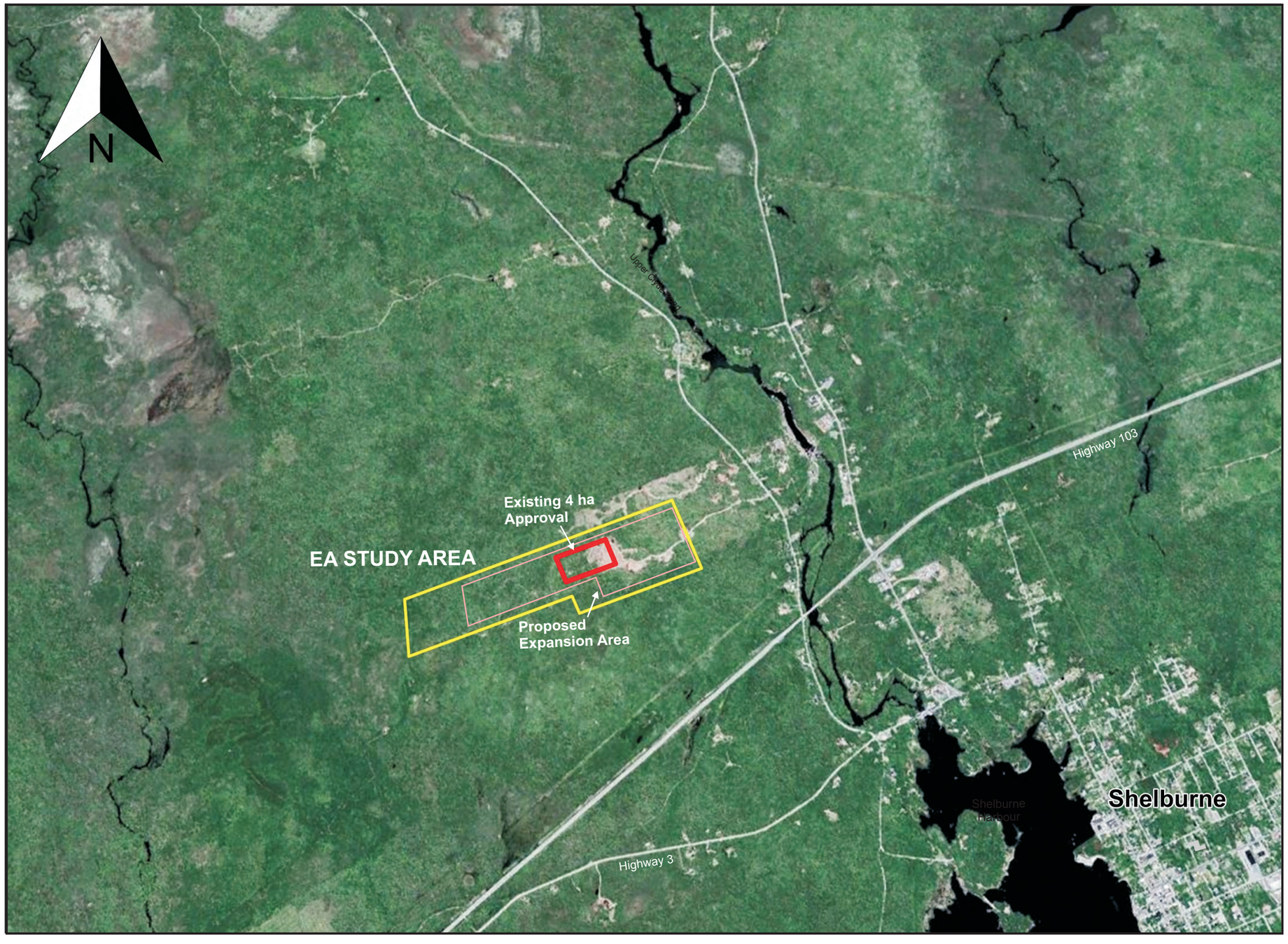
- EA Study Area
- Proposed Expansion

Mapping by:
Envirosphere Consultants Ltd.
Windsor, Nova Scotia
September 2020

Base Map: NTS 1:50,000, 20P14
Nova Scotia Geomatics Centre, 2013

DEXTER CONSTRUCTION COMPANY LIMITED

Map A-1



Map A-2

THE MUNICIPAL GROUP OF COMPANIES

DEXTER CONSTRUCTION COMPANY LTD.

WELSHTOWN QUARRY EXPANSION

Welshtown, Shelburne County
Nova Scotia

Aerial Imagery

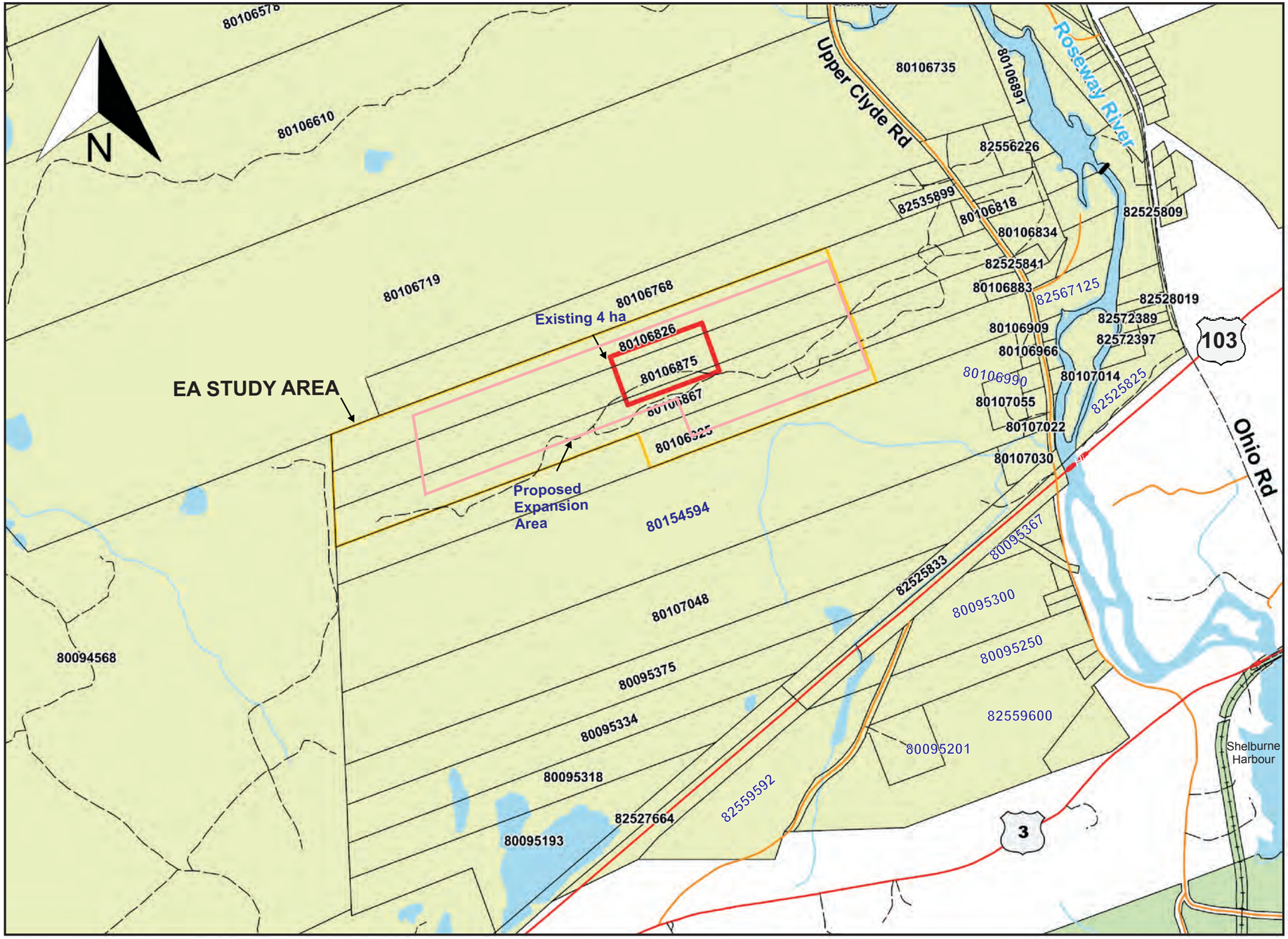
EA Study Area

Proposed Expansion

Mapping by:
Envirosphere Consultants Ltd.
Windsor, Nova Scotia
May 2020

Google Earth: June 9, 2017

DEXTER
DEXTER CONSTRUCTION COMPANY LIMITED



THE MUNICIPAL GROUP OF COMPANIES

DEXTER CONSTRUCTION COMPANY LTD.

WELSHTOWN QUARRY EXPANSION

Welshtown, Shelburne County, Nova Scotia

Property Ownership

Property Lines
- Crown Land
- Publicly Owned Land

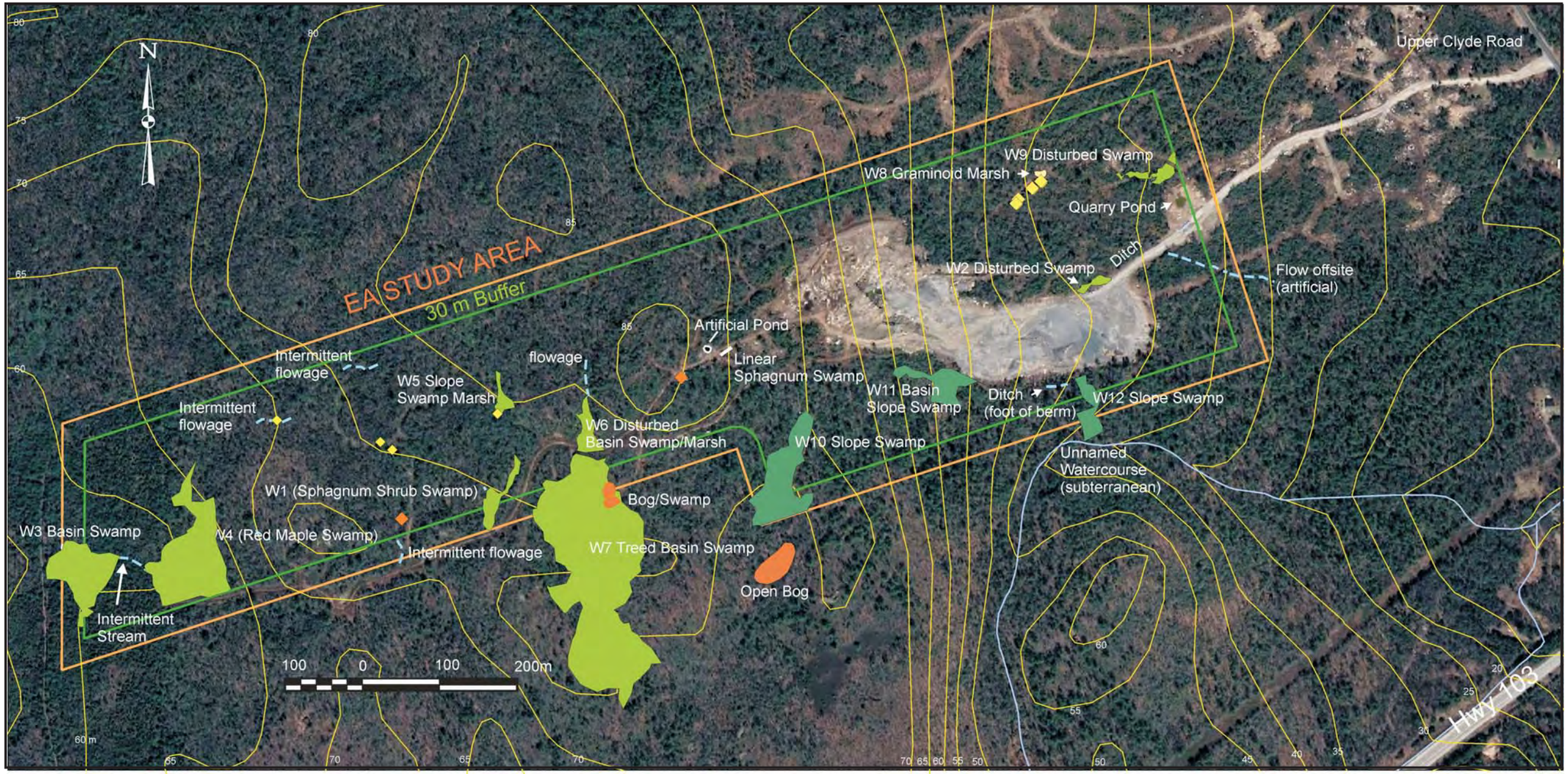
Transportation
- Track
- Highway
- Local
- Rail Road Track
- Trail
- Bridge

Misc.
- Open Water, Wetlands
- Proposed Expansion
- 4 ha Quarry
- Welshtown EA Study Area
- Dam

Mapping by:
Envirosphere Consultants Ltd.
Windsor, Nova Scotia
May 2020

DEXTER CONSTRUCTION COMPANY LIMITED

Map A-3



THE MUNICIPAL GROUP OF COMPANIES

DEXTER CONSTRUCTION COMPANY LTD.

WELSHTOWN QUARRY EXPANSION
SHELBURNE COUNTY
NOVA SCOTIA

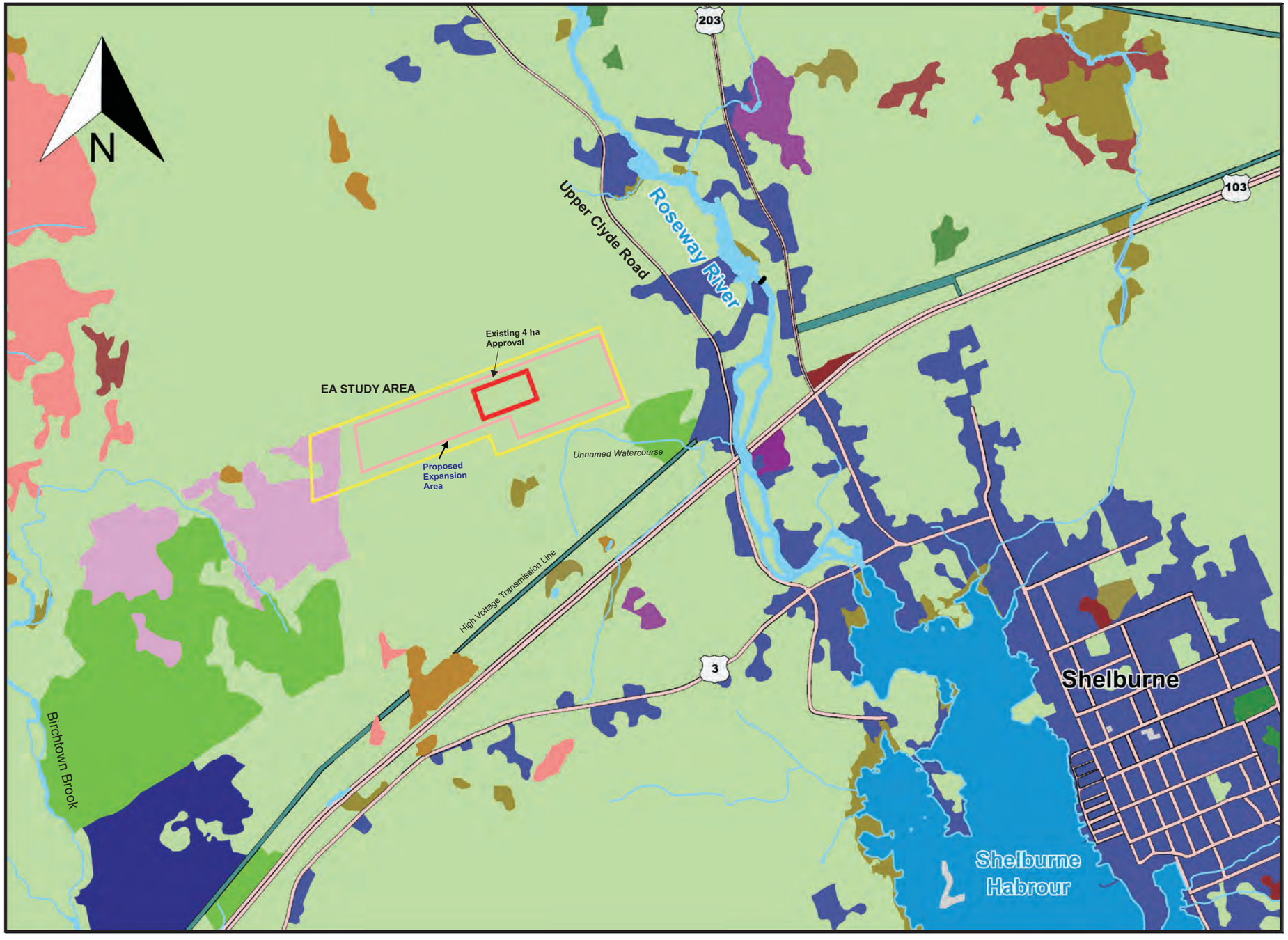
Site Features

- Elevations (m)
- Surface Waters
- EA Study Area
- 30 m Buffer
- Spring Pools
- Sphagnum Spring Pools

Map by:
Envirosphere Consultants Limited.
Windsor, Nova Scotia, August 2020
Aerial Image:
Google Earth, May 10, 2020.

DEXTER
DEXTER CONSTRUCTION COMPANY LIMITED

Map A-4



THE MUNICIPAL GROUP OF COMPANIES

DEXTER CONSTRUCTION COMPANY LTD.

WELSHTOWN QUARRY EXPANSION
SHELBURNE COUNTY
NOVA SCOTIA

Land Classification

- Natural stand
- Treated
- Dead
- Plantation
- Brush
- Alders less than 75% cover
- Clear cut
- Partial depletion verified
- Wetlands general
- Beaver flowage
- Open bogs
- Treed bogs
- Lake wetland
- Cliffs, dunes, coastal rocks
- Inland water
- Ocean
- Barren
- Agriculture
- Urban
- Miscellaneous
- Gravel pit
- Powerline corridor
- Road corridor

Map by:
Envirosphere Consultants Limited.
Windsor, Nova Scotia, May 2020
Current Forest Data, Cycles 2 & 3
Nova Scotia Forest Inventory

DEXTER
DEXTER CONSTRUCTION COMPANY LIMITED

Map A-5

APPENDIX B

BOTANICAL SURVEYS

Fall 2019 & Spring/Early Summer 2020

Botanical Survey for a Proposed Quarry Expansion at Welshtown, Shelburne County, Nova Scotia

Ruth E. Newell, B.Sc. (Hons.), M.Sc.
November 14, 2019

Botanical Survey for a Proposed Quarry Expansion at Welshtown, Shelburne County, Nova Scotia

Introduction

A fall survey of vascular plants was conducted at the site of a proposed quarry expansion at 10740 Upper Clyde Road, Welshtown, Shelburne County, Nova Scotia, on October 7th, 2019. The survey was conducted by botanist Ruth E. Newell, B.Sc. (Hons.), M.Sc. Observations from this survey are presented in this report.

The survey area, indicated by a yellow boundary in Fig. 1, is approximately 46.7 ha in size.

Primary habitats present within the survey area include: red maple swamps, a number of small wetlands including several marshes plus occasional, small, damp areas, coniferous woodland, mixed woodland, off highway vehicle trails and rock outcroppings. Much of the woodland has been cutover at various times in the past. Scattered large boulders occur throughout the property.

All vascular plants observed during this fall survey as well as the habitats in which they occur and their provincial general status ranks and Atlantic Canada Conservation Data Centre (ACCDC) subnational status ranks are provided in APPENDIX 1 at the end of this document. Information on these status ranks including status rank definitions can be found on the Atlantic Canada Conservation Data Centre (ACCDC) website (http://www.accdc.com) and Wild Species 2015, The General Status of Species in Canada website (at https://www.wildspecies.ca/).

Figure 1. The Welshtown Quarry with the survey area delineated by the yellow border.

Results

Habitat Descriptions

1) Coniferous Forest (C)

Figure 2. Primarily coniferous woodland (20T 0309665E, 4849789N) with mosses dominating the forest floor.

Primarily coniferous woodland within the survey area is somewhat limited. Figure 2 shows part of a coniferous woodland located west of the existing quarry (about halfway between the existing quarry and the western boundary of the property). Balsam Fir (*Abies balsamea*) is the dominant tree species in this habitat.

Herbaceous and shrub species are generally sparsely distributed in this particular habitat and include Cinnamon Fern (*Osmundastrum cinnamomeum*), Bunchberry (*Cornus canadensis*), Inkberry (*Ilex glabra*) and Red Maple seedlings (*Acer rubrum*). Various mosses dominate the forest floor. A large moss-covered boulder is present in the background of Fig. 2.

Species of conservation concern:

There were no species of conservation concern observed in this habitat during this survey.

2) Red Maple Swamps (R)

Figure 3. A large Red Maple swamp located near the west end of survey area (20T 0309434E 4849596N). The dominant plant in the foreground is Cinnamon Fern (*Osmundastrum cinnamomeum*).

Several Red Maple swamps were observed during this survey (Figs. 3 & 4). It is considered quite likely that additional field work will lead to the discovery of more of these within the quarry property. Red Maple (*Acer rubrum*) and Balsam Fir (*Abies balsamea*) are the dominant tree species in this habitat. Commonly occurring herbaceous species and shrubs include New York Fern (*Thelypteris noveboracensis*), Cinnamon Fern (*Osmundastrum cinnamomeum*), Black Huckleberry (*Gaylussacia baccata*), Sheep Laurel (*Kalmia angustifolia*), Goldthread (*Coptis trifolia*), and Star Flower (*Lysimachia borealis*). Poison Ivy (*Toxicodendron radicans*) was observed in one of the swamps. Sphagnum mosses (*Sphagnum* spp.) form the dominant ground cover in these wetlands.

Species of conservation concern:

There were no species of conservation concern observed in this habitat during this survey.

Figure 4. Red Maple swamp at OHV trail culvert (20T 0309903E 4849763N).

3) Mixed Forest (M)

Figure. 5. Mesic mixed woodland occurring within the survey area.

The higher elevations on the property generally consist of large areas of mesic mixed woodland (Figs. 5 & 6). Much of this habitat has been cutover at various times in the past.

Tree species present include Balsam Fir (*Abies balsamea*), Red Maple (*Acer rubrum*), Red Oak (*Quercus rubra*), Red Spruce (*Picea rubens*) and White Pine (*Pinus strobus*). To a lesser extent, Large-toothed Aspen (*Populus grandidentata*) and White Birch (*Betula papyrifera*) are also present. In addition to the trees, there is often a dense high shrub layer (Fig. 6) present. Species within the shrub layer include Black Huckleberry (*Gaylussacia baccata*), Bayberry (*Morella pensylvanica*), Inkberry (*Ilex glabra*), Chokeberry (*Photinia* sp.) and Sheep Laurel (*Kalmia angustfolia*). Ground vegetation includes Starflower (*Lysimachia borealis*), Wintergreen (*Gaultheria procumbens*), Indian Cucumber-root (*Medeola virginiana*), Bracken (*Pteridium aquilinum*) and Wild Sarsaparilla (*Aralia nudicaulis*).

Species of conservation concern:

There were no species of conservation concern observed in this habitat during this survey.

Figure 6. Mesic mixed woodland with a dense shrub layer.

Figure 7. One section of an area of outcroppings located within the survey area (20T 0309572E 4849652N).

4) Outcrops (O)

A small area of rock outcroppings is located on the property at map coordinates 20T 0309572E 4849652N (Figs. 7 & 8). Commonly occurring shrub species in this exposed habitat include Black Huckleberry (*Gaylussacia baccata*), Lowbush Blueberry (*Vaccinium angustifolium*), Sheep Laurel (*Kalmia angustifolia*) and Bayberry (*Morella pensylvanica*). A variety of low shrubs (subshrubs) were also present including several that were not observed elsewhere on the property. These include Golden-heather (*Hudsonia ericoides*) and Broom Crowberry (*Corema conradii*).

Tree species that establish in this habitat type are often stunted, likely as a result of limited soil and moisture. Tree species observed here include Wire Birch (*Betula populifolia*), Red Oak (*Quercus rubra*), Red Spruce (*Picea rubens*) and White Pine (*Pinus strobus*).

Very few herbaceous species were observed in this habitat.

Various reindeer lichens (*Cladonia* spp.) are abundant on these outcrops (Fig. 7 & 8)

Figure 8. Extensive beds of reindeer lichens (*Cladonia* spp.) (whitish ground cover) occurring on rock outcrops within the survey area.

Species of conservation concern:

Golden-heather (*Hudsonia ericoides*) was observed on the rock outcrops described above (20T 0309572E 4849652N), during this survey (Fig. 9). Both the Nova Scotia General Status Rank and the Atlantic Canada Conservation Data Centre subnational status designation for this species is S2/imperilled (ORANGE). It is considered to be at high risk of extirpation in the province due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

Figure 9. Golden-heather (*Hudsonia ericoides*) was observed on rock outcrops during this survey. This species is considered to be an **imperilled species** in Nova Scotia by the Atlantic Canada Conservation Data Centre (ACCDC) and the 2015 Wild Species of Canada Report.

5) Small wetlands (marshes and occasional small, damp, sphagnous areas)

Two small marshes were surveyed (20T 0309920E 4849790N; 20T 0310666E 4850153N).

One marsh (Fig. 10) may have been impacted by the construction of an OHV trail along its south edge. There are snags (standing dead trees) present in the open marsh suggesting that the construction of the trail may have resulted in more frequent or possibly permanent flooding, leading to the death of some of the existing trees and creating more open wetland habitat. A Red Maple swamp habitat occurs immediately to the south of the marsh and trail.

Common species in this marsh include Steeplebush (*Spiraea tomentosa*), Canada Manna Grass (*Glyceria canadensis*), Common Woolly Bulrush (*Scirpus cyperinus*), Black Huckleberry (*Gaylussacia baccata*), Red Maple (*Acer rubrum*), Cinnamon Fern (*Osmundastrum cinnamomeum*) and Black Spruce (*Picea mariana*).

A second marsh also has had a road built across it, but this does not appear to have negatively impacted the marsh (Fig. 11). The dominant species in this wetland is Button Sedge (*Carex bullata*). Other species present include Common Woolly Bulrush (*Scirpus cyperinus*), Soft Rush (*Juncus effusus*), Black Huckleberry (*Gaylussacia baccata*), Woodland Rush (*Juncus subcaudatus*) and Cinnamon Fern (*Osmundastrum cinnamomeum*).

Species of conservation concern observed in marsh habitat:

Woodland Rush (*Juncus subcaudatus*) occurs in the second wetland described above. This species is ranked as an S3/vulnerable (YELLOW) species, i.e., a species at moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

Figure. 10. Marsh habitat located along the main OHV trail southwest of the open quarry pit (20T 0309920E 4849790N).

Figure 11. Small marsh located near the east boundary of the survey area (20T 0310666E 4850153N).

In addition to marshes, various small low damp areas occur throughout the property (Fig. 12), some in woodland, others along old logging access routes. These generally have a sphagnous substrate and vascular plant species present include Common Woolly Bulrush (*Scirprus cyperinus*), Cinnamon Fern (*Osmundastrum cinnamomeum*), Inkberry (*Ilex glabra*), Sheep Laurel (*Kalmia angustifolia*), Bunchberry (*Cornus canadensis*), Snowberry (*Gaultheria hispidula*), etc.

Figure 12. A small, low, wet area along an old logging roadway (20T 0309693E 4849710N).

Species of conservation concern in small, damp, sphagnous areas:

There were no species of conservation concern observed in these areas during this survey.

6) OHV (off-highway vehicle) trails

A mix of native and exotic vascular plant species occur along the edges of OHV trails as well as directly on the trails themselves. Commonly occurring species observed during this survey in this habitat include: Green Alder (*Alnus alnobetula* ssp. *crispa*), Sweetfern (*Comptonia peregrina*), Wire Birch (*Betula populifolia*), Pinweed (*Lechea intermedia*), Pearly Everlasting (*Anaphalis margaritacea*), Calico Aster (*Symphyotrichum lateriflorum*), Downy Goldenrod (*Solidago puberula*), Rough Bentgrass (*Agrostis scabra*), Canada St. John's-wort (*Hypericum canadense*), Poverty Grass (*Danthonia spicata*) and Fall Dandelion (*Leontodon autumnalis*).

Species of conservation concern:

There were no species of conservation concern in this habitat.

Discussion

No species listed under either federal species-at-risk legislation or provincial species-at-risk- legislation were observed on the quarry property during this survey.

The majority of the vascular plant species observed and recorded during this current survey fall into the Nova Scotia general status rank categories of **GREEN, LIGHT GREEN** or **EXOTIC** with GREEN indicating a plant with a secure conservation status within the province, LIGHT GREEN indicating a species at a fairly low risk of extirpation and EXOTIC meaning a species that is considered to be non-native to Nova Scotia. The Atlantic Canada Conservation Data Centre subnational status ranks fall primarily into the categories of S5, S4 and SNA, also indicating that most species on site are not of conservation concern (S5 = **Secure** - Common, widespread, and abundant in the province; S4 = **Apparently Secure** - Uncommon but not rare; some cause for long-term concern due to declines or other factors; SNA = **Not Applicable** - A conservation status rank is not applicable because the species is not a suitable target for conservation activities a for example, non-native (exotic) species).

Two species were documented during this survey that have some degree of conservation concern. These are Golden-heather (*Hudsonia ericoides*) and Woodland Rush (*Juncus subcaudatus*).

Golden-heather was restricted to rock outcroppings and was relatively common in this particular habitat (Fig. 9). This species is listed as imperilled (S2) (ORANGE).

Woodland Rush was observed in one of the two marshes that were surveyed. It was not observed elsewhere on the property. This species is listed as vulnerable (S3) (YELLOW).

As this survey was conducted in the fall season, it is highly recommended that a late spring/early summer survey be conducted as a follow up to the current study to ensure early flowering or fruiting plants are documented.

APPENDIX

List of all vascular plants observed on the Welshtown quarry property during the October 7, 2019 survey, the habitats in which they occur and their current status ranks (both the Nova Scotia General Status Rank*and the Atlantic Canada Conservation Data Centre Subnational s-rank** are provided for each species). (Habitats: coniferous forest (C), mixed forest (M), Red Maple swamp (R), outcrops (O), small wet areas e.g., small marshes and damp, wooded and open areas (W), OHV (off-highway vehicle) trails (T).

Latin Name	**Common Name**	**Nova Scotia General Status Rank***	**ACCDC Subnational Status Rank****	**Habitat(s)**
Abies balsamea	Balsam Fir	S5/secure (green)	S5/secure	C, M, O, R, W
Acer rubrum	Red Maple	S5/secure (green)	S5/secure	C, M, O, R, T, W
Agrostis scabra	Rough Bent Grass	S5/secure (green)	S5/secure	T
Alnus alnobetula ssp. crispa	Green Alder	S5/secure (green)	S5/secure	T
Anaphalis margaritacea	Pearly Everlasting	S5/secure (green)	S5/secure	T
Aralia nudicaulis	Wild Sarsparilla	S5/secure (green)	S5/secure	M
Betula papyrifera	White Birch	S5/secure (green)	S5/secure	O, M, T
Betula populifolia	Wire Birch	S5/secure (green)	S5/secure	O, M, T
Carex bullata	Button Sedge	S4/apparently secure (light green)	S4/apparently secure	W
Comptonia peregrina	Sweetfern	S5/secure (green)	S5/secure	M, T
Coptis trifolia	Goldthread	S5/secure (green)	S5/secure	R
Corema conradii	Broom Crowberry	S4/apparently secure (light green)	S4/apparently secure	O
Cornus canadensis	Bunchberry	S5/secure (green)	S5/secure	C, M, R, W
Danthonia spicata	Poverty Grass	S5/secure (green)	S5/secure	T
Dennstaedtia punctilobua	Hay-scented Fern	S5/secure (green)	S5/secure	M, W
Dichanthelium *sp.*	a panic grass	-	-	T
Doellingeria umbellata	Tall White Aster	S5/secure (green)	S5/secure	M
Drosera rotundifolia	Round-leaved Sundew	S5/secure (green)	S5/secure	T
Dryopteris marginalis	Marginal Wood Fern	S5/secure (green)	S5/secure	O
Epigaea repens	Mayflower	S5/secure (green)	S5/secure	M, O, T
Eriophorum virginicum	Tawny Cottongrass	S5/secure (green)	S5/secure	W
Fragaria virginiana	Wild Strawberry	S5/secure (green)	S5/secure	W

Latin Name	Common Name	Nova Scotia General Status Rank*	ACCDC Subnational Status Rank**	Habitat(s)
Gaultheria hispidula	Creeping Snowberry	S5/secure (green)	S5/secure	R, W
Gaultheria procumbens	Wintergreen	S5/secure (green)	S5/secure	M, O, W
Gaylussacia baccata	Black Huckleberry	S5/secure (green)	S5/secure	M, O, R, W
Glyceria canadensis	Canada Manna Grass	S5/secure (green)	S5/secure	W
Hamamelis virginiana	American Witch-hazel	S5/secure (green)	S5/secure	M, O
Hudsonia ericoides	**Golden-heather**	**S2/imperilled (orange)**	**S2/imperiled**	O
Hypericum canadense	Canada St. John's-wort	S5/secure (green)	S5/secure	T
Hypericum gentianoides	False St. John's-wort	NA/exotic	SNA	T
Ilex glabra	Inkberry	S5/secure (green)	S5/secure	C, M, O, T, W
Ilex mucronata	Mountain Holly	S5/secure (green)	S5/secure	W
Ilex verticillata	Common Winterberry	S5/secure (green)	S5/secure	M, W
Juncus effusus	Soft Rush	S5/secure (green)	S5/secure	W
Juncus subcaudatus	**Woodland Rush**	**S3/vulnerable (yellow)**	**S3/vulnerable**	W
Kalmia angustifolia	Sheep Laurel	S5/secure (green)	S5/secure	M, O, R, T, W
Larix laricina	Larch	S5/secure (green)	S5/secure	W
Lechea intermedia	Pinweed	S4/apparently secure (light green)	S4/apparently secure	T
Leontodon autumnalis	Fall Dandelion	NA/exotic	SNA	T
Linnaea borealis	Twinflower	S5/secure (green)	S5/secure	W
Lycopodiella inundata	Northern Bog Clubmoss	S5/secure	S5/secure	T
Lysimachia borealis	Starflower	S5/secure (green)	S5/secure	C, M, R, W
Maianthemum canadense	Wild-Lily-of-the-Valley	S5/secure (green)	S5/secure	O, W
Medeola virginiana	Indian Cucumber-root	S5/secure (green)	S5/secure	M, O
Mitchella repens	Partridgeberry	S5/secure (green)	S5/secure	M
Morella pensylvanica	Bayberry	S5/secure (green)	S5/secure	M, O
Muhlenbergia uniflora	Bog Muhly	S5/secure (green)	S5/secure	T, W

Latin Name	Common Name	Nova Scotia General Status Rank*	ACCDC Subnational Status Rank**	Habitat(s)
Oclemena acuminata	Wood Aster	S5/secure (green)	S5/secure	M
Osmundastrum cinnamomeum	Cinnamon Fern	S5/secure (green)	S5/secure	C, R, W
Photinia sp.	a chokeberry	-	-	M
Picea mariana	Black Spruce	S5/secure (green)	S5/secure	R, W
Picea rubens	Red Spruce	S5/secure (green)	S5/secure	C, M, O
Pinus strobus	White Pine	S5/secure (green)	S5/secure	C, M, O
Polypodium vulgare	Rock Polypody	S5/secure (green)	S5/secure	O
Populus grandidentata	Large-toothed Aspen	S5/secure (green)	S5/secure	M, O
Potentilla *sp.*	a cinquefoil	-	-	T
Pteridium aquilinum	Bracken	S5/secure (green)	S5/secure	M, O
Quercus rubra	Northern Red Oak	S5/secure (green)	S5/secure	M, O
Rhododendron groenlandicum	Labrador-tea	S5/secure (green)	S5/secure	R
Rhynchospora capitellata	Small-headed Beakrush	S4/secure (light green)	S4/apparently secure	T
Rubus hispidus	Bristly Dewberry	S5/secure (green)	S5/secure	R, W
Scirpus cyperinus	Common Woolly Bulrush	S5/secure (green)	S5/secure	W
Solidago canadensis	Canada Goldenrod	S5/secure (green)	S5/secure	T
Solidago puberula	Downy Goldenrod	S5/secure (green)	S5/secure	O, T
Spiraea tomentosa	Steeplebush	S5/secure (green)	S5/secure	W
Symphyotrichum lateriflorum	Calico Aster	S5/secure (green)	S5/secure	T
Thelypteris noveboracensis	New York Fern	S5/secure (green)	S5/secure	R
Thelypteris simulata	Bog Fern	S4/apparently secure (green)	S4/apparently secure	R, W
Toxicodendron radicans	Poison Ivy	S5/secure (green)	S4/apparently secure	R
Vaccinium angustifolium	Lowbush Blueberry	S5/secure (green)	S5/secure	M, O, R
Viburnum nudum **var.** ***cassinoides***	Witherod	S5/secure (green)	S5/secure	M
Viola xsublanceolata	Primrose-leaved Violet	-	S4/apparently secure	T

*The Nova Scotia general status ranks used in this report are based on the ranks used in the 2015 Wild Species of Canada Report (available at https://www.wildspecies.ca/) ; S**5 = Secure/green** (at very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats**; S4 = Apparently secure/light green** (at a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors**; S3 = Vulnerable/yellow** (at moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors; **S2 = Imperilled/orange (**at high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors); **NA = not applicable (**non-native/exotic).

ACCDC: Atlantic Canada Conservation Data Centre explanation of status ranks used in this report (http://accdc.com/en/rank-definitions.html): **S5 = Secure (common, widespread, and abundant in the province); **S4** = **Apparently Secure** (uncommon but not rare; some cause for long-term concern due to declines or other factors); **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.)**;** 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. **SNA** = **Not Applicable** - a conservation status rank is not applicable because the species is not a suitable target for conservation activities, e.g. a non-native species.

Fall and Spring Botanical Surveys for a Proposed Quarry Expansion at Welshtown, Shelburne County, Nova Scotia

Ruth E. Newell, B.Sc. (Hons.), M.Sc.
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Fall and Spring Botanical Surveys for a Proposed Quarry Expansion at Welshtown, Shelburne County, Nova Scotia

Introduction

A fall survey of vascular plants was conducted at the site of a proposed quarry expansion at 10740 Upper Clyde Road, Welshtown, Shelburne County, Nova Scotia, on October 7th, 2019. A subsequent spring survey was conducted June 24-26, 2020. Both surveys were carried out by botanist Ruth E. Newell, B.Sc. (Hons.), M.Sc., and observations from both surveys are presented in this report.

The survey area for the October 7th, 2019 survey, is indicated by the yellow boundary in Figure 1, and is approximately 46.7 ha in size. For the follow-up spring survey, the survey area boundary was extended slightly along the southeast corner of the property (south of existing quarry pit) (Figure 2).

Primary habitats present within the survey area include: several red maple swamps, coniferous woodland, mixed woodland, a number of small wetlands including several marshes plus occasional, small, damp, often sphagnous areas, off highway vehicle trails and rock outcroppings. Much of the existing woodland has been cut-over or partially cut-over at various times in the past. Scattered large boulders occur throughout the property (Figure 9).

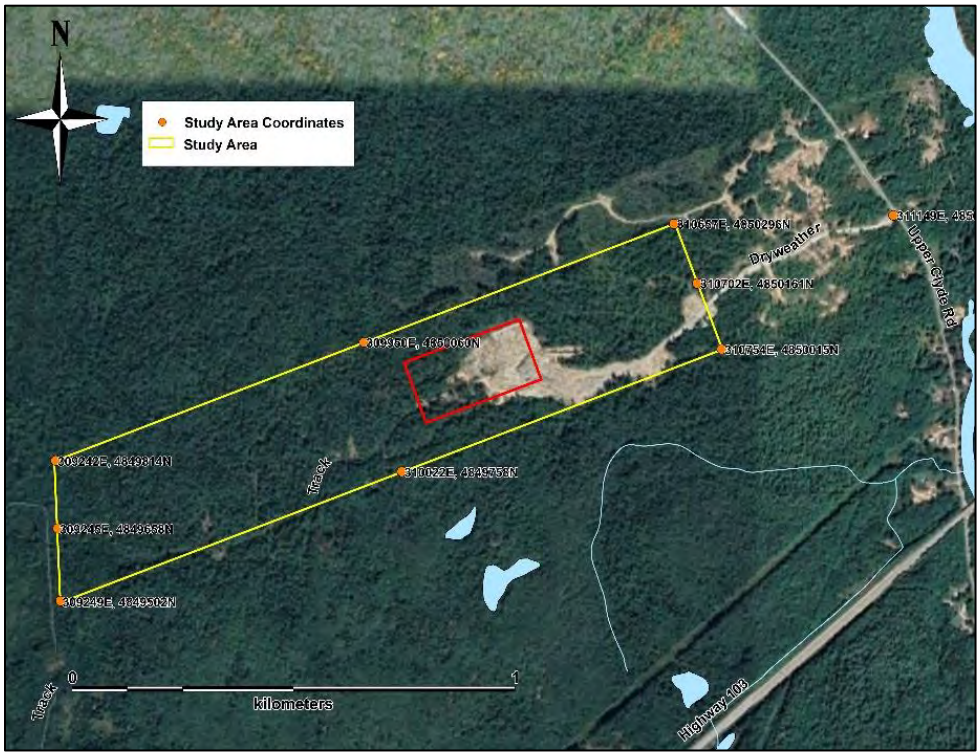


Figure 1. The Welshtown Quarry showing the original survey area (fall survey) as delineated by the yellow border.

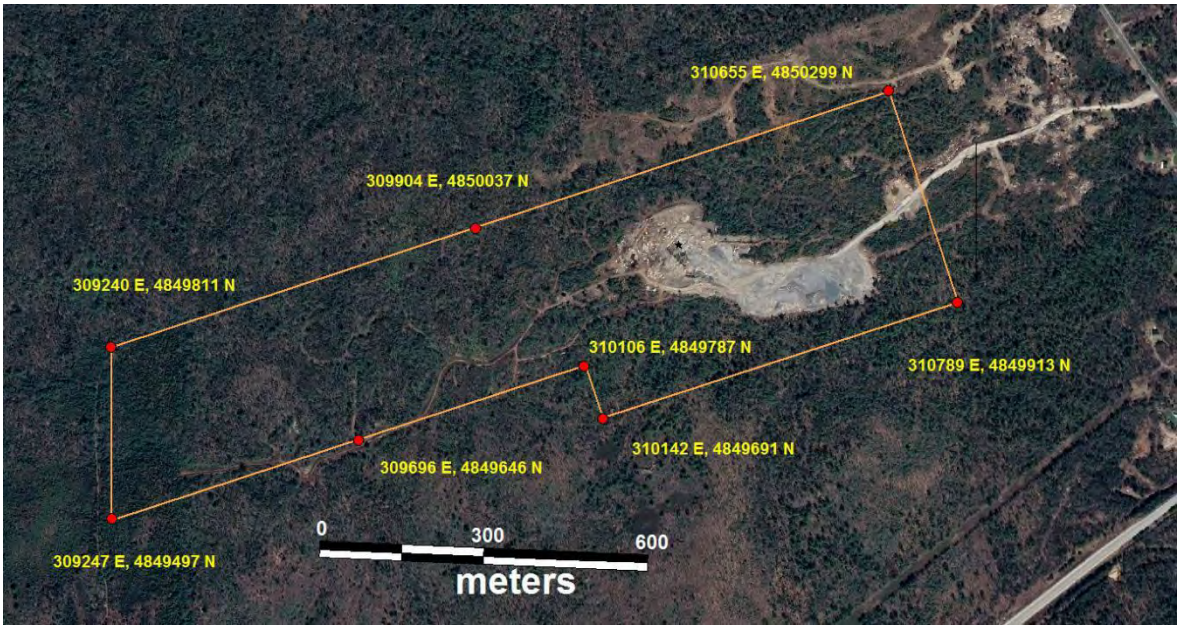


Figure 2. The Welshtown Quarry showing a slightly expanded survey area south of the existing pit area. This map version was used for the spring survey.

All vascular plants observed during these surveys as well as the habitats in which they occur and their provincial general status ranks and Atlantic Canada Conservation Data Centre (ACCDC) subnational status ranks are provided in the APPENDIX at the end of this document. Information on these status ranks including status rank definitions are provided in this document but can also be found on the Atlantic Canada Conservation Data Centre (ACCDC) website (http://www.accdc.com) and Wild Species 2015, The General Status of Species in Canada website (https://www.wildspecies.ca/).

Results

Habitat Descriptions

1) Coniferous Woodland (C)

Figure 3. Primarily coniferous woodland (20T 0309665E, 4849789N) with mosses dominating the forest floor. Photo taken during the fall survey.

Primarily coniferous woodland within the survey area is somewhat limited. Figure 3 shows part of a coniferous woodland located west of the existing quarry (about halfway between the existing quarry and the western boundary of the property). Balsam Fir (*Abies balsamea*) is the dominant tree species in this habitat.

Herbaceous and shrub species are generally sparsely distributed within this particular habitat and include Cinnamon Fern (*Osmundastrum cinnamomeum*), Bunchberry (*Cornus canadensis*), Inkberry (*Ilex glabra*) and Red Maple seedlings (*Acer rubrum*). Various mosses dominant the forest floor. A large moss-covered boulder is present in the background of Figure 3.

Species of conservation concern:

There were no species of conservation concern observed in this habitat during these surveys.

2) Red Maple Swamps (R)

Several Red Maple swamps were observed on the quarry property during this survey (Figs. 4, 5, 6 & 7) (20T 0309434E 4849596N; 20T 0309903E 4849763N). Red Maple (*Acer rubrum*) and Balsam Fir (*Abies balsamea*) are the dominant tree species in this habitat. Commonly occurring herbaceous species and shrubs include New York Fern (*Thelypteris noveboracensis*), Cinnamon Fern (*Osmundastrum cinnamomeum*), Black Huckleberry (*Gaylussacia baccata*), Sheep Laurel (*Kalmia angustifolia*), Goldthread (*Coptis trifolia*), and Star Flower (*Lysimachia borealis*). Poison Ivy (*Toxicodendron radicans*) was observed in one of the swamps. Sphagnum mosses (*Sphagnum* spp.) form the dominant ground cover in these wetlands.

A full species list is found in the Appendix.

Figure 4. A large Red Maple swamp located near the west end of the survey area (20T 0309434E 4849596N). The dominant plant in the foreground is Cinnamon Fern (*Osmundastrum cinnamomeum*). Photo taken during the fall survey.

Figure 5. Same Red Maple swamp as depicted in Figure 4 (at a different location within the swamp) in late spring.

Figure 6. A small Red Maple swamp at OHV trail culvert (20T 0309903E 4849763N). Photo taken during the fall survey.

Species of conservation concern in Red Maple swamp habitat:

Although no species of conservation concern were observed in Red Maple swamp habitat during the fall survey, one species was documented in the Red Maple swamp (20T 0309434E 4849596N) shown in Figs. 4 and 5, during the spring survey. This is Southern Twayblade (*Neottia bifolia*) (formerly *Listera australis*) (Fig. 7). Southern Twayblade dies back by mid-summer and would not have been apparent during the fall survey. Approximately 20 plants were observed within the swamp. Southern Twayblade is listed by the Atlantic Canada Conservation Data Centre as an S3 species (i.e., vulnerable) although the Nova Scotia General Status Rank is S4 (apparently secure/light green).

Figure 7. Southern Twayblade (*Neottia bifolia*) in Red Maple swamp at west end of property/survey area (Figures 4 & 5).

3) Mixed Woodland (M)

The higher elevations on the property generally consist of large areas of mesic mixed woodland (Figs. 8, 9, 10). Some of this habitat has been cutover or partially cutover at various times in the past. Other areas appear relatively undisturbed. Some areas have high dense shrub cover as shown in Fig. 10. Sizeable boulders are thinly scattered throughout (Fig. 9). Interspersed between the higher elevations are occasional small, low, damp, sphagnous areas often with dense patches of Cinnamon Fern (*Osmundastrum cinnamomeum*) (Fig. 11).

Tree species present include Balsam Fir (*Abies balsamea*), Red Maple (*Acer rubrum*), Red Oak (*Quercus rubra*), Red Spruce (*Picea rubens*) and White Pine (*Pinus strobus*). To a lesser extent, Large-toothed Aspen (*Populus grandidentata*) and White Birch (*Betula papyrifera*) are also present. In addition to the trees, there is often a dense high shrub layer present (Fig. 10). Common species within the shrub layer include Black Huckleberry (*Gaylussacia baccata*), Witch-hazel (Hamemelis virginiana), Bayberry (*Morella pensylvanica*), Inkberry (*Ilex glabra*), Chokeberry (*Photinia* sp.) and Sheep Laurel (*Kalmia angustfolia*). Ground vegetation includes Starflower (*Lysimachia borealis*), Wintergreen (*Gaultheria procumbens*), Indian Cucumber-root (*Medeola virginiana*), Bracken (*Pteridium aquilinum*) and Wild Sarsaparilla (*Aralia nudicaulis*).

A full species list is found in the Appendix.

Figure. 8. Mesic mixed woodland occurring within the survey area (fall survey).

Figure 9. Mesic mixed forest located south of the existing quarry (spring survey). Sizeable boulders are thinly scattered throughout this area (and elsewhere on the property) and are often moss and lichen-covered with occasional ferns and flowering plants.

Figure 10. Mesic mixed woodland with a dense shrub layer. Photo taken in the fall.

Figure 11. Occasional low damp sphagnous areas can be found within mixed forest habitat. In this area, Cinnamon Fern (*Osmundastrum cinnamomeum*) is dominant.

Species of conservation concern:

No species of conservation concern were observed in mixed woodland habitat during either the fall or spring surveys.

4) Outcrops (O)

A small area of rock outcroppings is located on the property at map coordinates 20T 0309572E 4849652N (Figs. 12 & 13) and 20T 0309601E 4849580N. Commonly occurring shrub species in this exposed habitat include Black Huckleberry (*Gaylussacia baccata*), Lowbush Blueberry (*Vaccinium angustifolium*), Sheep Laurel (*Kalmia angustifolia*) and Bayberry (*Morella pensylvanica*). A variety of low shrubs (subshrubs) were also present including several that were not observed elsewhere on the property. These include Golden-heather (*Hudsonia ericoides*) and Broom Crowberry (*Corema conradii*).

Tree species that establish in this habitat type are often stunted, likely as a result of limited soil and moisture. Tree species observed here include Wire Birch (*Betula populifolia*), Red Oak (*Quercus rubra*), Red Spruce (*Picea rubens*) and White Pine (*Pinus strobus*).

Very few herbaceous species were observed in this habitat.

Various reindeer lichens (*Cladonia* spp.) are abundant on these outcrops (Fig. 12 &13).

Figure 12. One section of an area of outcroppings located within the survey area (20T 0309572E 4849652N).

Figure 13. Extensive beds of reindeer lichens (*Cladonia* spp.) (whitish ground cover) occurring on rock outcrops within the survey area.

Species of conservation concern:

Golden-heather (*Hudsonia ericoides*) (Fig. 14) was observed on several rock outcrops described above (20T 0309572E 4849652N, 20T 0309601E 4849580N), during this survey. Both the Nova Scotia General Status Rank and the Atlantic Canada Conservation Data Centre subnational status designation for this species is S2/imperilled (ORANGE). It is considered to be at high risk of extirpation in the province due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

Figure 14. Golden-heather (*Hudsonia ericoides*) was observed primarily on rock outcrops during this survey. This species is considered to be an **imperilled species** in Nova Scotia by the Atlantic Canada Conservation Data Centre (ACCDC) and the 2015 Wild Species of Canada Report.

5) Small marshes and occasional damp sphagnous areas (W)

Two small marshes were surveyed.

A more-or-less open, boggy marsh (Figs. 15 & 16) occurs on the north side of an off highway vehicle trail at the following coordinates on the property: 20T 0309920E 4849790N. The construction of the OHV trail may have led to the formation of this particular habitat. There are snags (standing dead trees) present in this wetland suggesting that the trail construction may have resulted in more frequent or possibly more-or-less permanent flooding, leading to the death of some of the existing trees and creating open wetland habitat. A Red Maple swamp (Fig. 6) occurs immediately to the south of the

marsh and trail and it is suspected that the open marsh area, prior to the creation of the OHV trail, was Red Maple swamp habitat similar to that which occurs south of the trail.

Common species in this marsh include Steeplebush (*Spiraea tomentosa*), Atlantic Sedge (*Carex atlantica*), Canada Manna Grass (*Glyceria canadensis*), Common Woolly Bulrush (*Scirpus cyperinus*), Black Huckleberry (*Gaylussacia baccata*), Red Maple (*Acer rubrum*), Cinnamon Fern (*Osmundastrum cinnamomeum*) and Black Spruce (*Picea mariana*).

Figure. 15. Boggy marsh habitat located along the main OHV trail southwest of the open quarry pit. Photo taken in the fall.

Figure 16. Same wetland as shown in Fig. 15 but photo taken in late spring.

A second marsh on the quarry property (20T 0310666E 4850153N) also has had a road built across it, but this does not appear to have significantly impacted the marsh (Fig. 17). The dominant species in this wetland is Button Sedge (*Carex bullata*). Other species present include Common Woolly Bulrush (*Scirpus cyperinus*), Soft Rush (*Juncus effusus*), Black Huckleberry (*Gaylussacia baccata*), Woodland Rush (*Juncus subcaudatus*) and Cinnamon Fern (*Osmundastrum cinnamomeum*).

Species of conservation concern:

Woodland Rush (*Juncus subcaudatus*) occurs in the second wetland described above (Fig. 17). This species is ranked in Nova Scotia as an S3/vulnerable (YELLOW) species, i.e., a species at moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

Figure 17. Small marsh located near the east boundary of the survey area.

In addition to marshes described above, various low damp areas occur throughout the property (Fig. 18 & 19), some in woodland, and others along old logging access routes. These generally have a sphagnous substrate and vascular plant species present include Common Woolly Bulrush (*Scirprus cyperinus*), Cinnamon Fern (*Osmundastrum cinnamomeum*), Black Huckleberry (*Gaylussacia baccata*), Inkberry (*Ilex glabra*), Sheep Laurel (*Kalmia angustifolia*), Bunchberry (*Cornus canadensis*), Snowberry (*Gaultheria hispidula*), Sallow Sedge (*Carex lurida*), etc.

Figure 18. A small, low, wet area along an old logging roadway (20T 0309693E 4849710N).

Figure 19. Eastern Blue-eyed Grass (*Sisyrinchium atlanticum*) occurring along a damp, grown in logging road in the upper east corner of the survey area (20T 0310602 4850169). This species is listed as an S3S4 species (vulnerable to apparently secure (yellow to light green)).

Species of conservation concern:

There was one species of some conservation concern observed in one of these areas, i.e. overgrown logging roads, during this survey (20T 0310602 4850169). Eastern Blue-eyed Grass (*Sisyrinchium atlanticum*) (Fig. 19) in Nova Scotia is ranked as an S3S4 species (vulnerable to apparently secure - yellow to light green), meaning it ranges from potentially being 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) to being at a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.

6) OHV (off-highway vehicle) trails (T)

A mix of native and exotic vascular plant species occur along the edges of OHV trails as well as directly on the trails themselves. Commonly occurring species observed during this survey in this habitat include: Green Alder (*Alnus alnobetula* ssp. *crispa*), Sweetfern (*Comptonia peregrina*), Wire Birch (*Betula populifolia*), Pinweed (*Lechea intermedia*), Pearly Everlasting (*Anaphalis margaritacea*), Calico Aster (*Symphyotrichum lateriflorum*), Downy Goldenrod (*Solidago puberula*), Rough Bentgrass (*Agrostis scabra*), Canada St. John's-wort (*Hypericum canadense*), Poverty Grass (*Danthonia spicata*) and Fall Dandelion (*Leontodon autumnalis*).

Species of conservation concern:

There were no species of conservation concern in this habitat.

Discussion

No species listed under either federal species-at-risk legislation or provincial species-at-risk- legislation were observed on the quarry property during these surveys.

The majority of the vascular plant species observed and recorded during these current surveys fall into the Nova Scotia general status rank categories of **GREEN, LIGHT GREEN** or **EXOTIC** with GREEN indicating a plant with a secure conservation status within the province, LIGHT GREEN indicating a species at a fairly low risk of extirpation and EXOTIC meaning a species that is considered to be non-native to Nova Scotia. The Atlantic Canada Conservation Data Centre sub-national status ranks fall primarily into the categories of S5, S4 and SNA, also indicating that most species on site are not of conservation concern (S5 = **Secure** - Common, widespread, and abundant in the province; S4 = **Apparently Secure** - Uncommon but not rare; some cause for long-term concern due to declines or other factors; SNA = **Not Applicable** - a conservation status rank is not applicable because the species is not a suitable target for conservation activities, for example, non-native (exotic) species).

Two species were documented during the fall survey that have some degree of conservation concern. These are Golden-heather (*Hudsonia ericoides*) and Woodland Rush (*Juncus subcaudatus*).

Golden-heather (Fig. 14) was primarily restricted to rock outcroppings at 20T 0309572E 4849652N (Figs. 12 & 13) and 20T 0309601E 4849580N on the property and was relatively common in this particular habitat (Fig. 14). This species is listed as imperilled (S2) (ORANGE)

Woodland Rush was observed in one of the two marshes that were surveyed (20T 0310666E 4850153N). It was not observed elsewhere on the property. This species is listed as vulnerable (S3) (YELLOW).

An additional two species of conservation concern were documented during the late spring survey. These are Southern Twayblade (*Neottia bifolia*) and Eastern Blue-eyed Grass (*Sisyrinchim atlanticum*).

Southern Twayblade was restricted to a Red Maple Swamp located at the west end of the property (20T 0309434E 4849596N). This species is listed as a vulnerable (S3/YELLOW) species.

Eastern Blue-eyed Grass (Fig. 19) was observed along an overgrown logging road (20T 0310602 4850169) in the northeast corner of the survey area. This species is listed as vulnerable to apparently secure (S3S4/ YELLOW to LIGHT GREEN).

APPENDIX

List of all vascular plants observed on the Welshtown quarry property during surveys conducted on October 7, 2019 and June 24th - 26th, 2020, the habitats in which they occur and their current status ranks (both the Nova Scotia General Status Rank*and the Atlantic Canada Conservation Data Centre Subnational s-rank** are provided for each species). (Habitats: coniferous forest (C), mixed forest (M), Red Maple swamp (R), outcrops (O), small wet areas e.g., small marshes, damp, wooded and open areas and old logging roads (W), OHV (off-highway vehicle) trails (T).

Additional species documented during the spring survey are marked with the following symbol: †.

Species with a rarity ranking (and accompanying information) are in bold font.

Latin Name	**Common Name**	**Nova Scotia General Status Rank***	**ACCDC Subnational Status Rank****	**Habitat(s)**
Abies balsamea	Balsam Fir	S5/secure (green)	S5/secure	C, M, R, O, W
Acer rubrum	Red Maple	S5/secure (green)	S5/secure	C, M, R, O, W, T
Agrostis scabra	Rough Bent Grass	S5/secure (green)	S5/secure	T
Alnus alnobetula ssp. crispa	Green Alder	S5/secure (green)	S5/secure	T
Anaphalis margaritacea	Pearly Everlasting	S5/secure (green)	S5/secure	T
Aralia nudicaulis	Wild Sarsparilla	S5/secure (green)	S5/secure	M
Betula papyrifera	White Birch	S5/secure (green)	S5/secure	M, O, T

Latin Name	Common Name	Nova Scotia General Status Rank*	ACCDC Subnational Status Rank**	Habitat(s)
Betula populifolia	Wire Birch	S5/secure (green)	S5/secure	M, O, T
Carex atlantica†	Atlantic Sedge			W
Carex bullata	Button Sedge	S4/apparently secure (light green)	S4/apparently secure	W
Carex lurida†	Sallow Sedge	S5/secure (green)	S5/secure	W, T
Carex trisperma †	Three-seeded Sedge	S5/secure (green)	S5/secure	R, W
Clintonia borealis†	Bluebead Lily	S5/secure (green)	S5/secure	M
Comptonia peregrina	Sweetfern	S5/secure (green)	S5/secure	M, O, T
Coptis trifolia	Goldthread	S5/secure (green)	S5/secure	M, R, W
Corema conradii	Broom Crowberry	S4/apparently secure (light green)	S4/apparently secure	O
Cornus canadensis	Bunchberry	S5/secure (green)	S5/secure	C, M, R, W
Cypripedium acaule†	Pink Lady's-slipper	S5/secure (green)	S5/secure	T
Danthonia spicata	Poverty Grass	S5/secure (green)	S5/secure	T
Dennstaedtia punctilobua	Hay-scented Fern	S5/secure (green)	S5/secure	M, W, T
Dichanthelium depauperatum†	Starved Panic Grass	S4S5/apparently secure to secure (light green)	S4S5/apparently secure to secure	O
Dichanthelium implicatum†	Slender-stemmed Panic Grass	-	S5/secure	W, T
Dichanthelium lanuginosum†	Wooly Panic Grass	-	S5/secure	W, T
Doellingeria umbellata	Tall White Aster	S5/secure (green)	S5/secure	M
Drosera rotundifolia	Round-leaved Sundew	S5/secure (green)	S5/secure	T
Dryopteris marginalis	Marginal Wood Fern	S5/secure (green)	S5/secure	O
Eleocharis tenuis†	Slender Spikerush	S5/secure (green)	S5/secure	W, T
Epigaea repens	Mayflower	S5/secure (green)	S5/secure	M, O, T
Eriophorum virginicum	Tawny Cottongrass	S5/secure (green)	S5/secure	W
Fragaria virginiana	Wild Strawberry	S5/secure (green)	S5/secure	W

Latin Name	Common Name	Nova Scotia General Status Rank*	ACCDC Subnational Status Rank**	Habitat(s)
Gaultheria hispidula	Creeping Snowberry	S5/secure (green)	S5/secure	M, R, W
Gaultheria procumbens	Wintergreen	S5/secure (green)	S5/secure	M, O, W, T
Gaylussacia baccata	Black Huckleberry	S5/secure (green)	S5/secure	M, R, O, W, T
Glyceria canadensis	Canada Manna Grass	S5/secure (green)	S5/secure	W
Hamamelis virginiana	American Witch-hazel	S5/secure (green)	S5/secure	M, R, O
Hudsonia ericoides	**Golden-heather**	**S2/imperilled (orange)**	**S2/imperiled**	**O, T**
Hypericum canadense	Canada St. John's-wort	S5/secure (green)	S5/secure	T
Hypericum gentianoides	False St. John's-wort	NA/exotic	SNA	T
Ilex glabra	Inkberry	S5/secure (green)	S5/secure	C, M, R, O, W, T
Ilex mucronata	Mountain Holly	S5/secure (green)	S5/secure	R, W
Ilex verticillata	Common Winterberry	S5/secure (green)	S5/secure	M, R, W
Juncus effusus sl	Soft Rush	S5/secure (green)	S5/secure	W
Juncus subcaudatus	**Woodland Rush**	**S3/vulnerable (yellow)**	**S3/vulnerable**	**W**
Kalmia angustifolia	Sheep Laurel	S5/secure (green)	S5/secure	M, R, O, W, T
Larix laricina	Larch	S5/secure (green)	S5/secure	W
Lechea intermedia	Pinweed	S4/apparently secure (light green)	S4/apparently secure	T
Leontodon autumnalis	Fall Dandelion	NA/exotic	SNA	T
Linnaea borealis	Twinflower	S5/secure (green)	S5/secure	M, R, W, T
Lycopodiella inundata	Northern Bog Clubmoss	S5/secure	S5/secure	T
Lysimachia borealis	Starflower	S5/secure (green)	S5/secure	C, M, R, W, T
Maianthemum canadense	Wild-Lily-of-the-Valley	S5/secure (green)	S5/secure	M, O, W
Medeola virginiana	Indian Cucumber-root	S5/secure (green)	S5/secure	M, R, O
Melampyrum lineare †	Cow Wheat	S4/apparently secure (light green)	S5/secure	T
Mitchella repens	Partridgeberry	S5/secure (green)	S5/secure	M, R, W, T

Latin Name	Common Name	Nova Scotia General Status Rank*	ACCDC Subnational Status Rank**	Habitat(s)
Monotropa uniflora†	Ghostflower	S5/secure (green)	S5/secure	M, R
Morella pensylvanica	Bayberry	S5/secure (green)	S5/secure	M, R, O
Muhlenbergia uniflora	Bog Muhly	S5/secure (green)	S5/secure	T, W
Myrica gale†	Sweet Gale	S5/secure (green)	S5/secure	W
Neottia bifolia†	**Southern Twayblade**	**S3/vulnerable (yellow)**	**S3/vulnerable**	**R**
Oclemena acuminata	Wood Aster	S5/secure (green)	S5/secure	M, R
Osmundastrum cinnamomeum	Cinnamon Fern	S5/secure (green)	S5/secure	C, M, R, W
Photinia sp.	a chokeberry	-	-	M
Picea mariana	Black Spruce	S5/secure (green)	S5/secure	R, W
Picea rubens	Red Spruce	S5/secure (green)	S5/secure	C, M, O
Pinus strobus	White Pine	S5/secure (green)	S5/secure	C, M, O
Platanthera sp.	**an orchid**	**-**	**-**	R
Polypodium vulgare	Rock Polypody	S5/secure (green)	S5/secure	O
Populus grandidentata	Large-toothed Aspen	S5/secure (green)	S5/secure	M, O
Pteridium aquilinum	Bracken	S5/secure (green)	S5/secure	M, O
Quercus rubra	Northern Red Oak	S5/secure (green)	S5/secure	M, O
Rhododendron groenlandicum	Labrador-tea	S5/secure (green)	S5/secure	M, R
Rhynchospora capitellata	Small-headed Beakrush	S4/secure (light green)	S4/apparently secure	T
Rubus hispidus	Bristly Dewberry	S5/secure (green)	S5/secure	R, W
Scirpus cyperinus	Common Woolly Bulrush	S5/secure (green)	S5/secure	W
Sisyrinchium atlanticum	**Eastern Blue-eyed Grass**	**S3S4/vulnerable to apparently secure (yellow to light green))**	**S3S4 vulnerable to apparently secure**	**W, T**
Solidago canadensis	Canada Goldenrod	S5/secure (green)	S5/secure	T
Solidago puberula	Downy Goldenrod	S5/secure (green)	S5/secure	O, T
Solidago rugosa†	Rough Goldenrod	S5/secure (green)	S5/secure	W, T
Spiraea tomentosa	Steeplebush	S5/secure (green)	S5/secure	W

Latin Name	Common Name	Nova Scotia General Status Rank*	ACCDC Subnational Status Rank**	Habitat(s)
Symphyotrichum lateriflorum	Calico Aster	S5/secure (green)	S5/secure	T
Thelypteris noveboracensis	New York Fern	S5/secure (green)	S5/secure	M, R, W, T
Thelypteris simulata	Bog Fern	S4/apparently secure (green)	S4/apparently secure	R, W
Toxicodendron radicans	Poison Ivy	S5/secure (green)	S4/apparently secure	R
Trillium undulatum†	Painted Trillium	S5/secure (green)	S5/secure	M
Vaccinium angustifolium	Lowbush Blueberry	S5/secure (green)	S5/secure	M, R, O, W, T
Vaccinium macrocarpon†	Large Cranberry	S5/secure (green)	S5/secure	O
Viburnum nudum* var. *cassinoides	Witherod	S5/secure (green)	S5/secure	M
Viola xsublanceolata	Primrose-leaved Violet	-	S4/apparently secure	T

*The Nova Scotia general status ranks used in this report are based on the ranks used in the 2015 Wild Species of Canada Report (available at https://www.wildspecies.ca/) ; S**5 = Secure/green** (at very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats**; S4 = Apparently secure/light green** (at a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors**; S3 = Vulnerable/yellow** (at moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors; **S2 = Imperilled/orange (**at high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors); **NA = not applicable (**non-native/exotic).

ACCDC: Atlantic Canada Conservation Data Centre explanation of status ranks used in this report (http://accdc.com/en/rank-definitions.html): **S5 = Secure (common, widespread, and abundant in the province); **S4** = **Apparently Secure** (uncommon but not rare; some cause for long-term concern due to declines or other factors); **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.)**;** 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. **SNA** = **Not Applicable** - a conservation status rank is not applicable because the species is not a suitable target for conservation activities, e.g. a non-native species.

APPENDIX C

ATLANTIC CANADA CONSERVATION DATA CENTRE REPORT

Atlantic Canada Conservation Data Centre
Centre de données sur la conservation du Canada atlantique

DATA REPORT 6576: Welshtown, NS

Prepared 20 March 2020
by J. Churchill, Data Manager

CONTENTS OF REPORT

Map 1. A 100 km buffer around the study area

1.0 PREFACE

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

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

1.1 DATA LIST

Included datasets:

Filename	Contents
WelshtownNS_6576ob.xls	Rare and legally protected Flora and Fauna in your study area
WelshtownNS_6576ob100km.xls	A list of Rare and legally protected Flora and Fauna within 100 km of your study area
WelshtownNS_6576ma.xls	Managed Areas in your study area

1.2 RESTRICTIONS

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

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

1.3 ADDITIONAL INFORMATION

The accompanying Data Dictionary provides metadata for the data provided.

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

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

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

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

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

Billing
Jean Breau
Tel: (506) 364-2657
jean.breau@accdc.ca

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

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

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

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

Western: Sarah Spencer
(902) 634-7555
Sarah.Spencer@novascotia.ca

Central: Shavonne Meyer
(902) 893-6350
Shavonne.Meyer@novascotia.ca

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

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

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

2.0 RARE AND ENDANGERED SPECIES

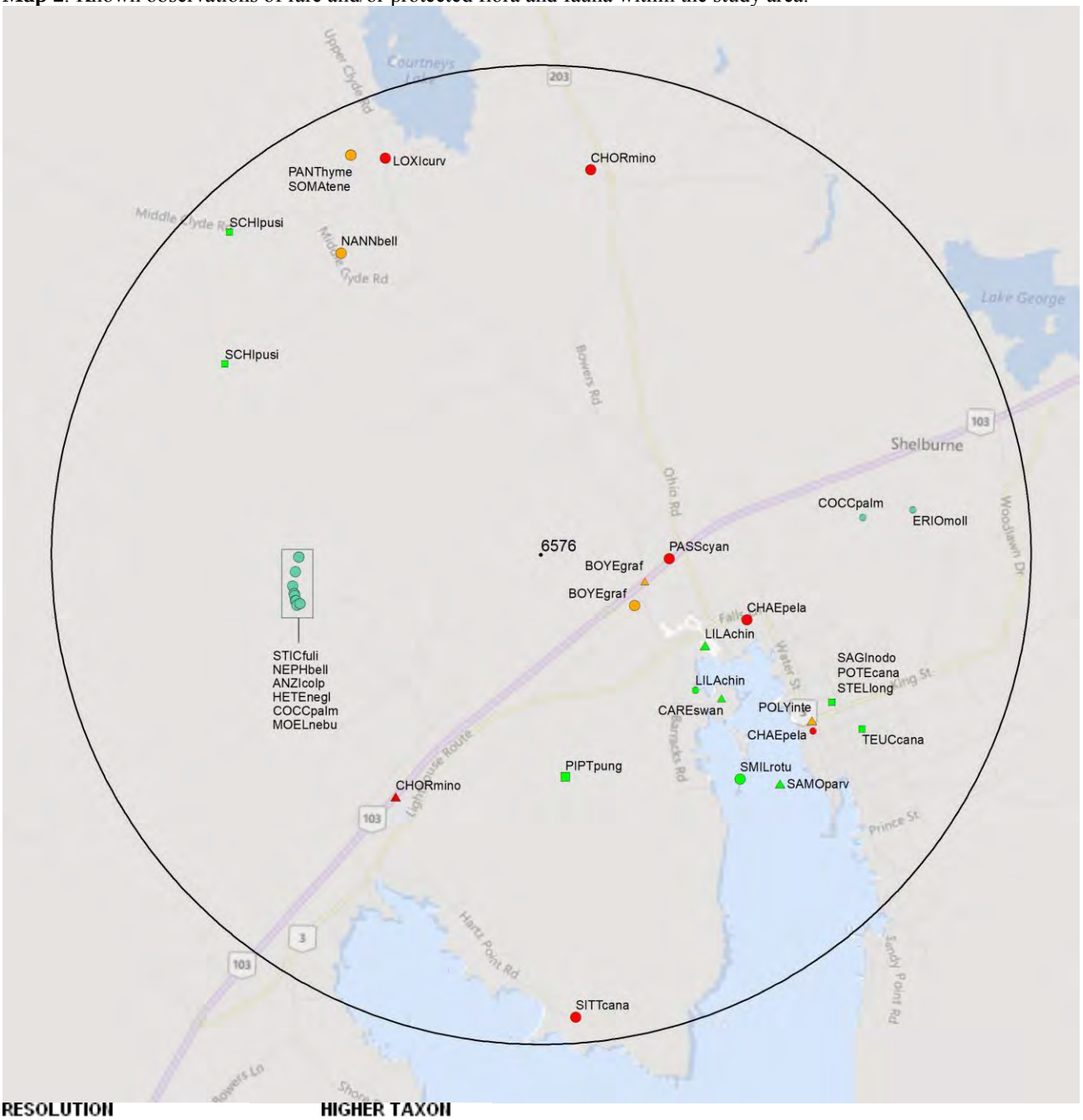
2.1 FLORA

The study area contains 12 records of 10 vascular, 14 records of 7 nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

The study area contains 7 records of 5 vertebrate, 6 records of 5 invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

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



RESOLUTION

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

HIGHER TAXON

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

3.0 SPECIAL AREAS

3.1 MANAGED AREAS

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

3.2 SIGNIFICANT AREAS

The GIS scan identified no biologically significant sites in the vicinity of the study area (Map 3).

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

4.0 RARE SPECIES LISTS

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

4.1 FLORA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
N	*Erioderma mollissimum*	Graceful Felt Lichen	Endangered	Endangered	Endangered	S1S2	2 May Be At Risk	1	3.8 ± 0.0
N	*Anzia colpodes*	Black-foam Lichen	Threatened	Threatened	Threatened	S3	3 Sensitive	3	2.5 ± 0.0
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3	3 Sensitive	1	2.5 ± 0.0
N	*Nephroma bellum*	Naked Kidney Lichen				S3	3 Sensitive	1	2.6 ± 0.0
N	*Moelleropsis nebulosa*	Blue-gray Moss Shingle Lichen				S3	4 Secure	1	2.5 ± 0.0
N	*Coccocarpia palmicola*	Salted Shell Lichen				S3S4	4 Secure	6	2.5 ± 0.0
N	*Heterodermia neglecta*	Fringe Lichen				S3S4	4 Secure	1	2.6 ± 0.0
P	*Lilaeopsis chinensis*	Eastern Lilaeopsis	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	2	1.9 ± 1.0
P	*Smilax rotundifolia*	Round-leaved Greenbrier	Not At Risk			S3	4 Secure	1	3.1 ± 0.0
P	*Stellaria longifolia*	Long-leaved Starwort				S2	3 Sensitive	1	3.3 ± 5.0
P	*Piptatheropsis pungens*	Slender Ricegrass				S2	3 Sensitive	1	2.3 ± 10.0
P	*Sagina nodosa*	Knotted Pearlwort				S2S3	4 Secure	1	3.3 ± 5.0
P	*Potentilla canadensis*	Canada Cinquefoil				S2S3	3 Sensitive	1	3.3 ± 5.0
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	1	3.7 ± 5.0
P	*Samolus parviflorus*	Seaside Brookweed				S3	3 Sensitive	1	3.4 ± 2.0
P	*Carex swanii*	Swan's Sedge				S3	3 Sensitive	1	2.4 ± 0.0
P	*Schizaea pusilla*	Little Curlygrass Fern				S3S4	4 Secure	2	3.8 ± 4.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2B,S1M	1 At Risk	2	2.2 ± 0.0
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S2B	1 At Risk	2	2.9 ± 1.0
A	*Passerina cyanea*	Indigo Bunting				S1?B	5 Undetermined	1	1.3 ± 0.0
A	*Sitta canadensis*	Red-breasted Nuthatch				S3	4 Secure	1	4.7 ± 0.0
A	*Loxia curvirostra*	Red Crossbill				S3S4	4 Secure	1	4.4 ± 0.0
I	*Pantala hymenaea*	Spot-Winged Glider				S2?B	3 Sensitive	1	4.5 ± 0.0
I	*Boyeria grafiana*	Ocellated Darner				S3	3 Sensitive	2	1.1 ± 0.0
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S3	4 Secure	1	4.5 ± 0.0
I	*Nannothemis bella*	Elfin Skimmer				S3	4 Secure	1	3.7 ± 0.0
I	*Polygonia interrogationis*	Question Mark				S3B	4 Secure	1	3.2 ± 2.0

4.3 LOCATION SENSITIVE SPECIES

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

Nova Scotia

Scientific *Name*	Common Name	SARA	Prov Legal Prot	Known within the Study Site?
Fraxinus nigra	Black Ash		Threatened	No
Emydoidea blandingii	*Blanding's Turtle - Nova Scotia pop.*	Endangered	Vulnerable	No
Glyptemys insculpta	Wood Turtle	Threatened	Threatened	No
Falco peregrinus pop. 1	Peregrine Falcon - anatum/tundrius pop.	Special Concern	Vulnerable	No
Bat Hibernaculum		**[Endangered][1]**	**[Endangered][1]**	**YES**

1 *Myotis lucifugus* (Little Brown Myotis), *Myotis septentrionalis* (Long-eared Myotis), and *Perimyotis subflavus* (Tri-colored Bat or Eastern Pipistrelle) are all Endangered under the Federal Species at Risk Act and the NS Endangered Species Act.

4.4 SOURCE BIBLIOGRAPHY

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

# recs	CITATION
12	Cameron, R.P. 2009. Cyanolichen database. Nova Scotia Environment & Labour, 1724 recs.
5	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
5	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2013.
4	Brunelle, P.-M. (compiler). 2009. ADIP/MDDS Odonata Database: data to 2006 inclusive. Atlantic Dragonfly Inventory Program (ADIP), 24200 recs.
3	Staff, DNR 2007. Restricted & Limited Use Land Database (RLUL).
2	Neily, T.H. 2017. Nova Scotia lichen records. Mersey Tobeatic Research Institute.
2	Roland, A.E. & Smith, E.C. 1969. The Flora of Nova Scotia, 1st Ed. Nova Scotia Museum, Halifax, 743pp.
1	Austin-Smith, P. 2014. 2014 Common Nighthawk personal communication report, NS. NS Department of Natural Resources.
1	Belliveau, A.G. 2018. E.C. Smith Herbarium and Atlantic Canada Conservation Data Centre Fieldwork 2018. E.C. Smith Herbarium, 6226 recs.
1	Benjamin, L.K. (compiler). 2007. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 8439 recs.
1	Brunelle, P.-M. (compiler). 2010. ADIP/MDDS Odonata Database: NB, NS Update 1900-09. Atlantic Dragonfly Inventory Program (ADIP), 935 recs.
1	Crowell, M.J. 2009. Lilaeopsis chinensis on Roseway River. Jacques Whitford Limited. Pers. comm. to D.M. Mazerolle, 1 rec.
1	e-Butterfly. 2018. Selected Maritimes butterfly records from 2016 and 2017. Maxim Larrivee, Sambo Zhang (ed.) e-butterfly.org.
1	Newell, R.E. 2000. E.C. Smith Herbarium Database. Acadia University, Wolfville NS, 7139 recs.
1	Newell, R.E. 2005. E.C. Smith Digital Herbarium. E.C. Smith Herbarium, Irving Biodiversity Collection, Acadia University, Web site: http://luxor.acadiau.ca/library/Herbarium/project/. 582 recs.
1	Oldham, M.J. 2000. Oldham database records from Maritime provinces. Oldham, M.J; ONHIC, 487 recs.

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 45331 records of 132 vertebrate and 466 records of 48 invertebrate fauna; 24988 records of 217 vascular, 2940 records of 130 nonvascular flora (attached: *ob100km.xls).

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

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Coregonus huntsmani*	Atlantic Whitefish	Endangered	Endangered	Endangered	S1	7 Exotic	35	50.5 ± 1.0	NS
A	*Myotis lucifugus*	Little Brown Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	21	2.1 ± 0.0	NS
A	*Perimyotis subflavus*	Eastern Pipistrelle	Endangered	Endangered	Endangered	S1	1 At Risk	24	62.9 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Emydoidea blandingii*	Blanding's Turtle - Nova Scotia pop.	Endangered	Endangered	Endangered	S1	1 At Risk	9714	51.1 ± 24.0	NS
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy pop.	Endangered	Endangered		S1	2 May Be At Risk	4	88.8 ± 1.0	NS
A	*Charadrius melodus melodus*	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B	1 At Risk	2461	15.6 ± 7.0	NS
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1B	1 At Risk	102	13.5 ± 0.0	NS
A	*Morone saxatilis pop. 2*	Striped Bass - Bay of Fundy pop.	Endangered			S1B	2 May Be At Risk	2	77.0 ± 1.0	NS
A	*Calidris canutus rufa*	Red Knot rufa ssp	Endangered	Endangered	Endangered	S2M	1 At Risk	802	19.6 ± 0.0	NS
A	*Caretta caretta*	Loggerhead Sea Turtle	Endangered	Endangered		SNA		1	88.0 ± 0.0	NS
A	*Colinus virginianus*	Northern Bobwhite	Endangered	Endangered				7	35.6 ± 7.0	NS
A	*Antrostomus vociferus*	Eastern Whip-Poor-Will	Threatened	Threatened	Threatened	S1?B	1 At Risk	7	16.0 ± 7.0	NS
A	*Limosa haemastica*	Hudsonian Godwit	Threatened			S1S2M	3 Sensitive	239	23.0 ± 0.0	NS
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2	3 Sensitive	9	6.2 ± 5.0	NS
A	*Anguilla rostrata*	American Eel	Threatened			S2	4 Secure	253	26.3 ± 0.0	NS
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2B,S1M	1 At Risk	222	2.2 ± 0.0	NS
A	*Thamnophis sauritus pop. 3*	Eastern Ribbonsnake - Atlantic pop.	Threatened	Threatened	Threatened	S2S3	1 At Risk	2079	37.9 ± 0.0	NS
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2 May Be At Risk	86	7.0 ± 7.0	NS
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	411	6.8 ± 7.0	NS
A	*Cardellina canadensis*	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	268	12.0 ± 0.0	NS
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Vulnerable	S3S4B	3 Sensitive	75	15.8 ± 7.0	NS
A	*Sturnella magna*	Eastern Meadowlark	Threatened	Threatened		SHB	3 Sensitive	1	96.3 ± 7.0	NS
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened		SUB	5 Undetermined	17	16.1 ± 7.0	NS
A	*Asio flammeus*	Short-eared Owl	Special Concern	Special Concern		S1S2B	2 May Be At Risk	5	35.6 ± 7.0	NS
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	2 May Be At Risk	104	6.8 ± 7.0	NS
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S2B	1 At Risk	284	2.9 ± 1.0	NS
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	420	5.2 ± 0.0	NS
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S2N	1 At Risk	20	32.8 ± 0.0	NS
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern	Special Concern		S2S3M	3 Sensitive	7	23.0 ± 0.0	NS
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	3 Sensitive	162	7.0 ± 10.0	NS
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	372	6.8 ± 7.0	NS
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern	Special Concern	Vulnerable	S3S4B,S3N	4 Secure	228	6.8 ± 7.0	NS
A	*Phocoena phocoena pop. 1*	Harbour Porpoise - Northwest Atlantic pop.	Special Concern			S4		10	92.5 ± 10.0	NS
A	*Podiceps auritus*	Horned Grebe	Special Concern	Special Concern		S4N	4 Secure	6	28.4 ± 7.0	NS
A	*Chrysemys picta picta*	Eastern Painted Turtle	Special Concern			S4S5	4 Secure	250	6.3 ± 0.0	NS
A	*Calidris subruficollis*	Buff-breasted Sandpiper	Special Concern	Special Concern		SNA	8 Accidental	103	19.6 ± 0.0	NS
A	*Lynx canadensis*	Canadian Lynx	Not At Risk		Endangered	S1	1 At Risk	3	45.3 ± 1.0	NS
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Not At Risk	Special Concern	Vulnerable	S1B,SNAM	3 Sensitive	2	24.5 ± 0.0	NS
A	*Glaucomys volans*	Southern Flying Squirrel	Not At Risk			S2S3	3 Sensitive	9	58.2 ± 5.0	NS
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S3	4 Secure	15	11.6 ± 0.0	NS
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	3 Sensitive	278	9.4 ± 0.0	NS
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	3 Sensitive	18	15.2 ± 0.0	NS
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	4 Secure	27	16.0 ± 7.0	NS
A	*Circus hudsonius*	Northern Harrier	Not At Risk			S3S4B	4 Secure	94	6.8 ± 7.0	NS
A	*Ammospiza nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	4 Secure	88	6.8 ± 7.0	NS
A	*Morone saxatilis*	Striped Bass	E,SC			S2S3	2 May Be At Risk	7	7.8 ± 1.0	NS
A	*Salmo salar*	Atlantic Salmon	E,T,SC			S1	2 May Be At Risk	14	12.5 ± 1.0	NS
A	*Martes americana*	American Marten			Endangered	S1	1 At Risk	22	54.0 ± 0.0	NS
A	*Alces americanus*	Moose			Endangered	S1	1 At Risk	109	9.1 ± 5.0	NS
A	*Passerina cyanea*	Indigo Bunting				S1?B	5 Undetermined	20	1.3 ± 0.0	NS
A	*Uria aalge*	Common Murre				S1?B,S5N	4 Secure	1	64.1 ± 0.0	NS
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1B	2 May Be At Risk	18	38.1 ± 7.0	NS
A	*Anas acuta*	Northern Pintail				S1B	2 May Be At Risk	3	39.4 ± 8.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Haematopus palliatus*	American Oystercatcher				S1B	5 Undetermined	117	27.2 ± 0.0	NS
A	*Myiarchus crinitus*	Great Crested Flycatcher				S1B	2 May Be At Risk	24	6.8 ± 7.0	NS
A	*Mimus polyglottos*	Northern Mockingbird				S1B	4 Secure	13	35.1 ± 7.0	NS
A	*Toxostoma rufum*	Brown Thrasher				S1B	5 Undetermined	3	43.1 ± 7.0	NS
A	*Vireo gilvus*	Warbling Vireo				S1B	5 Undetermined	7	36.3 ± 0.0	NS
A	*Setophaga pinus*	Pine Warbler				S1B	5 Undetermined	5	15.9 ± 0.0	NS
A	*Calidris minutilla*	Least Sandpiper				S1B,S3M	4 Secure	1537	19.6 ± 0.0	NS
A	*Charadrius semipalmatus*	Semipalmated Plover				S1B,S3S4M	4 Secure	2203	19.6 ± 0.0	NS
A	*Vespertilionidae sp.*	bat species				S1S2		75	3.3 ± 0.0	NS
A	*Lasiurus cinereus*	Hoary Bat				S1S2B,S1M	2 May Be At Risk	2	57.9 ± 0.0	NS
A	*Pluvialis dominica*	American Golden-Plover				S1S2M	3 Sensitive	301	19.6 ± 0.0	NS
A	*Vireo philadelphicus*	Philadelphia Vireo				S2?B	5 Undetermined	6	35.4 ± 0.0	NS
A	*Spatula clypeata*	Northern Shoveler				S2B	2 May Be At Risk	3	66.7 ± 7.0	NS
A	*Mareca strepera*	Gadwall				S2B	2 May Be At Risk	5	47.5 ± 7.0	NS
A	*Empidonax traillii*	Willow Flycatcher				S2B	3 Sensitive	10	16.1 ± 7.0	NS
A	*Setophaga tigrina*	Cape May Warbler				S2B	3 Sensitive	21	6.4 ± 0.0	NS
A	*Piranga olivacea*	Scarlet Tanager				S2B	5 Undetermined	26	16.0 ± 7.0	NS
A	*Pooecetes gramineus*	Vesper Sparrow				S2B	2 May Be At Risk	1	77.7 ± 7.0	NS
A	*Molothrus ater*	Brown-headed Cowbird				S2B	4 Secure	66	15.6 ± 7.0	NS
A	*Alca torda*	Razorbill				S2B,S4N	3 Sensitive	16	16.9 ± 0.0	NS
A	*Bucephala clangula*	Common Goldeneye				S2B,S5N	4 Secure	90	5.4 ± 1.0	NS
A	*Branta bernicla*	Brant				S2M	3 Sensitive	10	25.9 ± 12.0	NS
A	*Phalacrocorax carbo*	Great Cormorant				S2S3	3 Sensitive	38	16.9 ± 0.0	NS
A	*Asio otus*	Long-eared Owl				S2S3	2 May Be At Risk	7	7.3 ± 7.0	NS
A	*Spinus pinus*	Pine Siskin				S2S3	3 Sensitive	91	7.0 ± 7.0	NS
A	*Cathartes aura*	Turkey Vulture				S2S3B	3 Sensitive	8	21.3 ± 7.0	NS
A	*Rallus limicola*	Virginia Rail				S2S3B	5 Undetermined	1	96.3 ± 7.0	NS
A	*Tringa semipalmata*	Willet				S2S3B	2 May Be At Risk	2038	6.8 ± 7.0	NS
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	2 May Be At Risk	109	6.8 ± 7.0	NS
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S2S3B	3 Sensitive	57	15.6 ± 7.0	NS
A	*Icterus galbula*	Baltimore Oriole				S2S3B	2 May Be At Risk	38	6.8 ± 7.0	NS
A	*Pinicola enucleator*	Pine Grosbeak				S2S3B,S5N	2 May Be At Risk	41	15.6 ± 7.0	NS
A	*Numenius phaeopus hudsonicus*	Hudsonian Whimbrel				S2S3M	3 Sensitive	572	15.8 ± 0.0	NS
A	*Calidris melanotos*	Pectoral Sandpiper				S2S3M	4 Secure	420	19.6 ± 0.0	NS
A	*Phalaropus fulicarius*	Red Phalarope				S2S3M	3 Sensitive	9	27.2 ± 0.0	NS
A	*Perisoreus canadensis*	Canada Jay				S3	3 Sensitive	190	6.8 ± 7.0	NS
A	*Poecile hudsonicus*	Boreal Chickadee				S3	3 Sensitive	181	6.8 ± 7.0	NS
A	*Sitta canadensis*	Red-breasted Nuthatch				S3	4 Secure	511	4.7 ± 0.0	NS
A	*Alosa pseudoharengus*	Alewife				S3	3 Sensitive	20	12.5 ± 1.0	NS
A	*Salvelinus fontinalis*	Brook Trout				S3	3 Sensitive	8	56.6 ± 1.0	NS
A	*Pekania pennanti*	Fisher				S3	3 Sensitive	2	60.4 ± 5.0	NS
A	*Calidris maritima*	Purple Sandpiper				S3?N	3 Sensitive	192	11.3 ± 10.0	NS
A	*Falco sparverius*	American Kestrel				S3B	4 Secure	55	7.3 ± 7.0	NS
A	*Charadrius vociferus*	Killdeer				S3B	3 Sensitive	478	6.8 ± 7.0	NS
A	*Gallinago delicata*	Wilson's Snipe				S3B	3 Sensitive	200	7.3 ± 7.0	NS
A	*Sterna paradisaea*	Arctic Tern				S3B	2 May Be At Risk	115	13.5 ± 0.0	NS
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	2 May Be At Risk	29	15.6 ± 7.0	NS
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	3 Sensitive	87	6.8 ± 7.0	NS
A	*Dumetella carolinensis*	Gray Catbird				S3B	2 May Be At Risk	249	6.8 ± 7.0	NS
A	*Cardellina pusilla*	Wilson's Warbler				S3B	3 Sensitive	19	5.2 ± 0.0	NS
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S3S4M	3 Sensitive	1985	19.6 ± 0.0	NS
A	*Oceanodroma leucorhoa*	Leach's Storm-Petrel				S3B,S5M	4 Secure	56	26.4 ± 0.0	NS
A	*Fratercula arctica*	Atlantic Puffin				S3B,S5N	3 Sensitive	40	28.5 ± 0.0	NS
A	*Pluvialis squatarola*	Black-bellied Plover				S3M	4 Secure	2255	19.6 ± 0.0	NS
A	*Tringa flavipes*	Lesser Yellowlegs				S3M	4 Secure	758	19.6 ± 0.0	NS
A	*Arenaria interpres*	Ruddy Turnstone				S3M	4 Secure	1032	19.6 ± 0.0	NS
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	3 Sensitive	2099	19.6 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Calidris fuscicollis*	White-rumped Sandpiper				S3M	4 Secure	998	19.6 ± 0.0	NS
A	*Limnodromus griseus*	Short-billed Dowitcher				S3M	4 Secure	1376	19.6 ± 0.0	NS
A	*Calidris alba*	Sanderling				S3M,S2N	4 Secure	1768	19.6 ± 0.0	NS
A	*Somateria mollissima*	Common Eider				S3S4	4 Secure	529	7.2 ± 7.0	NS
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	3 Sensitive	30	7.0 ± 7.0	NS
A	*Loxia curvirostra*	Red Crossbill				S3S4	4 Secure	112	4.4 ± 0.0	NS
A	*Botaurus lentiginosus*	American Bittern				S3S4B	3 Sensitive	61	21.3 ± 7.0	NS
A	*Spatula discors*	Blue-winged Teal				S3S4B	2 May Be At Risk	19	25.2 ± 7.0	NS
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	719	6.8 ± 7.0	NS
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	178	13.2 ± 0.0	NS
A	*Regulus calendula*	Ruby-crowned Kinglet				S3S4B	3 Sensitive	451	6.8 ± 7.0	NS
A	*Catharus fuscescens*	Veery				S3S4B	4 Secure	170	6.8 ± 7.0	NS
A	*Catharus ustulatus*	Swainson's Thrush				S3S4B	4 Secure	522	6.8 ± 7.0	NS
A	*Oreothlypis peregrina*	Tennessee Warbler				S3S4B	3 Sensitive	54	15.6 ± 7.0	NS
A	*Setophaga castanea*	Bay-breasted Warbler				S3S4B	3 Sensitive	145	7.2 ± 7.0	NS
A	*Setophaga striata*	Blackpoll Warbler				S3S4B	3 Sensitive	43	15.6 ± 7.0	NS
A	*Passerella iliaca*	Fox Sparrow				S3S4B	4 Secure	33	16.0 ± 7.0	NS
A	*Mergus serrator*	Red-breasted Merganser				S3S4B,S5N	4 Secure	34	15.6 ± 7.0	NS
A	*Bucephala albeola*	Bufflehead				S3S4N	4 Secure	16	28.4 ± 7.0	NS
A	*Leucophaeus atricilla*	Laughing Gull				SHB	4 Secure	1	78.5 ± 0.0	NS
A	*Progne subis*	Purple Martin				SHB	2 May Be At Risk	1	98.3 ± 7.0	NS
A	*Morus bassanus*	Northern Gannet				SHB,S5M	4 Secure	1	64.1 ± 0.0	NS
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Endangered	S2B	3 Sensitive	90	20.4 ± 0.0	NS
I	*Danaus plexippus plexippus*	Monarch	Endangered	Special Concern		S2B	3 Sensitive	1	47.3 ± 0.0	NS
I	*Alasmidonta varicosa*	Brook Floater	Special Concern	Special Concern	Threatened	S1S2	3 Sensitive	2	95.3 ± 0.0	NS
I	*Bombus terricola*	Yellow-banded Bumblebee	Special Concern	Special Concern	Vulnerable	S3	3 Sensitive	14	11.1 ± 1.0	NS
I	*Ophiogomphus anomalus*	Extra-Striped Snaketail				S1	6 Not Assessed	8	67.0 ± 0.0	NS
I	*Leptodea ochracea*	Tidewater Mucket				S1	3 Sensitive	1	73.9 ± 0.0	NS
I	*Chlosyne nycteis*	Silvery Checkerspot				S1?	5 Undetermined	4	87.7 ± 2.0	NS
I	*Polygonia comma*	Eastern Comma				S1?	1 At Risk	1	98.9 ± 2.0	NS
I	*Polygonia satyrus*	Satyr Comma				S1?	3 Sensitive	2	98.9 ± 2.0	NS
I	*Strymon melinus*	Grey Hairstreak				S1S2	4 Secure	7	31.8 ± 0.0	NS
I	*Nymphalis l-album*	Compton Tortoiseshell				S1S2	4 Secure	9	47.2 ± 2.0	NS
I	*Somatochlora kennedyi*	Kennedy's Emerald				S1S2	2 May Be At Risk	4	56.7 ± 0.0	NS
I	*Satyrium calanus*	Banded Hairstreak				S2	5 Undetermined	2	7.1 ± 2.0	NS
I	*Epitheca princeps*	Prince Baskettail				S2	3 Sensitive	5	54.0 ± 1.0	NS
I	*Williamsonia fletcheri*	Ebony Boghaunter				S2	2 May Be At Risk	3	56.7 ± 0.0	NS
I	*Enallagma signatum*	Orange Bluet				S2	2 May Be At Risk	12	44.7 ± 0.0	NS
I	*Margaritifera margaritifera*	Eastern Pearlshell				S2	3 Sensitive	4	89.0 ± 0.0	NS
I	*Pantala hymenaea*	Spot-Winged Glider				S2?B	3 Sensitive	1	4.5 ± 0.0	NS
I	*Amblyscirtes hegon*	Pepper and Salt Skipper				S2S3	4 Secure	1	40.0 ± 2.0	NS
I	*Satyrium liparops*	Striped Hairstreak				S2S3	5 Undetermined	1	88.7 ± 2.0	NS
I	*Euphydryas phaeton*	Baltimore Checkerspot				S2S3	4 Secure	1	74.6 ± 0.0	NS
I	*Ophiogomphus aspersus*	Brook Snaketail				S2S3	2 May Be At Risk	2	48.0 ± 1.0	NS
I	*Ophiogomphus mainensis*	Maine Snaketail				S2S3	2 May Be At Risk	9	67.0 ± 0.0	NS
I	*Ophiogomphus rupinsulensis*	Rusty Snaketail				S2S3	2 May Be At Risk	11	67.5 ± 0.0	NS
I	*Somatochlora forcipata*	Forcipate Emerald				S2S3	2 May Be At Risk	2	56.7 ± 0.0	NS
I	*Somatochlora franklini*	Delicate Emerald				S2S3	3 Sensitive	1	89.2 ± 1.0	NS
I	*Erythrodiplax berenice*	Seaside Dragonlet				S2S3	3 Sensitive	30	19.9 ± 0.0	NS
I	*Enallagma vesperum*	Vesper Bluet				S2S3	3 Sensitive	16	48.7 ± 0.0	NS
I	*Hippodamia parenthesis*	Parenthesis Lady Beetle				S3	5 Undetermined	1	42.2 ± 0.0	NS
I	*Naemia seriata*	a Ladybird beetle				S3	3 Sensitive	4	39.7 ± 1.0	NS
I	*Chilocorus stigma*	Twice-stabbed Lady Beetle				S3	4 Secure	1	69.3 ± 0.0	NS
I	*Myzia pullata*	Streaked Lady Beetle				S3	4 Secure	1	52.8 ± 0.0	NS
I	*Callophrys henrici*	Henry's Elfin				S3	4 Secure	12	9.6 ± 0.0	NS
I	*Callophrys lanoraieensis*	Bog Elfin				S3	2 May Be At Risk	1	95.2 ± 2.0	NS
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3	4 Secure	4	75.7 ± 2.0	NS
I	*Polygonia faunus*	Green Comma				S3	4 Secure	5	79.3 ± 20.0	NS

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I	*Aeshna clepsydra*	Mottled Darner				S3	4 Secure	19	24.6 ± 0.0	NS
I	*Aeshna constricta*	Lance-Tipped Darner				S3	4 Secure	1	88.1 ± 0.0	NS
I	*Boyeria grafiana*	Ocellated Darner				S3	3 Sensitive	13	1.1 ± 0.0	NS
I	*Gomphaeschna furcillata*	Harlequin Darner				S3	3 Sensitive	25	32.7 ± 0.0	NS
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S3	4 Secure	14	4.5 ± 0.0	NS
I	*Nannothemis bella*	Elfin Skimmer				S3	4 Secure	19	3.7 ± 0.0	NS
I	*Amphiagrion saucium*	Eastern Red Damsel				S3	4 Secure	3	29.2 ± 1.0	NS
I	*Cupido comyntas*	Eastern Tailed Blue				S3?		1	60.7 ± 1.0	NS
I	*Polygonia interrogationis*	Question Mark				S3B	4 Secure	15	3.2 ± 2.0	NS
I	*Erynnis juvenalis*	Juvenal's Duskywing				S3S4	4 Secure	65	7.8 ± 0.0	NS
I	*Amblyscirtes vialis*	Common Roadside-Skipper				S3S4	4 Secure	15	9.7 ± 0.0	NS
I	*Polygonia progne*	Grey Comma				S3S4	4 Secure	3	79.3 ± 20.0	NS
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1	1 At Risk	45	8.5 ± 0.0	NS
N	*Erioderma mollissimum*	Graceful Felt Lichen	Endangered	Endangered	Endangered	S1S2	2 May Be At Risk	240	3.8 ± 0.0	NS
N	*Pannaria lurida*	Wrinkled Shingle Lichen	Threatened	Threatened	Threatened	S1S2	2 May Be At Risk	53	12.0 ± 1.0	NS
N	*Fuscopannaria leucosticta*	Rimmed Shingles Lichen	Threatened			S2S3	2 May Be At Risk	250	6.2 ± 0.0	NS
N	*Anzia colpodes*	Black-foam Lichen	Threatened	Threatened	Threatened	S3	3 Sensitive	126	2.5 ± 0.0	NS
N	*Sclerophora peronella (Atlantic pop.)*	Frosted Glass-whiskers (Atlantic population)	Special Concern	Special Concern		S1?		66	8.3 ± 0.0	NS
N	*Pectenia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	4 Secure	404	5.6 ± 0.0	NS
N	*Pseudevernia cladonia*	Ghost Antler Lichen	Not At Risk			S2S3	3 Sensitive	12	14.7 ± 0.0	NS
N	*Harpalejeunea molleri ssp. integra*	a liverwort				S1		3	65.3 ± 0.0	NS
N	*Orthotrichum pallens*	Pale Bristle Moss				S1		1	68.3 ± 0.0	NS
N	*Sphagnum carolinianum*	Carolina Peat Moss				S1	2 May Be At Risk	1	95.9 ± 0.0	NS
N	*Umbilicaria vellea*	Grizzled Rocktripe Lichen				S1	5 Undetermined	3	35.8 ± 0.0	NS
N	*Heterodermia leucomela*	Elegant Fringe Lichen				S1		3	48.5 ± 0.0	NS
N	*Flavoparmelia baltimorensis*	Rock Greenshield Lichen				S1	5 Undetermined	1	42.4 ± 1.0	NS
N	*Ephebe hispidula*	Dryside Rockshag Lichen				S1	5 Undetermined	1	46.8 ± 1.0	NS
N	*Parmotrema perforatum*	Perforated Ruffle Lichen				S1	5 Undetermined	2	65.7 ± 0.0	NS
N	*Pseudevernia consocians*	Common Antler Lichen				S1	2 May Be At Risk	1	97.4 ± 0.0	NS
N	*Leptogium hibernicum*	Hibernia Jellyskin Lichen				S1	2 May Be At Risk	8	11.7 ± 0.0	NS
N	*Hypotrachyna horrescens*	Hairy-spined Shield Lichen				S1	2 May Be At Risk	3	15.9 ± 0.0	NS
N	*Frullania selwyniana*	Selwyn's Scalewort				S1?	5 Undetermined	8	65.1 ± 0.0	NS
N	*Campylostelium saxicola*	a Moss				S1?	3 Sensitive	1	45.9 ± 1.0	NS
N	*Grimmia anodon*	Toothless Grimmia Moss				S1?	3 Sensitive	2	69.6 ± 3.0	NS
N	*Homomallium adnatum*	Adnate Hairy-gray Moss				S1?	3 Sensitive	2	45.3 ± 1.0	NS
N	*Sphagnum cyclophyllum*	a Moss				S1?	5 Undetermined	11	14.6 ± 1.0	NS
N	*Sphagnum molle*	Blushing Peat Moss				S1?		2	45.8 ± 0.0	NS
N	*Parmeliella parvula*	Poor-man's Shingles Lichen				S1?	2 May Be At Risk	22	29.0 ± 0.0	NS
N	*Aulacomnium heterostichum*	One-sided Groove Moss				S1S2	3 Sensitive	1	94.8 ± 5.0	NS
N	*Didymodon rigidulus*	Rigid Screw Moss				S1S2	3 Sensitive	2	74.3 ± 0.0	NS
N	*Sphagnum platyphyllum*	Flat-leaved Peat Moss				S1S2		1	45.9 ± 0.0	NS
N	*Sphagnum trinitense*	a peatmoss				S1S2		6	26.2 ± 0.0	NS
N	*Tortula mucronifolia*	Mucronate Screw Moss				S1S2	3 Sensitive	1	69.6 ± 3.0	NS
N	*Cyrto-hypnum minutulum*	Tiny Cedar Moss				S1S2	3 Sensitive	1	69.3 ± 0.0	NS
N	*Leptogium intermedium*	Forty-five Jellyskin Lichen				S1S2	5 Undetermined	1	45.2 ± 1.0	NS
N	*Sticta limbata*	Powdered Moon Lichen				S1S2	2 May Be At Risk	2	16.8 ± 0.0	NS
N	*Metzgeria crassipilis*	Hairy Veilwort				S1S3		2	21.8 ± 0.0	NS
N	*Porella pinnata*	Pinnate Scalewort				S1S3	5 Undetermined	1	71.5 ± 0.0	NS
N	*Umbilicaria polyrhiza*	Ballpoint Rocktripe Lichen				S1S3	5 Undetermined	1	42.3 ± 1.0	NS
N	*Peltigera neckeri*	Black-saddle Pelt Lichen				S1S3	5 Undetermined	1	65.6 ± 0.0	NS
N	*Usnea fragilescens*	Inflationary Beard Lichen				S1S3	5 Undetermined	2	38.2 ± 40.0	NS
N	*Stereocaulon grande*	Grand Foam Lichen				S1S3	5 Undetermined	1	20.2 ± 0.0	NS
N	*Stereocaulon intermedium*	Pacific Brain Foam Lichen				S1S3		2	79.8 ± 0.0	NS
N	*Cladonia subtenuis*	Dixie Reindeer Lichen				S1S3	6 Not Assessed	1	14.6 ± 0.0	NS
N	*Nephroma resupinatum*	a lichen				S2	2 May Be At Risk	2	21.6 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
N	*Parmotrema reticulatum*	Netted Ruffle Lichen				S2	3 Sensitive	5	45.3 ± 1.0	NS
N	*Anacamptodon splachnoides*	a Moss				S2?	3 Sensitive	1	67.7 ± 0.0	NS
N	*Atrichum angustatum*	Lesser Smoothcap Moss				S2?	3 Sensitive	7	66.9 ± 0.0	NS
N	*Bryum algovicum*	a Moss				S2?	3 Sensitive	3	12.4 ± 1.0	NS
N	*Campylium polygamum*	a Moss				S2?	5 Undetermined	1	69.5 ± 0.0	NS
N	*Campylium radicale*	Long-stalked Fine Wet Moss				S2?	5 Undetermined	2	68.2 ± 0.0	NS
N	*Climacium americanum*	American Tree Moss				S2?	3 Sensitive	9	67.1 ± 0.0	NS
N	*Dicranum condensatum*	Condensed Broom Moss				S2?	5 Undetermined	3	16.4 ± 0.0	NS
N	*Ditrichum rhynchostegium*	a Moss				S2?	3 Sensitive	5	67.4 ± 5.0	NS
N	*Fissidens bushii*	Bush's Pocket Moss				S2?	3 Sensitive	2	69.3 ± 0.0	NS
N	*Fontinalis hypnoides*	a moss				S2?	5 Undetermined	1	69.1 ± 0.0	NS
N	*Fontinalis sullivantii*	a Moss				S2?	3 Sensitive	4	27.8 ± 4.0	NS
N	*Grimmia olneyi*	a Moss				S2?	3 Sensitive	10	64.9 ± 15.0	NS
N	*Orthotrichum anomalum*	Anomalous Bristle Moss				S2?	3 Sensitive	1	68.3 ± 0.0	NS
N	*Philonotis marchica*	a Moss				S2?	5 Undetermined	1	74.3 ± 0.0	NS
N	*Physcomitrium collenchymatum*	a Moss				S2?	3 Sensitive	6	95.0 ± 2.0	NS
N	*Racomitrium affine*	a Moss				S2?	5 Undetermined	1	79.5 ± 0.0	NS
N	*Sematophyllum marylandicum*	a Moss				S2?	3 Sensitive	1	74.1 ± 0.0	NS
N	*Sphagnum subnitens*	Lustrous Peat Moss				S2?	3 Sensitive	4	62.0 ± 0.0	NS
N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S2?	3 Sensitive	3	68.6 ± 0.0	NS
N	*Plagiomnium rostratum*	Long-beaked Leafy Moss				S2?	5 Undetermined	3	67.1 ± 0.0	NS
N	*Pseudotaxiphyllum distichaceum*	a Moss				S2?	3 Sensitive	4	43.7 ± 0.0	NS
N	*Rauiella scita*	Smaller Fern Moss				S2?	3 Sensitive	16	62.9 ± 0.0	NS
N	*Platylomella lescurii*	a Moss				S2?	3 Sensitive	4	68.2 ± 0.0	NS
N	*Phylliscum demangeonii*	Black Rock-wafer Lichen				S2?	5 Undetermined	2	95.3 ± 0.0	NS
N	*Usnea flavocardia*	Blood-splattered Beard Lichen				S2?	3 Sensitive	1	37.5 ± 1.0	NS
N	*Leptogium teretiusculum*	Beaded Jellyskin Lichen				S2?	3 Sensitive	1	42.0 ± 0.0	NS
N	*Collema occultatum*	Crusted Tarpaper Lichen				S2?	5 Undetermined	1	75.3 ± 2.0	NS
N	*Xanthoparmelia mougeotii*	Powdered Rock-shield Lichen				S2?	2 May Be At Risk	4	20.2 ± 0.0	NS
N	*Peltigera collina*	Tree Pelt Lichen				S2?	3 Sensitive	3	42.0 ± 0.0	NS
N	*Eurhynchium hians*	Light Beaked Moss				S2S3	3 Sensitive	1	67.4 ± 5.0	NS
N	*Platydictya subtilis*	Bark Willow Moss				S2S3	3 Sensitive	1	74.5 ± 0.0	NS
N	*Collema leptaleum*	Crumpled Bat's Wing Lichen				S2S3	3 Sensitive	6	26.4 ± 4.0	NS
N	*Ahtiana aurescens*	Eastern Candlewax Lichen				S2S3	5 Undetermined	3	92.7 ± 0.0	NS
N	*Cladonia incrassata*	Powder-foot British Soldiers Lichen				S2S3	5 Undetermined	3	42.2 ± 2.0	NS
N	*Cladonia mateocyatha*	Mixed-up Pixie-cup				S2S3		1	17.6 ± 0.0	NS
N	*Cladonia parasitica*	Fence-rail Lichen				S2S3	5 Undetermined	1	36.4 ± 1.0	NS
N	*Hypotrachyna catawbiensis*	Powder-tipped Antler Lichen				S2S3	2 May Be At Risk	1	78.6 ± 0.0	NS
N	*Leptogium milligranum*	Stretched Jellyskin Lichen				S2S3	3 Sensitive	22	20.4 ± 0.0	NS
N	*Leptogium tenuissimum*	Birdnest Jellyskin Lichen				S2S3	6 Not Assessed	3	29.2 ± 0.0	NS
N	*Hypotrachyna minarum*	Hairless-spined Shield Lichen				S2S3	3 Sensitive	3	45.2 ± 1.0	NS
N	*Usnea cavernosa*	Pitted Beard Lichen				S2S3	3 Sensitive	1	40.7 ± 0.0	NS
N	*Usnea ceratina*	Warty Beard Lichen				S2S3	3 Sensitive	3	18.7 ± 3.0	NS
N	*Usnea rubicunda*	Red Beard Lichen				S2S3	3 Sensitive	4	20.2 ± 0.0	NS
N	*Physcia tenella var. tenella*	Fringed Rosette Lichen				S2S3		1	42.3 ± 0.0	NS
N	*Hypotrachyna revoluta*	Granulating Loop Lichen				S2S3	5 Undetermined	2	96.2 ± 0.0	NS
N	*Cetraria arenaria*	Sand-loving Icelandmoss Lichen				S2S3	5 Undetermined	1	31.5 ± 1.0	NS
N	*Cladonia coccifera*	Eastern Boreal Pixie-cup Lichen				S2S3	3 Sensitive	1	93.8 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
N	*Usnea flammea*	Coastal Bushy Beard Lichen				S2S3	3 Sensitive	1	41.7 ± 0.0	NS
N	*Ramalina thrausta*	Angelhair Ramalina Lichen				S3	3 Sensitive	1	42.2 ± 2.0	NS
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S3	3 Sensitive	37	13.1 ± 0.0	NS
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3	3 Sensitive	153	2.5 ± 0.0	NS
N	*Leptogium subtile*	Appressed Jellyskin Lichen				S3	3 Sensitive	13	12.5 ± 0.0	NS
N	*Fuscopannaria ahlneri*	Corrugated Shingles Lichen				S3	4 Secure	57	8.0 ± 0.0	NS
N	*Heterodermia speciosa*	Powdered Fringe Lichen				S3	4 Secure	15	8.4 ± 0.0	NS
N	*Heterodermia squamulosa*	Scaly Fringe Lichen				S3	3 Sensitive	5	42.2 ± 2.0	NS
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S3	3 Sensitive	179	6.2 ± 0.0	NS
N	*Nephroma bellum*	Naked Kidney Lichen				S3	3 Sensitive	10	2.6 ± 0.0	NS
N	*Placynthium nigrum*	Common Ink Lichen				S3	5 Undetermined	1	59.5 ± 3.0	NS
N	*Punctelia appalachensis*	Appalachian Speckleback Lichen				S3	3 Sensitive	4	45.3 ± 1.0	NS
N	*Moelleropsis nebulosa ssp. frullaniae*	Blue-gray Moss Shingle Lichen				S3	4 Secure	5	20.8 ± 0.0	NS
N	*Moelleropsis nebulosa*	Blue-gray Moss Shingle Lichen				S3	4 Secure	118	2.5 ± 0.0	NS
N	*Fuscopannaria sorediata*	a Lichen				S3		2	20.2 ± 0.0	NS
N	*Ephebe lanata*	Waterside Rockshag Lichen				S3	3 Sensitive	1	79.4 ± 0.0	NS
N	*Drummondia prorepens*	a Moss				S3?	3 Sensitive	4	58.2 ± 5.0	NS
N	*Anomodon tristis*	a Moss				S3?	3 Sensitive	6	24.6 ± 3.0	NS
N	*Cladina stygia*	Black-footed Reindeer Lichen				S3?	3 Sensitive	2	20.2 ± 0.0	NS
N	*Anomodon rugelii*	Rugel's Anomodon Moss				S3S4	3 Sensitive	6	45.2 ± 1.0	NS
N	*Dichelyma capillaceum*	Hairlike Dichelyma Moss				S3S4	4 Secure	6	67.0 ± 0.0	NS
N	*Dicranum leioneuron*	a Dicranum Moss				S3S4	4 Secure	2	41.7 ± 0.0	NS
N	*Splachnum ampullaceum*	Cruet Dung Moss				S3S4	4 Secure	1	99.1 ± 0.0	NS
N	*Thamnobryum alleghaniense*	a Moss				S3S4	3 Sensitive	1	94.4 ± 1.0	NS
N	*Hylocomiastrum pyrenaicum*	a Feather Moss				S3S4	3 Sensitive	1	67.7 ± 0.0	NS
N	*Arctoparmelia incurva*	Finger Ring Lichen				S3S4	4 Secure	2	20.2 ± 0.0	NS
N	*Hypogymnia vittata*	Slender Monk's Hood Lichen				S3S4	4 Secure	8	21.3 ± 0.0	NS
N	*Leptogium acadiense*	Acadian Jellyskin Lichen				S3S4		19	10.8 ± 0.0	NS
N	*Melanohalea olivacea*	Spotted Camouflage Lichen				S3S4	5 Undetermined	1	44.1 ± 7.0	NS
N	*Parmotrema chinense*	Powdered Ruffle Lichen				S3S4	4 Secure	15	15.9 ± 0.0	NS
N	*Peltigera hymenina*	Cloudy Pelt Lichen				S3S4	4 Secure	1	66.9 ± 2.0	NS
N	*Physconia detersa*	Bottlebrush Frost Lichen				S3S4	3 Sensitive	3	30.4 ± 0.0	NS
N	*Coccocarpia palmicola*	Salted Shell Lichen				S3S4	4 Secure	636	2.5 ± 0.0	NS
N	*Physcia caesia*	Blue-gray Rosette Lichen				S3S4	5 Undetermined	1	58.5 ± 20.0	NS
N	*Physcia tenella*	Fringed Rosette Lichen				S3S4	6 Not Assessed	1	42.4 ± 1.0	NS
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	4 Secure	25	30.4 ± 0.0	NS
N	*Bryoria pikei*	Pike's Horsehair Lichen				S3S4	5 Undetermined	3	36.4 ± 1.0	NS
N	*Dermatocarpon luridum*	Brookside Stippleback Lichen				S3S4	4 Secure	3	45.3 ± 1.0	NS
N	*Heterodermia neglecta*	Fringe Lichen				S3S4	4 Secure	125	2.6 ± 0.0	NS
P	*Coreopsis rosea*	Pink Coreopsis	Endangered	Endangered	Endangered	S1	1 At Risk	465	39.6 ± 0.0	NS
P	*Drosera filiformis*	Thread-leaved Sundew	Endangered	Endangered	Endangered	S1	1 At Risk	911	14.7 ± 0.0	NS
P	*Sabatia kennedyana*	Plymouth Gentian	Endangered	Endangered	Endangered	S1	1 At Risk	1211	37.7 ± 1.0	NS
P	*Geum peckii*	Eastern Mountain Avens	Endangered	Endangered	Endangered	S1	1 At Risk	3193	95.1 ± 0.0	NS
P	*Rhynchospora macrostachya*	Tall Beakrush	Endangered	Endangered	Endangered	S1	2 May Be At Risk	57	60.1 ± 0.0	NS
P	*Clethra alnifolia*	Coast Pepper-Bush	Endangered	Threatened	Vulnerable	S1	1 At Risk	293	35.5 ± 0.0	NS
P	*Baccharis halimifolia*	Eastern Baccharis	Threatened	Threatened	Threatened	S1	1 At Risk	169	37.1 ± 0.0	NS
P	*Fraxinus nigra*	Black Ash	Threatened		Threatened	S1S2	1 At Risk	61	56.8 ± 0.0	NS
P	*Hydrocotyle umbellata*	Water Pennywort	Special Concern	Special Concern	Endangered	S1	1 At Risk	195	43.9 ± 0.0	NS
P	*Lilaeopsis chinensis*	Eastern Lilaeopsis	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	182	1.9 ± 1.0	NS
P	*Eleocharis tuberculosa*	Tubercled Spike-rush	Special Concern	Special Concern	Vulnerable	S2	1 At Risk	517	7.8 ± 0.0	NS
P	*Lachnanthes caroliniana*	Redroot	Special Concern	Special Concern	Vulnerable	S2	1 At Risk	1460	67.7 ± 0.0	NS
P	*Lophiola aurea*	Goldencrest	Special Concern	Special Concern	Vulnerable	S2	1 At Risk	832	37.3 ± 3.0	NS

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P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	2	85.5 ± 0.0	NS
P	*Scirpus longii*	Long's Bulrush	Special Concern		Vulnerable	S3	3 Sensitive	726	14.2 ± 1.0	NS
P	*Smilax rotundifolia*	Round-leaved Greenbrier	Not At Risk			S3	4 Secure	991	3.1 ± 0.0	NS
P	*Crocanthemum canadense*	Long-branched Frostweed			Endangered	S1	1 At Risk	17	66.7 ± 0.0	NS
P	*Thuja occidentalis*	Eastern White Cedar			Vulnerable	S1	1 At Risk	112	44.9 ± 0.0	NS
P	*Toxicodendron vernix*	Poison Sumac				S1	2 May Be At Risk	40	61.9 ± 0.0	NS
P	*Antennaria parlinii*	a Pussytoes				S1	2 May Be At Risk	6	71.4 ± 0.0	NS
P	*Nabalus racemosus*	Glaucous Rattlesnakeroot				S1	2 May Be At Risk	9	97.5 ± 0.0	NS
P	*Lobelia spicata*	Pale-Spiked Lobelia				S1	2 May Be At Risk	1	45.7 ± 50.0	NS
P	*Stellaria crassifolia*	Fleshy Stitchwort				S1	2 May Be At Risk	1	58.6 ± 2.0	NS
P	*Lyonia ligustrina*	Maleberry				S1	2 May Be At Risk	10	44.6 ± 0.0	NS
P	*Desmodium canadense*	Canada Tick-trefoil				S1	2 May Be At Risk	7	45.4 ± 7.0	NS
P	*Hylodesmum glutinosum*	Large Tick-trefoil				S1	2 May Be At Risk	4	68.4 ± 0.0	NS
P	*Trichostema dichotomum*	Forked Bluecurls				S1	2 May Be At Risk	5	83.8 ± 0.0	NS
P	*Polygala polygama*	Racemed Milkwort				S1	5 Undetermined	10	69.7 ± 0.0	NS
P	*Podostemum ceratophyllum*	Horn-leaved Riverweed				S1	2 May Be At Risk	1	98.3 ± 0.0	NS
P	*Montia fontana*	Water Blinks				S1	2 May Be At Risk	3	97.1 ± 0.0	NS
P	*Lysimachia minima*	Chaffweed				S1	2 May Be At Risk	1	70.9 ± 0.0	NS
P	*Amelanchier nantucketensis*	Nantucket Serviceberry				S1	2 May Be At Risk	1	13.4 ± 0.0	NS
P	*Veronica catenata*	Pink Water-Speedwell				S1		1	97.4 ± 0.0	NS
P	*Boehmeria cylindrica*	Small-spike False-nettle				S1	2 May Be At Risk	45	95.0 ± 0.0	NS
P	*Carex digitalis*	Slender Wood Sedge				S1	2 May Be At Risk	4	69.9 ± 0.0	NS
P	*Carex haydenii*	Hayden's Sedge				S1	2 May Be At Risk	2	86.3 ± 0.0	NS
P	*Carex laxiflora*	Loose-Flowered Sedge				S1	2 May Be At Risk	2	66.2 ± 10.0	NS
P	*Carex ormostachya*	Necklace Spike Sedge				S1	2 May Be At Risk	1	91.6 ± 0.0	NS
P	*Carex viridula var. saxilittoralis*	Greenish Sedge				S1	2 May Be At Risk	2	93.3 ± 5.0	NS
P	*Cyperus diandrus*	Low Flatsedge				S1	2 May Be At Risk	7	44.0 ± 0.0	NS
P	*Fimbristylis autumnalis*	Slender Fimbry				S1	2 May Be At Risk	3	61.8 ± 0.0	NS
P	*Blysmopsis rufa*	Red Bulrush				S1	2 May Be At Risk	1	62.4 ± 1.0	NS
P	*Schoenoplectus torreyi*	Torrey's Bulrush				S1	2 May Be At Risk	8	67.5 ± 0.0	NS
P	*Sisyrinchium fuscatum*	Coastal Plain Blue-eyed-grass				S1	2 May Be At Risk	7	55.8 ± 0.0	NS
P	*Juncus brachycephalus*	Small-Head Rush				S1	2 May Be At Risk	2	66.8 ± 2.0	NS
P	*Juncus secundus*	Secund Rush				S1	2 May Be At Risk	2	72.5 ± 1.0	NS
P	*Allium tricoccum*	Wild Leek				S1	2 May Be At Risk	1	98.4 ± 7.0	NS
P	*Spiranthes casei var. casei*	Case's Ladies'-Tresses				S1	2 May Be At Risk	2	67.1 ± 0.0	NS
P	*Dichanthelium xanthophysum*	Slender Panic Grass				S1	2 May Be At Risk	9	95.1 ± 1.0	NS
P	*Adiantum pedatum*	Northern Maidenhair Fern				S1	2 May Be At Risk	2	53.2 ± 0.0	NS
P	*Selaginella rupestris*	Rock Spikemoss				S1	2 May Be At Risk	5	98.7 ± 0.0	NS
P	*Solidago hispida*	Hairy Goldenrod				S1?	2 May Be At Risk	3	55.4 ± 7.0	NS
P	*Carex pensylvanica*	Pennsylvania Sedge				S1?	2 May Be At Risk	1	94.1 ± 10.0	NS
P	*Bolboschoenus robustus*	Sturdy Bulrush				S1?	5 Undetermined	1	57.3 ± 7.0	NS
P	*Dichanthelium lindheimeri*	Lindheimer's Panicgrass				S1?	5 Undetermined	4	57.1 ± 1.0	NS
P	*Panicum dichotomiflorum ssp. puritanorum*	Spreading Panicgrass				S1?	2 May Be At Risk	17	7.6 ± 0.0	NS
P	*Huperzia selago*	Northern Firmoss				S1?	2 May Be At Risk	3	93.3 ± 5.0	NS
P	*Cornus suecica*	Swedish Bunchberry				S1S2	3 Sensitive	2	43.8 ± 0.0	NS
P	*Proserpinaca intermedia*	Intermediate Mermaidweed				S1S2	2 May Be At Risk	5	48.4 ± 1.0	NS
P	*Conopholis americana*	American Cancer-root				S1S2	2 May Be At Risk	39	62.6 ± 0.0	NS
P	*Hepatica americana*	Round-lobed Hepatica				S1S2	2 May Be At Risk	2	95.2 ± 1.0	NS
P	*Ranunculus sceleratus*	Cursed Buttercup				S1S2	2 May Be At Risk	3	27.9 ± 0.0	NS
P	*Juncus greenei*	Greene's Rush				S1S2	2 May Be At Risk	6	31.8 ± 0.0	NS
P	*Calamagrostis stricta ssp. stricta*	Slim-stemmed Reed Grass				S1S2	3 Sensitive	1	67.7 ± 0.0	NS
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S1S2	2 May Be At Risk	34	95.0 ± 0.0	NS
P	*Selaginella selaginoides*	Low Spikemoss				S1S2	2 May Be At Risk	2	96.8 ± 1.0	NS

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P	*Conioselinum chinense*	Chinese Hemlock-parsley				S2	3 Sensitive	9	47.0 ± 0.0	NS
P	*Erigeron philadelphicus*	Philadelphia Fleabane				S2	3 Sensitive	1	64.2 ± 1.0	NS
P	*Eutrochium dubium*	Coastal Plain Joe Pye Weed				S2	2 May Be At Risk	184	15.8 ± 7.0	NS
P	*Lactuca hirsuta*	Hairy Lettuce				S2	3 Sensitive	6	16.1 ± 7.0	NS
P	*Symphyotrichum undulatum*	Wavy-leaved Aster				S2	3 Sensitive	122	35.5 ± 7.0	NS
P	*Cardamine parviflora*	Small-flowered Bittercress				S2	3 Sensitive	1	96.7 ± 5.0	NS
P	*Stellaria longifolia*	Long-leaved Starwort				S2	3 Sensitive	1	3.3 ± 5.0	NS
P	*Oxybasis rubra*	Red Goosefoot				S2	2 May Be At Risk	3	27.9 ± 0.0	NS
P	*Hudsonia ericoides*	Pinebarren Golden Heather				S2	3 Sensitive	17	6.8 ± 7.0	NS
P	*Hypericum majus*	Large St John's-wort				S2	3 Sensitive	2	51.2 ± 1.0	NS
P	*Crassula aquatica*	Water Pygmyweed				S2	3 Sensitive	2	22.6 ± 0.0	NS
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S2	3 Sensitive	9	25.6 ± 7.0	NS
P	*Utricularia resupinata*	Inverted Bladderwort				S2	3 Sensitive	41	20.6 ± 0.0	NS
P	*Oenothera fruticosa ssp. tetragona*	Narrow-leaved Evening Primrose				S2	5 Undetermined	11	43.7 ± 1.0	NS
P	*Persicaria arifolia*	Halberd-leaved Tearthumb				S2	3 Sensitive	7	54.2 ± 0.0	NS
P	*Rumex triangulivalvis*	Triangular-valve Dock				S2	3 Sensitive	1	94.6 ± 1.0	NS
P	*Anemonastrum canadense*	Canada Anemone				S2	2 May Be At Risk	4	70.5 ± 1.0	NS
P	*Galium boreale*	Northern Bedstraw				S2	2 May Be At Risk	3	89.4 ± 0.0	NS
P	*Salix pedicellaris*	Bog Willow				S2	3 Sensitive	91	61.2 ± 1.0	NS
P	*Salix sericea*	Silky Willow				S2	2 May Be At Risk	168	50.6 ± 0.0	NS
P	*Agalinis maritima*	Saltmarsh Agalinis				S2	3 Sensitive	48	40.0 ± 0.0	NS
P	*Viola nephrophylla*	Northern Bog Violet				S2	3 Sensitive	1	20.2 ± 1.0	NS
P	*Carex hystericina*	Porcupine Sedge				S2	2 May Be At Risk	1	53.9 ± 1.0	NS
P	*Carex longii*	Long's Sedge				S2	3 Sensitive	16	6.8 ± 7.0	NS
P	*Carex tenera*	Tender Sedge				S2	3 Sensitive	3	8.5 ± 0.0	NS
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S2	3 Sensitive	2	97.0 ± 3.0	NS
P	*Vallisneria americana*	Wild Celery				S2	2 May Be At Risk	10	60.2 ± 0.0	NS
P	*Allium schoenoprasum*	Wild Chives				S2	2 May Be At Risk	1	97.1 ± 1.0	NS
P	*Allium schoenoprasum var. sibiricum*	Wild Chives				S2	2 May Be At Risk	2	96.7 ± 0.0	NS
P	*Najas gracillima*	Thread-Like Naiad				S2	3 Sensitive	20	56.9 ± 7.0	NS
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S2	3 Sensitive	62	40.7 ± 0.0	NS
P	*Platanthera flava*	Southern Rein-Orchid				S2	3 Sensitive	41	24.6 ± 5.0	NS
P	*Platanthera flava var. flava*	Southern Rein Orchid				S2	3 Sensitive	416	27.6 ± 0.0	NS
P	*Platanthera flava var. herbiola*	Pale Green Orchid				S2	5 Undetermined	7	46.6 ± 0.0	NS
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S2	3 Sensitive	3	65.1 ± 1.0	NS
P	*Spiranthes casei*	Case's Ladies'-Tresses				S2	3 Sensitive	4	18.7 ± 0.0	NS
P	*Spiranthes casei var. novaescotiae*	Case's Ladies'-Tresses				S2	3 Sensitive	19	8.5 ± 1.0	NS
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2	2 May Be At Risk	4	29.2 ± 7.0	NS
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S2	3 Sensitive	3	31.8 ± 0.0	NS
P	*Piptatheropsis canadensis*	Canada Ricegrass				S2	3 Sensitive	24	9.8 ± 0.0	NS
P	*Piptatheropsis pungens*	Slender Ricegrass				S2	3 Sensitive	9	2.3 ± 10.0	NS
P	*Symphyotrichum boreale*	Boreal Aster				S2?	3 Sensitive	15	48.4 ± 1.0	NS
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2?	5 Undetermined	5	27.9 ± 0.0	NS
P	*Epilobium coloratum*	Purple-veined Willowherb				S2?	3 Sensitive	4	71.2 ± 100.0	NS
P	*Rumex persicarioides*	Peach-leaved Dock				S2?	2 May Be At Risk	5	27.9 ± 0.0	NS
P	*Eleocharis ovata*	Ovate Spikerush				S2?	3 Sensitive	5	40.5 ± 0.0	NS
P	*Scirpus pedicellatus*	Stalked Bulrush				S2?	3 Sensitive	1	84.9 ± 5.0	NS
P	*Potamogeton pulcher*	Spotted Pondweed			Vulnerable	S2S3	3 Sensitive	49	44.4 ± 0.0	NS
P	*Hieracium robinsonii*	Robinson's Hawkweed				S2S3	3 Sensitive	4	54.6 ± 1.0	NS
P	*Iva frutescens*	Big-leaved Marsh-elder				S2S3	3 Sensitive	59	36.5 ± 0.0	NS
P	*Senecio pseudoarnica*	Seabeach Ragwort				S2S3	3 Sensitive	4	61.5 ± 1.0	NS
P	*Betula michauxii*	Michaux's Dwarf Birch				S2S3	3 Sensitive	52	49.4 ± 0.0	NS
P	*Sagina nodosa*	Knotted Pearlwort				S2S3	4 Secure	31	3.3 ± 5.0	NS
P	*Sagina nodosa ssp. borealis*	Knotted Pearlwort				S2S3	4 Secure	2	32.2 ± 1.0	NS

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P	*Ceratophyllum echinatum*	Prickly Hornwort				S2S3	3 Sensitive	4	64.4 ± 0.0	NS
P	*Hypericum x dissimulatum*	Disguised St. John's-wort				S2S3	3 Sensitive	10	15.7 ± 0.0	NS
P	*Shepherdia canadensis*	Soapberry				S2S3	3 Sensitive	1	21.4 ± 0.0	NS
P	*Euphorbia polygonifolia*	Seaside Spurge				S2S3	3 Sensitive	11	31.6 ± 0.0	NS
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	3 Sensitive	6	57.1 ± 5.0	NS
P	*Polygonum aviculare ssp. buxiforme*	Box Knotweed				S2S3	5 Undetermined	1	93.3 ± 7.0	NS
P	*Polygonum oxyspermum ssp. raii*	Ray's Knotweed				S2S3	5 Undetermined	16	16.4 ± 5.0	NS
P	*Amelanchier fernaldii*	Fernald's Serviceberry				S2S3	5 Undetermined	2	11.1 ± 1.0	NS
P	*Potentilla canadensis*	Canada Cinquefoil				S2S3	3 Sensitive	11	3.3 ± 5.0	NS
P	*Galium aparine*	Common Bedstraw				S2S3	3 Sensitive	3	15.2 ± 0.0	NS
P	*Galium obtusum*	Blunt-leaved Bedstraw				S2S3	3 Sensitive	21	44.5 ± 0.0	NS
P	*Carex adusta*	Lesser Brown Sedge				S2S3	3 Sensitive	1	55.3 ± 7.0	NS
P	*Carex houghtoniana*	Houghton's Sedge				S2S3	3 Sensitive	7	30.6 ± 0.0	NS
P	*Eleocharis flavescens var. olivacea*	Bright-green Spikerush				S2S3	3 Sensitive	20	40.6 ± 0.0	NS
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S2S3	3 Sensitive	1	95.2 ± 7.0	NS
P	*Botrychium lanceolatum ssp. angustisegmentum*	Narrow Triangle Moonwort				S2S3	3 Sensitive	3	51.7 ± 1.0	NS
P	*Botrychium simplex*	Least Moonwort				S2S3	3 Sensitive	4	66.2 ± 1.0	NS
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	3 Sensitive	9	43.1 ± 7.0	NS
P	*Hieracium paniculatum*	Panicled Hawkweed				S3	4 Secure	21	40.9 ± 0.0	NS
P	*Bidens beckii*	Water Beggarticks				S3	4 Secure	28	44.8 ± 0.0	NS
P	*Alnus serrulata*	Smooth Alder				S3	3 Sensitive	807	32.1 ± 2.0	NS
P	*Mononeuria groenlandica*	Greenland Stitchwort				S3	3 Sensitive	63	79.9 ± 0.0	NS
P	*Vaccinium cespitosum*	dwarf bilberry				S3	4 Secure	26	97.3 ± 0.0	NS
P	*Vaccinium uliginosum*	Alpine Bilberry				S3	3 Sensitive	3	95.1 ± 0.0	NS
P	*Bartonia virginica*	Yellow Bartonia				S3	4 Secure	87	7.0 ± 50.0	NS
P	*Geranium bicknellii*	Bicknell's Crane's-bill				S3	4 Secure	8	8.0 ± 5.0	NS
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	4 Secure	31	48.2 ± 1.0	NS
P	*Proserpinaca pectinata*	Comb-leaved Mermaidweed				S3	4 Secure	99	15.1 ± 0.0	NS
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	69	3.7 ± 5.0	NS
P	*Decodon verticillatus*	Swamp Loosestrife				S3	4 Secure	334	8.0 ± 0.0	NS
P	*Epilobium strictum*	Downy Willowherb				S3	3 Sensitive	2	68.2 ± 0.0	NS
P	*Persicaria pensylvanica*	Pennsylvania Smartweed				S3	4 Secure	1	34.6 ± 5.0	NS
P	*Fallopia scandens*	Climbing False Buckwheat				S3	3 Sensitive	6	28.3 ± 0.0	NS
P	*Plantago rugelii*	Rugel's Plantain				S3	4 Secure	1	89.8 ± 0.0	NS
P	*Primula laurentiana*	Laurentian Primrose				S3	4 Secure	13	55.5 ± 7.0	NS
P	*Samolus parviflorus*	Seaside Brookweed				S3	3 Sensitive	82	3.4 ± 2.0	NS
P	*Pyrola asarifolia*	Pink Pyrola				S3	4 Secure	1	88.7 ± 7.0	NS
P	*Agrimonia gryposepala*	Hooked Agrimony				S3	4 Secure	15	33.3 ± 5.0	NS
P	*Amelanchier spicata*	Running Serviceberry				S3	4 Secure	38	32.3 ± 5.0	NS
P	*Cephalanthus occidentalis*	Common Buttonbush				S3	3 Sensitive	1945	12.2 ± 0.0	NS
P	*Limosella australis*	Southern Mudwort				S3	4 Secure	21	7.8 ± 0.0	NS
P	*Lindernia dubia*	Yellow-seeded False Pimperel				S3	4 Secure	6	22.6 ± 0.0	NS
P	*Verbena hastata*	Blue Vervain				S3	4 Secure	33	70.5 ± 1.0	NS
P	*Carex cryptolepis*	Hidden-scaled Sedge				S3	4 Secure	5	41.8 ± 2.0	NS
P	*Carex lupulina*	Hop Sedge				S3	4 Secure	28	36.9 ± 1.0	NS
P	*Carex swanii*	Swan's Sedge				S3	3 Sensitive	26	2.4 ± 0.0	NS
P	*Carex tribuloides*	Blunt Broom Sedge				S3	4 Secure	1	66.6 ± 0.0	NS
P	*Carex wiegandii*	Wiegand's Sedge				S3	3 Sensitive	1	32.4 ± 1.0	NS
P	*Carex foenea*	Fernald's Hay Sedge				S3	4 Secure	3	15.2 ± 2.0	NS
P	*Eleocharis nitida*	Quill Spikerush				S3	4 Secure	2	79.2 ± 7.0	NS
P	*Eleocharis rostellata*	Beaked Spikerush				S3	3 Sensitive	73	19.8 ± 0.0	NS
P	*Schoenoplectus americanus*	Olney's Bulrush				S3	3 Sensitive	96	32.2 ± 0.0	NS
P	*Elodea canadensis*	Canada Waterweed				S3	4 Secure	1	43.9 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Juncus marginatus*	Grassleaf Rush				S3	3 Sensitive	46	6.2 ± 0.0	NS
P	*Juncus subcaudatus*	Woods-Rush				S3	3 Sensitive	24	8.1 ± 0.0	NS
P	*Juncus dudleyi*	Dudley's Rush				S3	4 Secure	5	45.4 ± 0.0	NS
P	*Goodyera repens*	Lesser Rattlesnake-plantain				S3	3 Sensitive	13	6.8 ± 7.0	NS
P	*Neottia bifolia*	Southern Twayblade				S3	4 Secure	95	17.8 ± 0.0	NS
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	4 Secure	4	47.4 ± 5.0	NS
P	*Platanthera hookeri*	Hooker's Orchid				S3	4 Secure	10	44.3 ± 0.0	NS
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3	4 Secure	43	15.8 ± 7.0	NS
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S3	4 Secure	38	9.3 ± 0.0	NS
P	*Dichanthelium clandestinum*	Deer-tongue Panic Grass				S3	4 Secure	248	16.0 ± 0.0	NS
P	*Coleataenia longifolia*	Long-leaved Panicgrass				S3	4 Secure	2326	25.4 ± 0.0	NS
P	*Sparganium natans*	Small Burreed				S3	4 Secure	2	96.9 ± 3.0	NS
P	*Asplenium trichomanes*	Maidenhair Spleenwort				S3	4 Secure	2	89.9 ± 1.0	NS
P	*Lorinseria areolata*	netted chain fern				S3	4 Secure	324	16.0 ± 7.0	NS
P	*Equisetum variegatum*	Variegated Horsetail				S3	4 Secure	3	95.4 ± 2.0	NS
P	*Isoetes tuckermanii ssp. acadiensis*	Acadian Quillwort				S3	3 Sensitive	25	24.8 ± 0.0	NS
P	*Sceptridium dissectum*	Dissected Moonwort				S3	4 Secure	8	43.5 ± 0.0	NS
P	*Polypodium appalachianum*	Appalachian Polypody				S3	5 Undetermined	3	74.3 ± 0.0	NS
P	*Persicaria amphibia var. emersa*	Long-root Smartweed				S3?	5 Undetermined	27	45.8 ± 0.0	NS
P	*Diphasiastrum x sabinifolium*	Savin-leaved Ground-cedar				S3?	4 Secure	1	69.8 ± 0.0	NS
P	*Solidago latissimifolia*	Elliott's Goldenrod				S3S4	4 Secure	251	8.0 ± 0.0	NS
P	*Suaeda calceoliformis*	Horned Sea-blite				S3S4	4 Secure	12	37.1 ± 0.0	NS
P	*Vaccinium corymbosum*	Highbush Blueberry				S3S4	4 Secure	692	5.1 ± 2.0	NS
P	*Rhexia virginica*	Virginia Meadow Beauty				S3S4	4 Secure	1936	6.6 ± 0.0	NS
P	*Nuphar microphylla*	Small Yellow Pond-lily				S3S4	4 Secure	4	25.9 ± 4.0	NS
P	*Polygonum fowleri ssp. fowleri*	Fowler's Knotweed				S3S4	4 Secure	1	46.7 ± 0.0	NS
P	*Polygonum fowleri*	Fowler's Knotweed				S3S4	4 Secure	1	43.7 ± 0.0	NS
P	*Rumex fueginus*	Tierra del Fuego Dock				S3S4	4 Secure	2	39.4 ± 5.0	NS
P	*Salix petiolaris*	Meadow Willow				S3S4	4 Secure	4	61.4 ± 5.0	NS
P	*Agalinis neoscotica*	Nova Scotia Agalinis				S3S4	4 Secure	248	6.2 ± 0.0	NS
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S3S4	4 Secure	23	40.0 ± 0.0	NS
P	*Symplocarpus foetidus*	Eastern Skunk Cabbage				S3S4	4 Secure	365	38.6 ± 0.0	NS
P	*Carex argyrantha*	Silvery-flowered Sedge				S3S4	4 Secure	21	47.6 ± 0.0	NS
P	*Eriophorum russeolum*	Russet Cottongrass				S3S4	4 Secure	4	20.0 ± 0.0	NS
P	*Sisyrinchium atlanticum*	Eastern Blue-Eyed-Grass				S3S4	4 Secure	357	5.6 ± 1.0	NS
P	*Triglochin gaspensis*	Gasp ├╌ Arrowgrass				S3S4	5 Undetermined	18	19.7 ± 0.0	NS
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	4 Secure	14	45.3 ± 0.0	NS
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	4 Secure	10	27.9 ± 0.0	NS
P	*Panicum philadelphicum*	Philadelphia Panicgrass				S3S4	4 Secure	29	25.6 ± 0.0	NS
P	*Equisetum hyemale ssp. affine*	Common Scouring-rush				S3S4	4 Secure	4	86.4 ± 1.0	NS
P	*Diphasiastrum complanatum*	Northern Ground-cedar				S3S4	4 Secure	2	38.0 ± 0.0	NS
P	*Schizaea pusilla*	Little Curlygrass Fern				S3S4	4 Secure	295	3.8 ± 4.0	NS
P	*Bidens discoidea*	Swamp Beggarticks				SH	0.1 Extirpated	1	74.5 ± 0.0	NS
P	*Dichanthelium meridionale*	Matting Witchgrass				SH	0.1 Extirpated	3	48.6 ± 5.0	NS

5.1 SOURCE BIBLIOGRAPHY (100 km)

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

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36	McNeil, J.A. 2017. Eastern Ribbonsnake (Thamnophis sauritus) sightings, 2017. Mersey Tobeatic Research Institute, 36 recs.
34	Bayne, D.Z. 2014. 2014 rare species observations from southwest Nova Scotia. Nova Scotia Department of Natural Resources, 46 recs.
34	Zinck, M. & Roland, A.E. 1998. Roland's Flora of Nova Scotia. Nova Scotia Museum, 3rd ed., rev. M. Zinck; 2 Vol., 1297 pp.

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33	Taylor, P.D. 2006. Long-term monitoring of Listera australis in southwestern Nova Scotia; summary report for 2006, year 3. Acadia University, 33.
32	Newell, R.E. 2000. Eleocharis tuberculosa records in NS, 1994-99. Acadia University, Wolfville NS, Pers. comm. to S.H. Gerriets, Feb. 11. 32 recs.
30	Frittaion, C. 2012. NSNT 2012 Field Observations. Nova Scotia Nature Trust, Pers comm. to S. Blaney Feb. 7, 34 recs.
30	Klymko, J.J.D. 2018. 2017 field data. Atlantic Canada Conservation Data Centre.
29	Manthorne, A. 2014. MaritimesSwiftwatch Project database 2013-2014. Bird Studies Canada, Sackville NB, 326 recs.
29	Nature Conservancy Canada. 2008. Geum peckii on Brier Island. Nature Conservancy Canada, 29 recs.
27	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2014.
25	McNeil, J.A. 2019. Snapping Turtle records, 2017. Mersey Tobeatic Research Institute.
24	Bayne, D.M., Cameron, R.C. 2014. 2014 Lichen records near Little Bon Mature Lake, Queens NS. NS Department of Natural Resources.
24	Broders, H.G. 2006. Unpublished data. , 24 recs.
24	Clayden, S. Digitization of Wolfgang Maass Nova Scotia forest lichen collections, 1964-2004. New Brunswick Museum. 2018.
22	Breen, A. 2018. 2018 Atlantic Whitefish observations. Coastal Action.
21	Benjamin, L.K. (compiler). 2010. Baccharis halimifolia observation records. NS Dept of Natural Resources, 40.
20	O'Grady, Sally. 2010. Water Pennywort in Kejimkujik National Park, 2010. Parks Canada, 20 shapefiles.
20	Richardson, D., Anderson, F., Cameron, R, Pepper, C., Clayden, S. 2015. Field Work Report on the Wrinkled Shingle lichen (Pannaria lurida). COSEWIC.
19	Benjamin, L.K. 2011. NSDNR fieldwork & consultant reports 1997, 2009-10. Nova Scotia Dept Natural Resources, 85 recs.
19	Nova Scotia Nature Trust. 2013. Nova Scotia Nature Trust 2013 Species records. Nova Scotia Nature Trust, 95 recs.
18	Cameron, R.P. 2017. 2017 rare species field data. Nova Scotia Environment, 64 recs.
18	Catling, P.M. 1981. Taxonomy of autumn-flowering Spiranthes species of southern Nova Scotia in Can. J. Bot. , 59:1250-1273. 30 recs.
18	Plissner, J.H. & Haig, S.M. 1997. 1996 International piping plover census. US Geological Survey, Corvallis OR, 231 pp.
17	Klymko, J.J.D. 2012. Odonata specimens & observations, 2010. Atlantic Canada Conservation Data Centre, 425 recs.
17	MacKinnon, D.S. 2000. Fieldwork 2000. Dept of Environment and Labour, Protected Areas Branch, 17 recs.
17	McKendry, Karen. 2016. Rare species observations, 2016. Nova Scotia Nature Trust, 19 recs.
17	Oldham, M.J. 2000. Oldham database records from Maritime provinces. Oldham, M.J; ONHIC, 487 recs.
16	e-Butterfly. 2016. Export of Maritimes records and photos. Maxim Larrivee, Sambo Zhang (ed.) e-butterfly.org.
16	Ferguson, D.C. 1954. The Lepidoptera of Nova Scotia. Part I, macrolepidoptera. Proceedings of the Nova Scotian Institute of Science, 23(3), 161-375.
16	Holder, M. 2003. Assessment and update status report on the Eastern Lilaeopsis (Lilaeopsis chinensis) in Canada. Committee on the Status of Endangered Wildlife in Canada, 16 recs.
16	LaPaix, R.W.; Crowell, M.J.; MacDonald, M.; Neily, T.D.; Quinn, G. 2017. Stantec Nova Scotia rare plant records, 2012-2016. Stantec Consulting.
15	Benjamin, L.K. 2009. NSDNR Fieldwork & Consultants Reports. Nova Scotia Dept Natural Resources, 143 recs.
15	Klymko, J. 2019. Atlantic Canada Conservation Data Centre zoological fieldwork 2018. Atlantic Canada Conservation Data Centre.
15	Neily, T.H. Tom Neily NS Sphagnum records (2009-2014). T.H. Neily, Atlantic Canada Conservation Data Centre. 2019.
15	Porter, C.J.M. 2014. Field work data 2007-2014. Nova Scotia Nature Trust, 96 recs.
15	Toms, Brad. 2011. Species at Risk data from 2011 field surveys. Mersey Tobeatic Research Institute, 17 recs.
14	McNeil, J.A. 2018. Snapping Turtle records, 2018. Mersey Tobeatic Research Institute.
13	Cameron, R.P. 2018. Degelia plumbea records. Nova Scotia Environment.
13	MacKinnon, D.S. 1998. Ponhook Lake survey map & notes. Dept of Environment and Labour, Protected Areas Branch, 13 recs.
13	Parks Canada. 2010. Specimens in or near National Parks in Atlantic Canada. Canadian National Museum, 3925 recs.
12	Basquill, S.P. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre, Sackville NB, 69 recs.
12	Blaney, C.S. 2000. Fieldwork 2000. Atlantic Canada Conservation Data Centre. Sackville NB, 1265 recs.
12	Brunelle, P.-M. (compiler). 2010. ADIP/MDDS Odonata Database: NB, NS Update 1900-09. Atlantic Dragonfly Inventory Program (ADIP), 935 recs.
12	Whittam, R.M. 1999. Status Report on the Roseate Tern (update) in Canada. Committee on the Status of Endangered Wildlife in Canada, 36 recs.
11	Cameron, R.P. 2013. 2013 rare species field data. Nova Scotia Department of Environment, 71 recs.
11	Neily, T.H. Hectanooga, Nova Scotia Liverwort records. T.H. Neily. 2017.
11	Sollows, M.C,. 2008. NBM Science Collections databases: mammals. New Brunswick Museum, Saint John NB, download Jan. 2008, 4983 recs.
10	Boyne, A.W. & Grecian, V.D. 1999. Tern Surveys. Canadian Wildlife Service, Sackville, unpublished data. 23 recs.
10	Newell, R.E. 2002. A Botanical Survey of the Sand Pond National Wildlife Area. , 12 recs.
10	Smith, T.W. 2009. Eleocharis tuberculosa records in Yarmouth, Shelburne Count. COSEWIC. Pers. comm. to D.M. Mazerolle, 10 recs.
9	Basquill, S.P., Porter, C. 2019. Bryophyte and lichen specimens submitted to the E.C. Smith Herbarium. NS Department of Lands and Forestry.
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9	MacKinnon, D.S. & Maass, O.C. 1996. Fieldwork 1996. Dept Natural Resources, Parks Division, 9 recs.
9	Neily, T.H. 2019. Tom Neily NS Bryophyte records (2009-2013). T.H. Neily, Atlantic Canada Conservation Data Centre, 1029 specimen records.
9	O'Grady, Sally. 2010. Piping Plover Nesting in Kejimkujik Seaside Annex, 2008-10. Parks Canada, 9 recs.
8	Adams, J. & Herman, T.B. 1998. Thesis, Unpublished map of C. insculpta sightings. Acadia University, Wolfville NS, 88 recs.
8	Kennedy, B.; Cron, C. 2019. observations of Poison Sumac andButtonbush, Nova Scotia. pers. commun to AC CDC.
8	Neily, T.H. & Pepper, C.; Toms, B. 2018. Nova Scotia lichen database Update. Mersey Tobeatic Research Institute, 14 recs.
8	Neily, T.H. 2010. Erioderma Pedicellatum records 2005-09. Mersey Tobiatic Research Institute, 67 recs.
8	Wood, E.W. 2011. Sabatia kennedyana locations in Nova Scotia. Pers. comm. to C.S. Blaney. Gray Herbarium, Harvard University, 8 recs.
7	Belliveau, A. 2013. email to Sean Blaney regarding Listera australis observations in SW Nova Scotia. Mersey Tobeatic Research Institute, 8.
7	Klymko, J.J.D. 2011. Insect fieldwork & submissions, 2010. Atlantic Canada Conservation Data Centre. Sackville NB, 742 recs.

# recs	CITATION
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7	NS DNR. 2017. Black Ash records from NS DNR Permanent Sample Plots (PSPs), 1965-2016. NS Dept of Natural Resources.
7	Pepper, C. 2013. 2013 rare bird and plant observations in Nova Scotia. , 181 records.
7	Robinson, S.L. 2011. 2011 ND dune survey field data. Atlantic Canada Conservation Data Centre, 2715 recs.
7	WIlliams, M. Cape Breton University Digital Herbarium. Cape Breton University Digital Herbarium. 2013.
6	Benedict, B. Connell Herbarium Specimens (Data) . University New Brunswick, Fredericton. 2003.
6	Blaney, C.S. 1999. Fieldwork 1999. Atlantic Canada Conservation Data Centre. Sackville NB, 292 recs.
6	Bredin, K.A. 2002. NS Freshwater Mussel Fieldwork. Atlantic Canada Conservation Data Centere, 30 recs.
6	Christie, D.S. 2000. Christmas Bird Count Data, 1997-2000. Nature NB, 54 recs.
6	Ogden, K. Nova Scotia Museum butterfly specimen database. Nova Scotia Museum. 2017.
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5	Keddy, C. 1986. Status report on the eastern mountain avens, Geum peckii, in Canada Ottawa, Ontario, Canada: Committee on the Status of Endangered Wildlife in Canada (COSEWIC).
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4	Belliveau, A.G. 2019. Maleberry (Lyonia ligustrina) count at Long Lake, Yarmouth Co., NS. E.C Smith Herbarium, Acadia University, Wolfville NS, 4 records.
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4	Cameron, R.P. 2009. Nova Scotia nonvascular plant observations, 1995-2007. Nova Scotia Dept Natural Resources, 27 recs.
4	Clayden, S.R. 1998. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, 19759 recs.
4	Newell, R.E. 2006. Rare plant observations in Digby Neck. Pers. comm. to S. Blaney, 6 recs.
4	Newell, R.E. 2019. Crocanthemum canadense records compiled for provincial status report. pers. comm. from Ruth Newell to AC CDC.
4	Toms, B. 2015. Lophiola aurea (Goldencrest) records from Molega Lake. Mersey Tobeatic Research Institute, 4 records.
4	Toms, B. 2016. Email list of four GPS locations of Golden Crest (Lophiola aurea) from the previously documented site on Molega Lake, NS. Mersey Tobeatic Research Institute, 4 records.
3	Anon. Dataset of butterfly records for the Maritime provinces. Museum of Comparative Zoology, Harvard University. 2017.
3	Austin-Smith, P. 2014. 2014 Common Nighthawk personal communication report, NS. NS Department of Natural Resources.
3	Basquill, S.P. 2009. 2009 field observations. Nova Scotia Dept of Natural Resources.
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3	Benjamin, L.K. 2002. Rare plant observations by P. MacDonald, P. Mills, S. Eaton, H. MacKinnon, B. Colpitts at Sloans Lake, NS. Pers. comm. to L.K. Benjamin, NSDNR, with P. MacDonald, 3 recs.
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3	e-Butterfly. 2018. Selected Maritimes butterfly records from 2016 and 2017. Maxim Larrivee, Sambo Zhang (ed.) e-butterfly.org.
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3	Mills, Pamela. 2008. Clethra alnifolia at Mudflat Lake. Nova Scotia Dept of Natural Resources, Wildlife Div. Pers. comm. to D.M. Mazerolle, 4 recs.
3	NatureServe Canada. 2018. iNaturalist Butterfly Data Export . iNaturalist.org and iNaturalist.ca.
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3	Sollows, M.C. 2008. NBM Science Collections databases: herpetiles. New Brunswick Museum, Saint John NB, download Jan. 2008, 8636 recs.
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2	Anon. 2017. Export of Maritimes Butterfly records. Global Biodiversity Information Facility (GBIF).
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2	Basquill, S.P. 2012. 2012 rare vascular plant field data. Nova Scotia Department of Natural Resources, 37 recs.
2	Belliveau, A. & Toms, B. 2012. Email regarding Lophiola aurea (Goldencrest) location on Molega Lake, NS. Mersey Tobeatic Research Institute, 3 records.
2	Cameron, R.P. 2014. 2013-14 rare species field data. Nova Scotia Department of Environment, 35 recs.
2	Clayden, S.R. 2005. Confidential supplement to Status Report on Ghost Antler Lichen (Pseudevernia cladonia). Committee on the Status of Endangered Wildlife in Canada, 27 recs.
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2	Klymko, J. Univeriste de Moncton insect collection butterfly record dataset. Atlantic Canada Conservation Data Centre. 2017.
2	Majka, C.G. & McCorquodale, D.B. 2006. The Coccinellidae (Coleoptera) of the Maritime Provinces of Canada: new records, biogeographic notes, and conservation concerns. Zootaxa. Zootaxa, 1154: 49–68. 7 recs.
2	Mills, P. 2016. Email communication to S. Blaney, re: Scirpus longii at Upper Great Brook, Queens Co. NS. NS DNR, 2 recs.
2	Olsen, R. Herbarium Specimens. Nova Scotia Agricultural College, Truro. 2003.
2	Phinney, Lori; Toms, Brad; et. al. 2016. Bank Swallows (Riparia riparia) in Nova Scotia: inventory and assessment of colonies. Merset Tobeiatc Research Institute, 25 recs.
1	Arsenault, R. 2009. Goodyera pubescens record in Kejimkujik National Park. Pers. comm. to C.S. Blaney, 1 rec.
1	Basquill, S.P.; Neily, T. 2015. Database of Sphagnum records for Nova Scotia. NS Department of Natural Resources, 4 recs.

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1	Benedict, B. Connell Herbarium Specimens. University New Brunswick, Fredericton. 2003.
1	Bernard, Laurel. 2013. Email to Sean Blaney regarding Listera australis at Lake Rossignol. Nature Conservancy of Canada, 1.
1	Breen, A. 2017. 2017 Atlantic Whitefish observation. Coastal Action.
1	Bryson, I. 2013. Nova Scotia rare plant records. CBCL Ltd., 180 records.
1	Cameron, R.P. 2008. Erioderma pedicellatum N of Jones Harbour. Nova Scotia Environment & Labour. Pers. comm. to D.M. Mazerolle, 1 rec.
1	Churchill, J.L. 2018. Atlantic Canada Conservation Data Centre Fieldwork 2017. Atlantic Canada Conservation Data Centre, 2318 recs.
1	Churchill, J.L. 2018. Atlantic Canada Conservation Data Centre Fieldwork 2018. Atlantic Canada Conservation Data Centre, 907 recs.
1	Crowell, M.J. 2009. Lilaeopsis chinensis on Roseway River. Jacques Whitford Limited. Pers. comm. to D.M. Mazerolle, 1 rec.
1	deGooyer, K. 2018. Chelydra serpentina observation record. Nova Scotia Environment.
1	Dibble, A. 1992. Rare plant field form for Amelanchier nantucketensis on McLean Is., Shelburne Co., NS in 1992. University of Maine, Orono, 2 pp.
1	Downes, C. 1998-2000. Breeding Bird Survey Data. Canadian Wildlife Service, Ottawa, 111 recs.
1	Edsall, J. 2007. Personal Butterfly Collection: specimens collected in the Canadian Maritimes, 1961-2007. J. Edsall, unpubl. report, 137 recs.
1	Elderkin M.F. 2007. Selaginella rupestris, Iris prismatica & Lophiola aurea records in NS. NS Dept of Natural Resources, Wildlife Div. Pers. comm. to C.S. Blaney, 3 recs.
1	Fernald, M.L. 1921. Expedition to Nova Scotia. Rhodora 13: 136-273.
1	Hall, Duane. 2018. Martes americana record by Duane Sabine, emailed to J. Klymko on 13 12 2018. pers. comm.
1	Hill, N.M. 2013. email communications to Sean Blaney and David Mazerolle regarding the discovery of Listera australis populations at Black River Lake and Middlewood. , 2.
1	Hill, N.M. 2016. Email communications to Sean Blaney and Alain Belliveau regarding the discovery of Fimbristylis autumnalis on the shores of Loon Lake, Kejimkujik National Park. Pers. comm., 1 rec.
1	Hope, P. 2007. Water-pennywort (Hydrocotyle umbellata) on Ell Island. Parks Canada, Kejimkujik NP, 1 record.
1	Johnstone, D.; Churchill J. 2014. 2014 Chimney Swift observation, Kejimkujik NP, NS. Atlantic Canada Conservation Data Centre.
1	Jotcham, J. 2013. email to Sean Blaney regarding the discovery of a Listera australis population at Port Mouton. , 1.
1	Kennedy, B. 2019. observations of Crocanthemum canadense at Bangs Falls, Nova Scotia. iNaturalist.ca.
1	Klymko, J. Acadia Univeristy Collection rare butterfly records. Atlantic Canada Conservation Data Centre. 2013.
1	Klymko, J.J.D. 2012. Insect fieldwork & submissions, 2011. Atlantic Canada Conservation Data Centre. Sackville NB, 760 recs.
1	Klymko, J.J.D. 2016. 2014 field data. Atlantic Canada Conservation Data Centre.
1	MacKinnon, D.S. 2002. Fieldwork 2002. Dept of Environment & Labour, Protected Areas Branch, 1 rec.
1	MacKinnon, D.S. 2012. Goodyera pubescens observation, photo. Pers. comm. to S. Blaney, Sep 18, 1 rec.
1	McAlpine, D.F. 1998. NBM Science Collections databases to 1998. New Brunswick Museum, Saint John NB, 241 recs.
1	McMahon, R. 2019. Mainland Moose observation. Pers. comm. to A. Belliveau.
1	McNeil, J.A. 2018. Wood Turtle records, 2018. Mersey Tobeatic Research Institute, 68 recs.
1	Neily, P.D. Plant Specimens. Nova Scotia Dept Natural Resources, Truro. 2006.
1	Newell, R.E. 2000. Assessment and update status report on the Eastern Mountain Avens (Geum peckii) in Canada. Committee on the Status of Endangered Wildlife in Canada, 1 rec.
1	Parker, G.R., Maxwell, J.W., Morton, L.D. & Smith,G.E.J. 1983. The ecology of Lynx , Lynx canadensis, on Cape Breton Island. Canadian Journal of Zoology, 61:770-786. 51 recs.
1	Porter, K. 2013. 2013 rare and non-rare vascular plant field data. St. Mary's University, 57 recs.
1	Proulx, V. 2008. Geum peckii observation. Pers. comm. to D. Mazerolle, 1 rec.
1	Scott, F.W. 1988. Status Report on the Southern Flying Squirrel (Glaucomys volans) in Canada. Committee on the Status of Endangered Wildlife in Canada, 2 recs.
1	Smith, M. 2016. Email regarding additional location of Fimbristylis autumnalis on shores of Loon Lake, Kejimkujik National Park. pers. comm., 1 record.
1	Toms, Brad. 2009. New Scirpus longii record on Lake Rossignol. Mersey Tobeatic Research Institute.
1	Tummer, Kevin. 2016. Email communication (April 30, 2016) to John Klymko regarding Snapping Turtle observation in Nova Scotia. Pers. Comm.
1	Weatherby, C.A. 1942. Two weeks in southwestern Nova Scotia. Rhodora, 44: 229-236.
1	Webster, R.P. Atlantic Forestry Centre Insect Collection, Maritimes butterfly records. Natural Resources Canada. 2014.
1	White, S. 2019. Notable species sightings, 2018. East Coast Aquatics.
1	Zinck, M. 2008. Nova Scotia Museum. Pers. comm. to D.M. Mazerolle, 1 rec.

APPENDIX D

NOVA SCOTIA MUSEUM REPORT

HERITAGE AND BIOLOGICAL RESOURCES

NOVA SCOTIA

Communities, Culture & Heritage

1741 Brunswick Street
3rd Floor
P.O. Box 456
Halifax, NS
B3J 2R5

Tel: (902) 424-6475
Fax: (902) 424-0560

April 14, 2020

Heather Levy
Envirosphere Consultants Ltd
PO Box 2906 Unit 5 -120 Morrison Dr.
Windsor, NS B0N 2T0

Dear Heather Levy:

RE: Environmental Screening 2020-03-09
Welshtown Quarry Expansion

Further to your request of March 3, 2020 staff at Communities, Culture and Heritage has reviewed their files for reference to the presence of natural and heritage resources in the study area. Please be aware that the information is not comprehensive and may include varying degrees of accuracy with respect to the precise location and condition of natural and heritage resources.

It should be noted that the amount and degree of disturbance from previous developments could have a significant role in establishing the presence, absence or condition of natural and heritage resources in this area.

Archaeology

The appears to border a small watercourse. There are 3 archaeology sites in the vicinity, including a pre-contact site. Finally, historic mapping indicates some settlement. An Archaeological Resource Impact Assessment is recommended.

Botany

The Nova Scotia Museum has records of the following plants species in the vicinity of the Welshtown Quarry:

- *Lechea intermedia*
- *Rubus idaeus*
- Fuscopannaria sp.
- *Euthamia gramnifolia*

The only record of concern among these species is the *Fuscopannaria* sp.; one species in this genus (*F. leucosticta*) is designated as "threatened" by COSEWIC. However, this record was from approximately 8 km north of the study area.

Other databases indicate the presence of both boreal felt lichen and vole ears lichen within 10 km of the study area, but these were not directly within or immediately adjacent to (i.e., <500 m) the study area.

The boreal felt lichen model used by the Department of Lands and Forestry, and more recent models for vole ears lichen (SARA Endangered) and boreal felt lichen (SARA Endangered) that are under development were also reviewed. According to the Dept. of Lands and Forestry BFL model, suitable habitat for boreal felt lichen exists within 500 m of the study area. Habitat with a probability of presence of 0.67-0.70 for vole ears lichen exists in several locations within and immediately adjacent to the study area, centered around areas with a high water table and red maple as a co-dominant canopy species. Note that this does not mean the lichen occurs in the study area, but that patches of high-quality habitat may exist for it.

Finally, iNaturalist observations for the area were reviewed. Observations included several indicator species (e.g., *Pannaria conoplea, Sticta fuliginosa*) within a 10 km radius, confirming that the general area is of high-quality for the coastal-swamp epiphyte communities that include rare and at-risk species.

Paleontology

The Study Area contains bedrock geology including Goldenville Formation (Cambrian to Ordovician turbidite slates) in the middle of the parcel (red box) of Site Map, surrounded by Middle to Late Ordovician monzogranites. Rare fossils are possible within the Goldenville, but significant specimens are not likely, therefore the concerns in terms of palaeontology are low.

If you have any questions, please contact me at anna.cross@novascotia.ca.

Sincerely,

Anna Cross

Anna Cross
Acting Coordinator, Special Places

APPENDIX E

LABORATORY RESULTS

TSS & pH

Envirosphere Consultants Limited

Unit 5—120 Morison Drive, Box 2906, Windsor, Nova Scotia, B0N 2T0

ph: (902) 798-4022, fax: (902) 798-2614, e-mail: enviroco@ns.sympatico.ca, website: www.envirosphere.ca

Envirosphere
PO Box 2906
120 Morison Drive
Windsor, Nova Scotia

Environmental Sample Analysis Report

Report Date: 28-Jul-20 Report Number: A0796

Lab #	Sample ID	Sample Details	Sample Material	Date Received	Date Analyzed	pH	Type of Sample	Detection Limit	Sample Comments
L2020-30	CRM	Welshtown Quarry	CRM	2020-07-09	2020-07-09	7.0	STD	0.1	CRM (pH = 7.0)
L2020-30	Culvert - Upper Clyde River Road	Welshtown Quarry	stream	2020-07-09	2020-07-09	6.2	REG	0.1	Upper Clyde River Road culvert
L2020-30	Site 1	Welshtown Quarry	stream	2020-07-09	2020-07-09	6.5	REG	0.1	Headwater stream adjacent to quarry property up from Clyde River Rd.
L2020-30	Site 1 (dup)	Welshtown Quarry	stream	2020-07-09	2020-07-09	6.4	DUP	0.1	Headwater stream adjacent to quarry property up from Clyde River Rd.
L2020-30	Site 2	Welshtown Quarry	stream	2020-07-09	2020-07-09	6.0	REG	0.1	Outflow from culvert under main quarry access road
L2020-30	Site 3	Welshtown Quarry	pond	2020-07-09	2020-07-09	6.3	REG	0.1	Quarry pond
L2020-30	West Headwater Stream	Welshtown Quarry	stream	2020-07-09	2020-07-09	4.5	REG	0.1	Headwater stream on western portion of quarry property

Name of Analyst: Jay Baker Analyses reviewed by: Director / Lab Manager (circle one)

This laboratory applies standard practice in conformance with ISO/IEC 17025:2017, "General Requirements for the Competence of Testing and Calibration Laboratories".

Validation Range: 3-10 units The results in this report relate only to the items tested. More information is available upon request.

The quality of the results is dependent on the quality of sample provided.

Comment: Samples for pH should be kept cool until delivery to the lab unless the samples are analyzed immediately. Preferably samples should be analyzed within 24 hours. Hach manual recommends filling bottle completely and capping tightly; cooling to 4°C for storage and analyzing within 6 hours. If this can't be done, Hach manual recommends reporting the holding time with results.

Method: Standard Methods for the Examination of Water and Wastewater 23rd Edition. 2017 and online version., 4500-HB. Electrometric measurement of pH. ECL Method 8, pH.

Type of Sample: REG = regular; STD = standard; DUP = duplicate; CRM = certified reference material.

Sample Comments: BDL = Below Detection limit; QR = Qualified result; NR = No result, damaged or insufficient sample; MAC = Maximum Allowable Concentration.

Envirosphere Consultants Limited

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Environmental Sample Analysis Report

Report Date: 28-Jul-20 Report Number: A0795

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Lab #	Sample ID	Sample Details	Sample Material	Date Received	Date Analyzed	TSS (mg/L)	Type of Sample	Detection Limit	Sample Comments
L2020-30	BLANK	Welshtown Quarry	dH2O	2020-07-09	2020-07-15	<0.5	BLANK	0.5 mg/L	
L2020-30	CRM	Welshtown Quarry	CRM	2020-07-09	2020-07-15	212.0	STD	0.5 mg/L	CRM=211 mg/L
L2020-30	Culvert - Upper Clyde River Road	Welshtown Quarry	stream	2020-07-09	2020-07-15	<0.5	REG	0.5 mg/L	Upper Clyde River Road culvert
L2020-30	Site 1	Welshtown Quarry	stream	2020-07-09	2020-07-15	9.0	REG	0.5 mg/L	Headwater stream adjacent to quarry property up from Clyde River Rd.
L2020-30	Site 2	Welshtown Quarry	stream	2020-07-09	2020-07-15	34.5	REG	0.5 mg/L	Outflow from culvert under main quarry access road
L2020-30	Site 3	Welshtown Quarry	pond	2020-07-09	2020-07-15	16.0	REG	0.5 mg/L	Quarry pond
L2020-30	Site 3 (dup)	Welshtown Quarry	pond	2020-07-09	2020-07-15	14.0	DUP	0.5 mg/L	Quarry pond
L2020-30	West Headwater Stream	Welshtown Quarry	stream	2020-07-09	2020-07-15	4.0	REG	0.5 mg/L	Headwater stream on western portion of quarry property

Name of Analyst: _____ Analyses reviewed by: _____ Director / Lab Manager (circle one)

This laboratory applies standard practice in conformance with ISO/IEC 17025:2017, "General Requirements for the Competence of Testing and Calibration Laboratories".

Validation Range: 1-1000 mg/L The results in this report relate only to the items tested. More information is available upon request.

The quality of the results is dependent on the quality of sample provided.

Samples for TSS analysis should be kept cool until delivery to the lab unless they are analyzed immediately. A minimum sample volume of 500 ml is preferred. Place sample in a clean plastic container free of cracks or contamination. Fill the bottle to the top and then cap. Samples should reach the lab within 24 hours of sampling, but will be accepted up to 7 days.

Methods: Modified from Standard Methods for the Examination of Water and Wastewater 23rd Edition. 2017 and online version. 2540D. Total Suspended Solids. ECL method 3, Total Suspended Solids.

Type of Sample: REG = regular; STD = standard; DUP = duplicate; CRM = certified reference material.

Sample Comments: BDL = Below Detection limit; QR = Qualified result; NR = No result, damaged or insufficient sample; MAC = Maximum Allowable Concentration.