

APPENDIX D
BIOPHYSICAL ASSESSMENT REPORT
(Envirosphere Consultants Limited, 2016)

Environmental Assessment Registration Document:
Williamsdale Quarry Expansion
Williamsdale, Cumberland County, Nova Scotia

Biophysical Assessment:

Williamsdale Quarry Expansion

1736 Wentworth-Collingwood Road, Williamsdale,
Cumberland County,
Nova Scotia – PIDs 25348863 & 25085994

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Submitted to:

Dexter Construction Company Limited

Bedford, Nova Scotia

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1 INTRODUCTION

Dexter Construction Company Limited (Dexter), Bedford, Nova Scotia, is proposing to expand its quarry in the Williamsdale area of Cumberland County, about 17 km south of Oxford, 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 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 Department of Natural Resources, Nova Scotia Department of Aquaculture and Fisheries (NSDAF), Fisheries and Oceans Canada, contacts with organizations, businesses and individuals in the Williamsdale area; review of existing published information including soil surveys, reports on geology and natural history (e.g. *Natural History of Nova Scotia*); use of relevant websites and databases (Nova Scotia Open Data Portal; DNR Significant Habitat and Wetland Databases, Atlantic Canada Conservation Data Centre, and Nova Scotia Museum of Natural History); 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 September 17, 2016 and June 8, 2017 (fall and late spring/early summer botany surveys); June 9, 2017 (owls and breeding birds); and May 1, and June 8-9 & 13, 2017 (site reconnaissance). Key project personnel included Patrick Stewart (M.Sc.), Valerie Kendall (M.Env.Sci), and Heather Levy (B.Sc. Hons. Env. Sci.) (background review, site reconnaissance, wetlands, water quality & fish habitat assessment); Ruth Newell, M.Sc. (botany surveys); and Mr. Fulton Lavender and Mr. Richard Hatch (bird surveys).

3 SITE LOCATION AND STUDY AREA

The Williamsdale Quarry in Cumberland County is located off a private road approximately one kilometre south of the Wentworth-Collingwood Road at the community of Jackson/Williamsdale East, at approximately UTM Zone 20, NAD83, Easting 434,200 and Northing 5047500. The site is shown in Nova Scotia Air Photos 2014 0905-0233 & 0905-0083, September 15, 2014, and Google Earth satellite imagery from September 23, 2014. The focus area for the assessment is shown on Figures 1 & 2, and Map A-1, Appendix A. The quarry is shown in Figures 3 & 4. The proposed expansion area will be located entirely within the EA study area.



Figure 1. Project location shown on NTS 1:50,000 Map 11E12.

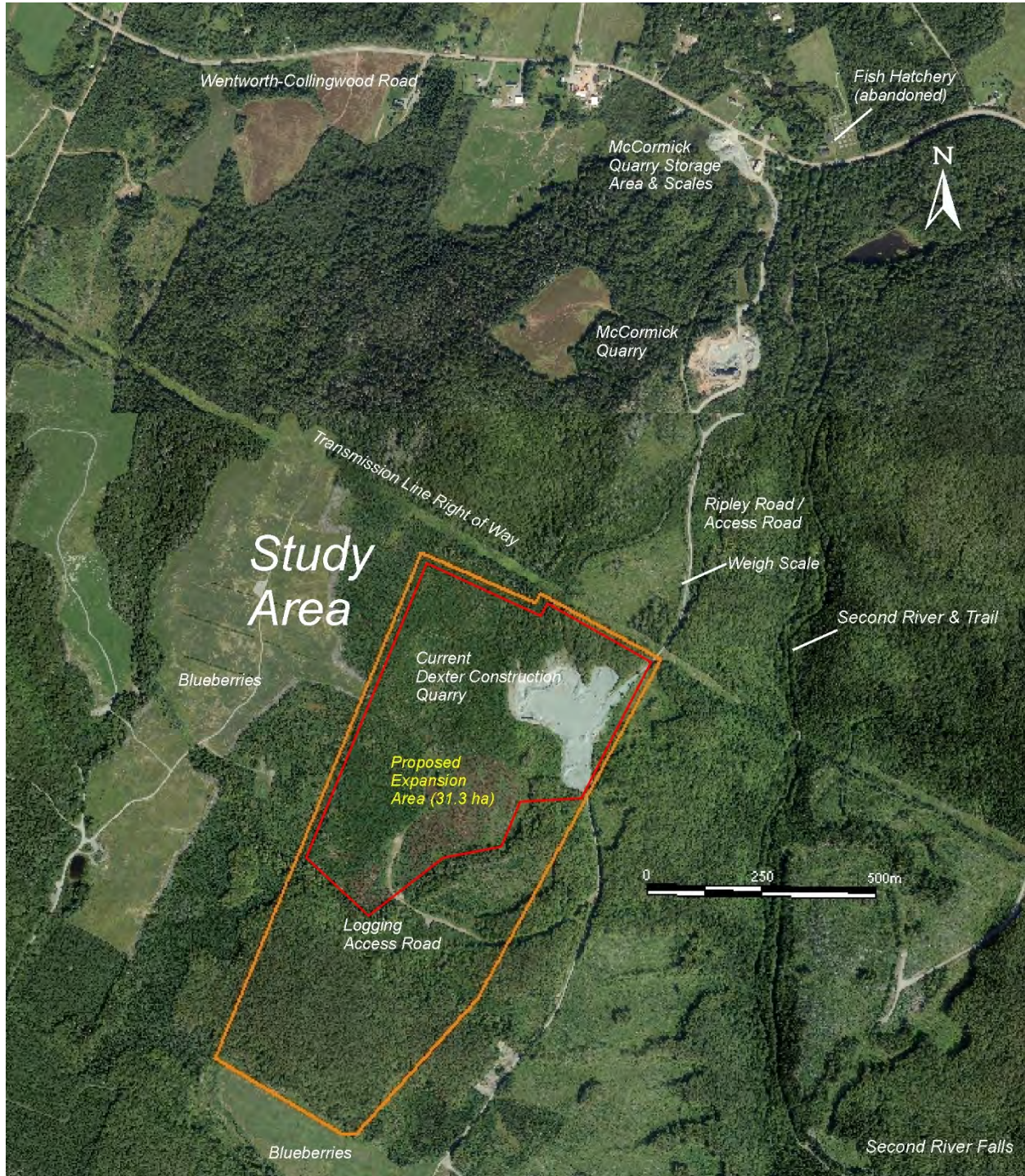


Figure 2. Williamsdale Quarry study area and key features.



Figure 3. Panoramic view of Williamsdale Quarry, facing east, 2016.

4 EXISTING ENVIRONMENT

4.1 PHYSICAL ENVIRONMENT

4.1.1 CLIMATE AND WINDS

The Williamsdale Quarry study site is an inland location, but with marine influences, found approximately 35 kilometers south of Northumberland Strait, 20 kilometers southeast of Springhill, and approximately 25 kilometers north of Economy, Nova Scotia. Presence of the ocean results in a cool, humid, temperate climate in which the weather displays variability during all seasons. The variability is due to continuous interactions between continental and maritime air masses, with continental influence dominating. The winters are cold and snowfall is abundant; forage and fall grain crops are often killed by the cold during winter. Springs are late, cool, and cloudy and summers are warm and humid. Rainfall is the most during the fall months.

Temperatures range from -6.0 degrees Celsius in January to 18.3 degrees Celsius in July. Cumberland County has a mean annual precipitation 989.9 to 1193.8 mm of rainfall and 1524 to 2032 mm of snowfall. During the growing season, 381 mm of rain is received and evapotranspiration is 431.8 mm. Frost-free period ranges from 100 to 140 days (Figure 5)(Canadian Climate Normals 2017). Annual winds are predominantly from the north to northwest in winter, shifting to the south and southwest during the May to November period (TDC 1991). The study area is expected to experience winds which are above-average in severity due to the elevation and exposure, and position near the northern slope of the Cobequid Highlands. Winds with north-south components are forced upward by the mountains, and consequently the mountainous areas are prone to local cloud and thunderstorm formation and shower activity (NavCan 2013).

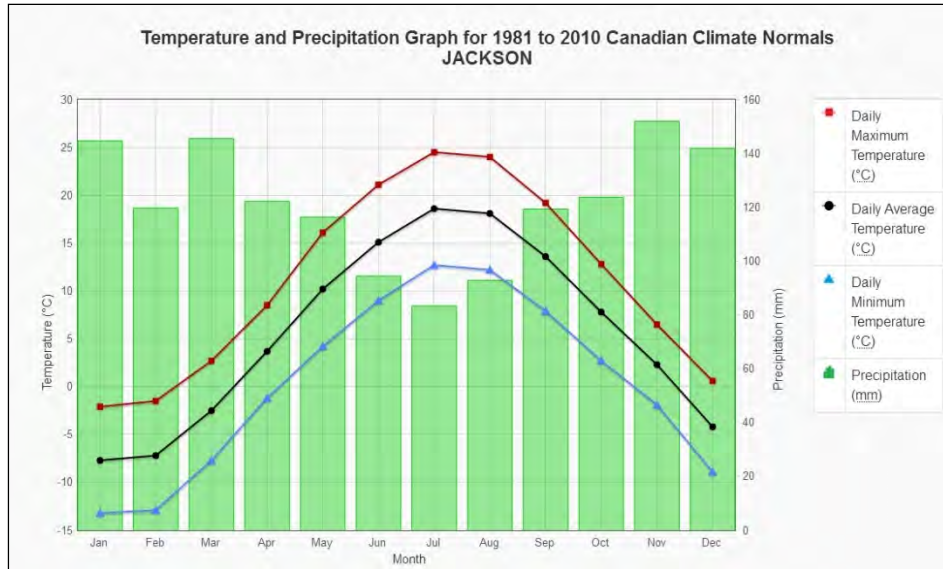


Figure 4. Annual temperature and precipitation cycle for Williamsdale Quarry using observations from Jackson (1981-2010) (Canadian Climate Normals 2017).

4.1.2 TOPOGRAPHY AND GEOLOGY

Landscape

The site is located on the top of a broad, rounded upland fairly characteristic of the type found in the northern Cobequid Highlands (Figure 6) with a relatively flat crown and gradual slopes (2:5) to the northeast, east and southeast (1:6), and a moderate slope (1:5) to the valley of Second River east (Map A-2). It is surrounded by rolling hills frequently occupied by blueberry fields and farms, and larger streams such as Second River and Sugarloaf Brook are found in the bases of valleys between upland areas (Maps A-1 & A-2, Figure 6).



Figure 5. Eastern view of landscape at the quarry site showing Sugarloaf Mountain, June 13, 2017.

Bedrock Geology

The study area is located on the northern edge of the Cobequid Highland's where it meets the northern slope of the coastal plain extending to Northumberland Strait. Bedrock is dominated by igneous rocks predominantly granite, diorite and gabbro and basalt with metamorphosed turbidites at higher elevations, all forming part of the Jeffers Group (Keppie 2000; Pe-Piper and Piper 2003). Sedimentary rocks (conglomerate and sandstone) of the Polly Brook formation of the Cumberland Group occur in close proximity to the site with the boundary in the vicinity of and largely parallel to Westchester Road north of the site (Figure 7). The quarry site occupies a zone of metamorphic turbidites of the Jeffers Group.

Surficial Geology

Surface deposits in the Williamsdale area are a mixture of types ranging from an overburden of glacial till with occasional bedrock outcrops; to glacial features such as drumlins, eskers and kame fields; as well as abundant depressions containing surface water (e.g. lakes, ponds etc.) and alluvially-formed deposits. Surface deposits are mostly glacially derived, at higher elevations predominantly silty to stony glacial till, which is often less than 1 m in thickness, with exposed bedrock barrens in the vicinity of the site (Figure 8). A combination of coarse gravel to sandy alluvial deposits occurs in the base of ravines and valleys as a result of both recent and glacial stream flow. Eskers and kame fields (mounds of glacial till settling after glacial ice melt) occupy a broad north south oriented valley north of the site. (Figure 8)(Stea *et al* 1992).

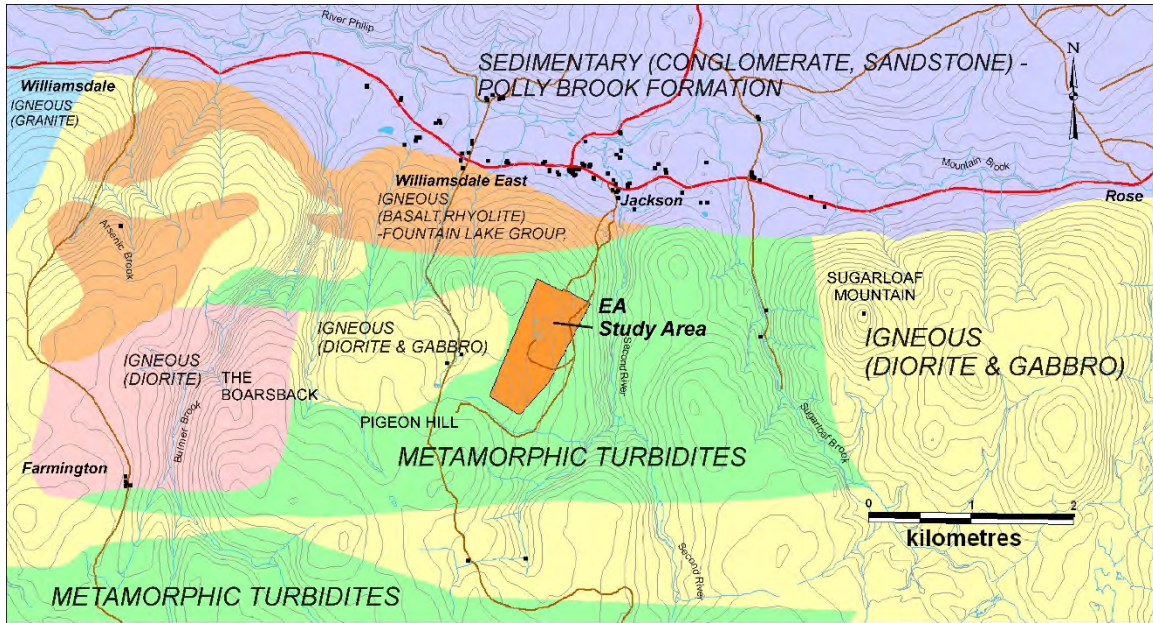


Figure 6. Bedrock geology of the study area. From (Keppie 2000; Pe-Piper and Piper 2003).

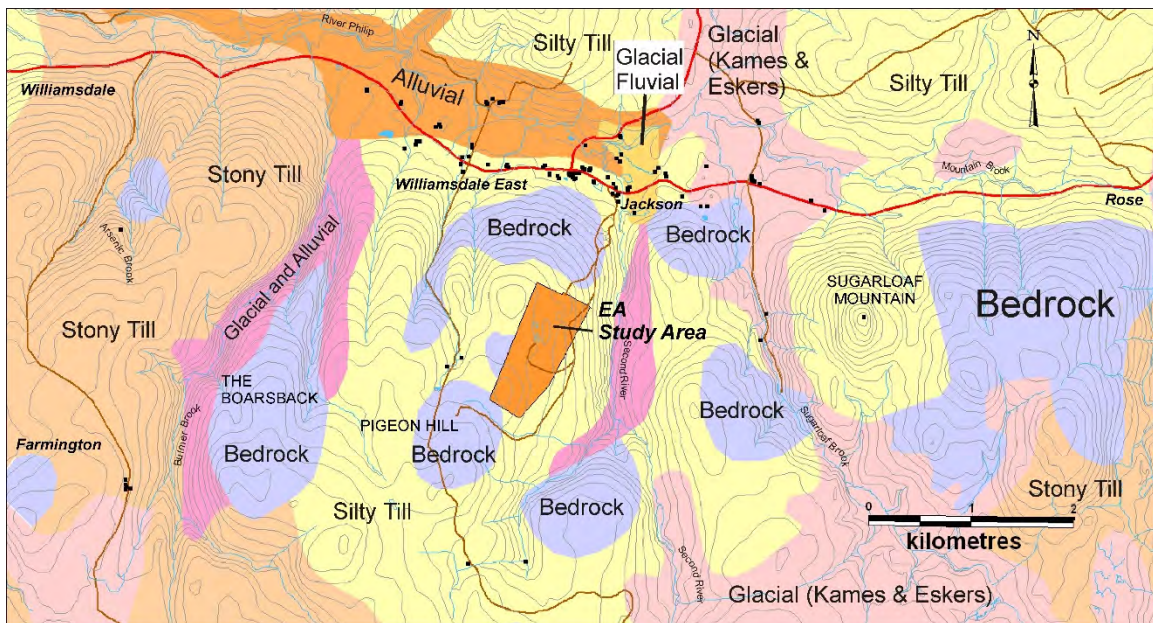


Figure 7. Surficial geology of the study area. From Stea *et al* (1992) and digital version (2016).

4.1.3 AIR QUALITY, NOISE & LIGHT

The Williamsdale area experiences low levels of artificial light, low levels of ambient noise, and high air quality. There are few sources of artificial light in the area; ambient noise levels reflect local vehicle traffic, agricultural equipment, and operations of the quarry; and air quality is expected to be good due to the rural location and predominantly forested setting.

House and yard lights from local residences, vehicle lights and site lighting for quarry operations, are the main sources of artificial light at the site. Road traffic includes vehicles and equipment traveling on Wentworth Collingwood Road, and adjacent roads, Ripley Number 4 Road, Farmington Road, and Paine Road. Traffic levels on Wentworth Collingwood Road, which passes north of the quarry, are expected to be low and generate little artificial light. Lights at the quarry, as well as 'skyshine' from operations when low cloud occurs, can probably be seen from Wentworth Collingwood Road, and residences in the area.

The Williamsdale area is expected to have a relatively high natural baseline air quality typical of areas with low levels of human activity. Neighbouring forested areas as well as vehicle traffic, including that associated with quarry activities, may influence air quality. Areas surrounding the site are predominantly forested with a low density of residential properties. 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 equipment operating at the site uses particulate separators and fines are stored in a separate bermed area at the site.

The scope and scale of operations for the quarry are not expected to change and ambient noise levels in general are expected to be low due to the relatively isolated location of the quarry. Wentworth Collingwood Road is the main road that passes through the area and to which Ripley Number 4, Farmingham and Paine Roads are connected. Residential vehicle use is relatively low along these routes. Traffic related to quarries is low to moderate but can be significant when major construction projects are in the area. Peak vehicle noise on the highway is expected to coincide with vehicle traffic patterns. Morning and evening traffic and noise level peaks, as well as seasonal (summer) peaks in traffic noise corresponding to tourist activities, are expected. The quarry and associated movement of trucks and equipment would continue to provide a periodic source of noise in the area. Noise levels reaching the nearest residences are primarily a result of truck traffic along Wentworth Collingwood Road and use of engine brakes on trucks descending the road from the quarry¹. 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 may take place periodically for a few weeks at a time; a portable asphalt plant may operate at the site periodically; and transport of product using trucks and heavy loading equipment would occur on an as-required basis. Typical noise includes blasting, and sound from crusher and other heavy equipment

¹ Most local residents interviewed indicated having adapted to noise levels associated with brake use by trucks from the quarry.

operations (e.g. motors, back-up signals etc.). All trucks leaving the site are required to follow best operational practices to minimize noise and to cover loads to minimize dust release. Noise levels arising from the quarry in future are expected to be consistent with those produced by the existing quarry operations at the site.

4.1.4 HYDROLOGY

Williamsdale Quarry is located in the River Philip watershed, draining north into the Northumberland Strait and the Gulf of St. Lawrence. Major first order tributaries which join to form the headwaters of the East Branch of River Philip including Mountain Brook, Second River, Sugarloaf Brook, and Arsenic Brook. The annual average monthly flow of River Philip at Collingwood Corner is 3.1 m³/s based on a watershed area of 105.0 km² (Environment Canada 1989), with seasonal highs in the spring and fall (Figure 8). Highest monthly average flow is approximately 8.1 m³/s in April, dropping to between 0.7 to 1.1 m³/s in the July-September period. Winter flows are moderate at 3.6 - 3.9 m³/s. Significant fluctuations in daily average flow can occur at the site.

River Philip Discharge at Collingwood Corner (m³/s)
(1979-1999)

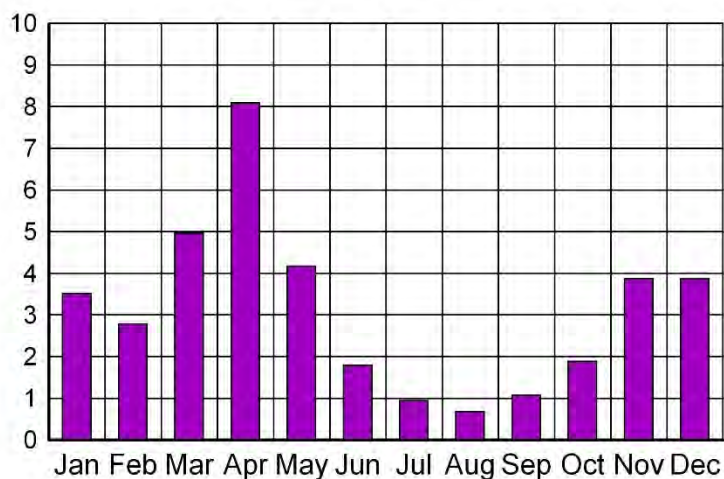


Figure 8. Annual flows in River Philip at Collingwood based on Wallace River flows at Wentworth Center, 1979-1999, based on drainage areas of 105 and 298 km² respectively (Environment Canada 1989 & Water Survey of Canada, <https://wateroffice.ec.gc.ca>).

Surface runoff in the proposed expansion area mainly follows the prevailing slope which is to the east and northeast, eventually entering Second River which flows into River Philip about 1 km northeast of the site; the south part of the site drains east and southeast with minor flowages exiting the property along the road ditch and across blueberry fields. There are no permanent first-order streams on the site; a small permanent stream crosses the northern part of the site on a diagonal east-west, exiting at the southeast corner of the

present quarry footprint, where it flows through a culvert and then downslope to Second River (Map A-2, Figures 9 to 11). An area of seepage, possibly a spring, supporting a flow similar to that in the stream, exits from under a pile of stored aggregate and follows the ditch along the access road, accumulating small flows from seepages along the way, and then flows through a culvert under the access road at the weigh scale (Figures 12 & 13). Presence of blueberry fields southwest of the site have affected drainage in that area and reduced the source water for a mapped stream to the southwest (Map A-2), which was dry at the time of the June 8-9, 2017 survey. Flat to gently-sloping topography in the northwest two-thirds of the property, combined with shallow soil and impervious bedrock close to the surface has led to formation of three intermittent to seasonal forest marshes / ponds (Figures 18 & 28). Removal of forest cover over much of the site has reduced the retention of water in these areas and all three were dry in the fall of 2016. It is assumed that some runoff from this section of the site flows under the quarry floor and is the source of the flow entering the ditch on the access road, exiting from the site through a culvert at the weigh scale, to flow towards Second River. Surface runoff from the quarry floor is channelled mainly along the access road ditch and through culverts into downslope areas, where erosional ravines have formed, (Map A-2), but some leaves the site directly and flows downslope into the woods towards Second River.



Figure 9. Permanent stream crossing study area, in the middle of the expansion area where it passes between clearcuts, showing riparian swamp and blow downs, June 13, 2017.



Figure 10. Permanent stream in the study area where it exits the forest at southeast corner of Williamsdale Quarry, June 13, 2017.



Figure 11. Permanent stream after it leaves the proposed expansion area enroute to Second River, June 13, 2017. View is upslope towards quarry.



Figure 12. Location of source of seepage from underneath aggregate piles on east side of Williamsdale Quarry. Seepage flows in ditch along access road to vicinity of weigh scale, June 13, 2017.



Figure 13. Seepage flow from quarry base along access road at weigh scale, June 8, 2017.

4.1.5 HYDROGEOLOGY

Groundwater develops predominantly on impervious bedrock surfaces beneath overburden, as well as subsurface in cracks, fractures and horizontal surfaces between strata in bedrock at the site; as well as in till and alluvial deposits. Much of the precipitation entering the site likely leaves in surface water runoff in the form of small streams or flowages, with a smaller proportion leaving the site subsurface, principally through cracks and fractures in the bedrock. Adjacent areas of Williamsdale at lower elevations such as along valleys where overburden is thicker would allow development of near surface dug wells as well as drilled wells. No wells are recorded in the NS well log database as occurring within 1 km of the site (Kennedy and Fisher 2013) and seven are recorded within 5 km of the site, including both residential and commercial wells, and one drilled for the abandoned Collingwood Fish Hatchery which is about 1.5 km from the study site. Private residences in the area are assumed to be on dug wells; however none are located within 800 m of the quarry.

4.1.6 SOILS

Soils on the northern slope of the Cobequid Highlands where the quarry is situated are derived from tills formed from dominant igneous and metamorphic bedrock (e.g. diorite, gabbro and metamorphosed turbidites) in the area. Soils are dominated by the Wyvern Unit, consisting of well-drained sandy to gravelly loams; with predominantly well-drained sandy loams and gravelly sandy loam and gravelly loam of the Rodney Unit and at lower elevations (Nowland and MacDougall 1973; Davis and Browne 1997). These soils have only a moderate to low capability for agriculture due to stoniness. Floodplains for River Philip and Mountain Brook contain well-drained sandy loams of the Cumberland unit with moderate capacity for agriculture. Many of the upland areas adjacent to the site were developed for agriculture and currently are widely used for blueberry production (Figure 15). Forest cover developed on the landscape is predominantly deciduous—Sugar Maple, Yellow Birch, and American Beech—with softwoods including Balsam Fir, and Red and Black Spruce (Davis and Browne 1997).

4.2 BIOLOGICAL RESOURCES AND HABITAT

4.2.1 TERRESTRIAL ENVIRONMENT

Roughly 40% of the study area, including slopes east to southeast of the property, supports the natural mature deciduous forest (Sugar Maple, American Beech, Yellow Birch and associated understorey species) with occasional occurrences of softwoods, in particular Red Spruce and Balsam Fir, in depressions, ravines and wetter areas of the site (Figure 16). The remainder has been cut over and has regenerated to mixed deciduous forest over approximately 10 years (Figure 17). Fields developed for blueberry production border the southwest end of the study area and, to a limited extent, to the northwest (Figure 15). Softwood blowdown occurs extensively around the margins of cutover areas and in the forestry buffers along watercourses (Figure 10 & 18). Topography is rolling with highest elevations in the southwest quarter (Figures 9-11).



Figure 14. Southeast view of blueberry field located south of the EA Study Area, Williamsdale Quarry, showing topography (June 8, 2017).



Figure 15. Mature deciduous woodland (Sugar Maple, American Beech, and Yellow Birch) in southwest section of study area, June 9, 2017.



Figure 16. Clearing created by logging activity at the end of woods road in mixed softwood/deciduous regen in west section of cutover area in west part of EA Study area, June 13, 2017.



Figure 17. Blowdowns along watercourse crossing study area, June 13, 2017.

Plant communities at the site are comparatively diverse with 136 species recorded in botany surveys conducted in September 2016 and June 2017 (Appendix B). Three species of conservation concern were

found at the site. Tender Sedge (*Carex tenera*) was observed in a clearcut just north of the northernmost marsh where several clumps were located (Figure 19). This species has a general status of Yellow (= sensitive) in Nova Scotia and is listed as an S2 species (= imperiled) by the Atlantic Canada Conservation Data Centre. Yellow Ladies'-tresses (*Spiranthes ochroleuca*), which has an S3 (vulnerable) status was scattered along the edge of a logging access road (Appendix B and Figure 19). This status indicates the species has a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation. The population size for Yellow Ladies'-tresses at this location was approximately 10 plants. Approximately 10 flowering plants plus several non-flowering plants of Blood Milkwort (*Polygala sanguinea*) also occurred both along the edge, and in the centre of, the logging access road (Appendix B, Figures 19). The species has a Nova Scotia General Status of Yellow, meaning 'sensitive' and ACCDC subnational status of S2S3 indicating that there is some uncertainty associated with the status of this species and it's status is between 'Imperiled' and 'Vulnerable'.

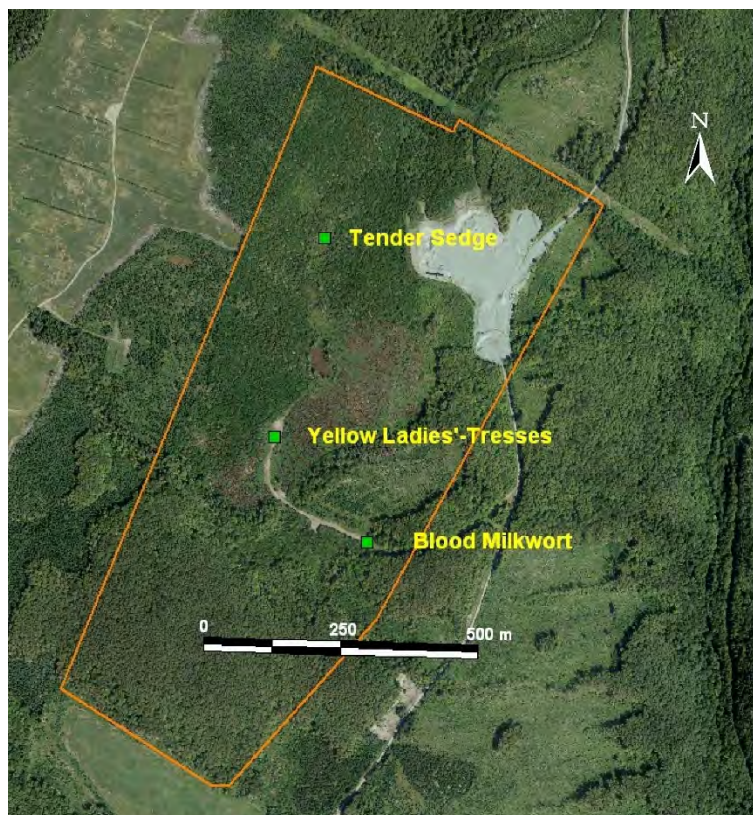


Figure 18. Locations of plant species of concern at the Williamsdale Quarry site, based on fall 2016 and spring-early summer 2017 botanical surveys at the site.

Landscape at the site is predominantly forested, however a significant amount of clear-cutting has taken place on the northwestern half of the study area. Remaining uncut forest habitat on the property consists predominantly (40-50%) of mature deciduous stands (Figure 16). These hardwood woodlands support tree species including American Beech (*Fagus grandifolia*), Sugar Maple (*Acer saccharum*), Mountain Maple

(*Acer spicatum*), Moose Maple (*Acer pensylvanicum*), Yellow Birch (*Betula alleghaniensis*), Red Spruce (*Picea rubens*) and Eastern Hemlock (*Tsuga canadensis*). Commonly occurring herbaceous species in this habitat include several wood ferns (*Dryopteris intermedia*, *D. cathusiana*), Cinnamon Fern (*Osmunda cinnamomea*), Wild Sarsaparilla (*Aralia nudicaulis*), Oak fern (*Gymnocarpium dryopteris*), Wood Aster (*Oclemena acuminata*) and Jack-in-the-pulpit (*Arisaema triphyllum*). Shrubs present include Canada Fly Honeysuckle (*Lonicera canadensis*), Hobblebush (*Viburnum alnifolium*), and Beaked Hazelnut (*Corylus cornuta*).

Disturbed areas along the logging road which bisects the property support a mixture of both exotic (non-native) and native vascular plant species including: Common Plantain (*Plantago major*), Fall Dandelion (*Leontodon autumnalis*), Common St. John's-wort (*Hypericum perforatum*), Healall (*Prunella vulgaris*), Path Rush (*Juncus tenuis*), Wild Strawberry (*Fragaria virginiana*), Colonial Bentgrass (*Agrostis capillaris*), Rough Bentgrass (*Agrostis scabra*), Pearly Everlasting (*Anaphalis margaritacea*), Poverty Grass (*Dantonionia spicata*), various Goldenrods (*Solidago* spp.) various Asters including Tall White Aster (*Doellingeria umbellata*), Wood Aster (*Oclemena acuminata*), New York Aster (*Symphotrichum novi-belgii*) and Calico Aster (*Symphotrichum lateriflorum*), etc. Many of these species are characteristic of disturbed and/or runout soils. Two of the rare native vascular plant species found at the site (Yellow Ladies' Tresses and Blood Milkwort) were documented within this habitat. These are species that would normally be found in areas of natural disturbance in the wild.

Clearcuts which occupy about 40% of the site support common herbaceous species including Canada Goldenrod (*Solidago canadensis*), Rough Goldenrod (*Solidago rugosa*), Tall White Aster (*Doellingeria umbellata*), Fowl Manna Grass (*Glyceria striata*), Soft Rush (*Juncus effusus* s.l.), Fireweed (*Epilobium angustifolium*), Pearly Everlasting (*Anaphalis margaritacea*), and Wild Strawberry (*Fragaria virginiana*). Common shrub and tree species include: Pin Cherry (*Prunus pensylvanica*), Wire Birch (*Betula populifolia*), Balsam Fir (*Abies balsamea*), Wild Raspberry (*Rubus strigosus*), willows (*Salix* spp.), White Spruce (*Picea glauca*), Lowbush Blueberry (*Vaccinium angustifolium*), etc.

Seasonal ponds identified in the clearcut area (Map A-2, Figures 20-22) support plant species including: Royal Fern (*Osmunda regalis*), common species including Sensitive Fern (*Onoclea sensibilis*), Cinnamon Fern (*Osmunda cinnamomea*) and Red-osier Dogwood (*Cornus stolonifera*), and various willow species (*Salix* spp.) at the pond edges. The middle pond (Figure 21) was dominated by Common Woolly Bulrush (*Scirpus cyperinus*) with willows common in the peripheral areas. The northernmost seasonal pond is dominated by the shrub Meadowsweet (*Spiraea alba* var. *latifolia*), but includes Rhodora (*Rhododendron canadense*) and Large Cranberry (*Vaccinium macrocarpon*) with willows (*Salix* spp.) around the margins (Map A-2, Figure 22).



Figure 19. Vegetation in southernmost seasonal pond in northwest section (September 17, 2016) during a period when the pond was dry.



Figure 20. Vegetation in middle seasonal pond in northwest section (September 17, 2016) during a period when the pond was dry.



Figure 21. Vegetation in northernmost seasonal pond in northwest section (September 17, 2016) during a period when the pond was dry.



Figure 22. Recent clearcut (6-10 yrs) in northwestern part of study area (September 17, 2016).

4.2.2 AQUATIC ENVIRONMENT

Major first order tributaries in the vicinity of the Williamsdale Quarry join to form the headwaters of the East Branch of River Philip, including Mountain Brook, Second River, Sugarloaf Brook, and Arsenic Brook (Maps A-1 & A-3). The site is primarily in the watershed of Second River, with a small fraction on the west and northwest entering River Philip directly. There are no permanent, first-order streams on site. The permanent stream which crosses the central part of the study area (Figures 10-12 & Figure 18) is small, typically less than 1 m in width and 10 to 20 cm deep although at times it disappears beneath the surface or becomes braided and spreads out in wet riparian wetland areas. Several intermittent flowages also occur, flowing downslope at the site. A chain of three semi-permanent ponds were identified in the northwest part of the study area (Map A-2, Figures 20-11), all of which were dry in September 2016². These ponds have formed in a slight depression on a level impervious bedrock subsurface, have shallow mineral soil, and are supplied entirely through precipitation. Prior to logging they likely were woodland ponds, but have since dried out due to the removal of forest cover. The mature deciduous woodland on the southwest central parts of the property has occasional water accumulation features, like vernal ponds, where runoff accumulates on level surfaces during high runoff events (Figure 24) but wet conditions have not usually persisted for long enough for wetland vegetation to develop (Figure 24), although some small wetlands have developed in places (e.g. Wetland 5, Figure 29).

²The ponds contained water in June 2017.



Figure 23. Level seasonally wet area in mature deciduous woodland in mature deciduous forest in southwest central part of study site, June 9, 2017.

4.2.3 WATER QUALITY

Surface waters sampled at the site were typical of undisturbed natural stream environments in upper watersheds of north central Nova Scotia such as the Cobequid Hills and Pictou/Antigonish Highlands. Samples showed low conductivities, high transparency, and low suspended sediment levels, as well as high oxygen levels, and were within normal and guideline ranges for the protection of freshwater aquatic life (Tables 1A & 1B). Freshwater drainage from beneath gravel storage piles at the quarry, which forms one of the main contributors to flow off the site, showed elevated conductivities compared with natural waters, but otherwise high water quality, including oxygen levels near saturation, normal temperature levels and suspended sediment levels, which were negligible. Characteristics of natural waters sampled at the quarry were similar in Second River and a small stream which drains the area northwest of the study area (Tables 1; Map A-2).

Table 1a. Water quality measurements from surface waters located at the Williamsdale Quarry. For locations see Map A-2.					
Site Location & Date	June 13, 2017				
	WS8 Stream Crossing of woods road	WS6 Stream at Quarry	WS5 Subsurface Flow from Quarry	WS4 Ditch at Weigh Scale	Second River at Wentworth Collingwood Road
Temperature °C	15.8	18.0	9.9	19.1	18.0
Dissolved Oxygen (mg/L)	8.5	9.0	13.0	9.2	10.3
Dissolved Oxygen (% saturation)	86.8	95.1	109.7	99.7	107.2
Conductivity (µs/cm)	29.0	29.3	216.5	242.3	25.1
Specific Conductivity (25°) (µs/cm)	35.2	33.7	306.3	273.8	29.4
pH	6.7	7.2	8.0	7.8	7.1
TSS (mg/L)	<0.5	1.5	<0.5	0.5	4.5
Colour	Clear, Colourless	Clear, Colourless	Clear, Colourless	Clear, Colourless	Clear, Colourless
Time (ADT)	16:59	16:01	15:16	14:58	14:40
Note: TSS = Total Suspended Solids					

Table 1b. Water quality measurements from streams in the vicinity of Williamsdale Quarry. For locations see Map A-2.			
Site Location & Date	June 9, 2017		
	WS1 Second River at Wentworth- Collingwood Rd.	WS2 Second River at Power Line	WS3 Unnamed Stream at Civic 1501, Collingwood Road
Temperature °C	10.0	10.0	10.3
Dissolved Oxygen (mg/L)	8.7	9.5	8.3
Dissolved Oxygen (% saturation)	76.5	--	76.3
Conductivity (µs/cm)	23	21.9	37.6
Specific Conductivity (25°) (µs/cm)	32.5	30.8	54.0
pH	7.2	7.2	7.2
TSS (mg/L)	<0.5	<0.5	67.0
Colour	Clear, Colourless	Clear, Colourless	Clear, Colourless

Time	0930	1130	1317
Note: TSS = Total Suspended Solids			

4.2.4 WETLANDS

The quarry property and proposed expansion area is well drained and gradually sloping and typically does not lead to wetland development. Wetlands occurring in the study area include: 1) three seasonal ponds/marshes in areas of shallow soil situated over bedrock depressions close to the surface in the northwest part of the study area; 2) several small seepage areas on the east side, possibly connected with the main stream flowing the site, which form small (0.1 ha) seepage swamps; and 3) temporary pond features like vernal ponds in the mature deciduous hardwood forest in the southwest part of the study area. The stream flowing through the site has swampy riparian areas (Figures 25 to 28) and some older trees including an old Eastern Hemlock. The three seasonal ponds/marshes range from 0.04 to 0.18 ha in area (Figure 29, Table 2). In addition to wetlands on the site, a 0.4 ha marsh is located west of the aggregate storage and work area for the Ray McCormick and Sons Quarry along the Wentworth Collingwood Road (Map A-2).



Figure 24. Riparian / seepage swamp along stream in southwest part of study area (June 9, 2017).



Figure 25. Riparian / seepage swamp along watercourse in southwest part of property (June 9, 2017).



Figure 26. Upper reaches of permanent stream which crosses the study area, showing riparian swamp development, June 9, 2017.



Figure 27. Riparian swamp / wet meadow in deciduous woodland along stream, southwest end of study area (June 8, 2017).

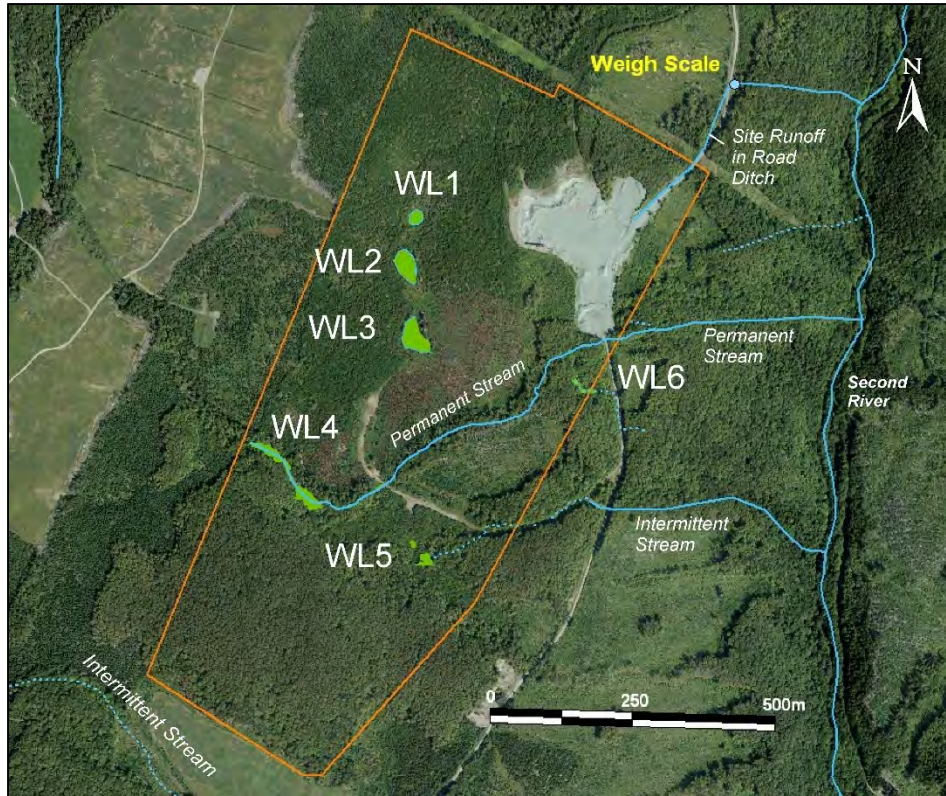


Figure 28. Wetlands and watercourses in study area.

Table 2. Wetlands, Williamsdale Quarry Expansion. Locations shown in Figure 29.		
Identification	Area (ha)	Type and Comments
WL1	0.04	Intermittent Pond / Marsh
WL2	0.14	“
WL3	0.18	“
WL4	0.27	Seepage / Riparian Swamp
WL5	0.05	Vernal Ponds
WL6	0.03	Seepage Swamp

4.2.5 FISH & FISH HABITAT

No streams or water bodies which could support fish, occur within the EA study area. Watercourses at the site are generally shallow and/or intermittent, and there is a steep gradient (1:5) impassible by fish separating the site from Second River, which is approximately 0.5 kilometers east. Water quality at the site and in the general vicinity is high and was a factor in selection of Jackson at the junction of the Second River and River Philip for the first Atlantic Salmon hatchery operated by the Canadian Fisheries Research Board there, from the 1930s to the late 1990s.

River Philip and its tributaries in the vicinity of the Williamsdale Quarry are expected to support a moderate diversity of freshwater and anadromous fish³, through a combination of varied habitat types and relatively pristine, uncontaminated surface water. Major first order tributaries which join to form the headwaters of the East Branch of River Philip including Mountain Brook, Second River, Sugarloaf Brook, and Arsenic Brook (Map A-1)), are wide mountain headwater streams flowing along valley floors (Figure 30), having coarse substrate (mainly cobble and larger), a low to moderate gradient and high percentage of riffles, high shade and debris, which provide good fish habitat. These are fed by intermittent to permanent feeder streams which slope steeply to the valley floor and are unsuitable for fish and fish passage. River Philip in the area is a second order river occupying a wide valley (Figure 31). Several smaller flowages and creeks, some of which originate in the uplands in the Cobequid Highlands near the Williamsdale Quarry, enter River Philip in the area.

Second River is the largest watercourse immediately adjacent to the study site (Figure 30). Species known to occur in River Philip from recent sampling (2011) include salmonids (Atlantic Salmon, Brook Trout, Brown Trout), minnows (Lake Chub, Creek Chub, Blacknose Dace, Common Shiner & Golden Shiner,

³ 3 Minnow traps were set for 12 hrs overnight on June 8, 2017, in Second River and a River Philip tributary west of the site under DFO Gulf Region Permit SG-RHQ-17-060, but no fish were captured.

Three-spine Stickleback and Black-spotted Stickleback), American Eel and Lamprey (Breau and Ripley 2012). Blacknose Dace has a localized distribution in Nova Scotia, occurring only in watersheds in the Cobequid Hills on both the Northumberland Strait and Bay of Fundy drainages (Gilhen and Hebda 2002). The species has been sampled in River Philip at Collingwood Corner (Gilhen and Hebda 2002); and may occur in River Philip and Second River in the immediate vicinity of the project site. The species has a Vulnerable (S3) status in Nova Scotia which means it can be susceptible to disturbance or removal due to a restricted range, relatively few populations, recent and widespread declines, or other factors. River Philip is an important river for multi-year Atlantic Salmon, and supports high levels of smolt production (Breau and Ripley 2012). The first Atlantic Salmon hatchery in Nova Scotia was located near the quarry site at the junction of Second River and River Philip and operated for over 60 years until the late 1990s (Figure 31).



Figure 29. Second River at Wentworth Collingwood Road, looking upstream, June 8, 2017.



Figure 30. River Philip looking upstream from bridge on Ripley #4 Road near study site, June 9, 2017.



Figure 31 Abandoned federal government fish hatchery on Wentworth-Collingwood Road at Jackson. Hatchery was divested by Fisheries and Oceans Canada in the late 1990s and subsequently closed.

4.2.6 BIRDS

Birds are an important component of the ecosystem in the vicinity of the Williamsdale Quarry. Approximately 139 species of birds potentially breed in Cape Chignecto to Cobequid Hills region and 92

species are known to, or potentially breed in the 10 km survey squares (20MR34 & 20MR35) surrounding the study area (Maritime Breeding Bird Atlas 2016) and have the potential to occur at the site (Table 3).

Table 3. Birds potentially occurring in the Cape Chignecto / Cobequid Hills / Northumberland Strait Lowlands (Maritime Breeding Bird Atlas 2016).

Songbirds (Passeriformes)		
Alder Flycatcher	Common Raven	Palm Warbler
American Crow	Common Yellowthroat	Pine Grosbeak
American Goldfinch	Dark-eyed Junco	Pine Siskin
American Redstart	Eastern Bluebird †	Purple Finch
American Robin	Eastern Kingbird	Purple Martin ‡
Baltimore Oriole	Eastern Phoebe	Red Crossbill †
Bank Swallow §	Eastern Towhee †	Red-breasted Nuthatch
Barn Swallow	Eastern Wood-Pewee	Red-eyed Vireo
Bay-breasted Warbler	European Starling	Red-winged Blackbird
Bicknell's Thrush †	Evening Grosbeak	Rose-breasted Grosbeak
Black-and-white Warbler	Fox Sparrow	Ruby-crowned Kinglet
Blackburnian Warbler	Golden-crowned Kinglet	Rusty Blackbird †
Black-capped Chickadee	Gray Catbird	Savannah Sparrow
Blackpoll Warbler	Gray Jay	Scarlet Tanager †
Black-throated Blue Warbler	Hermit Thrush	Song Sparrow
Black-throated Green Warbler	Horned Lark †	Swainson's Thrush
Blue Jay	House Sparrow	Swamp Sparrow
Blue-headed Vireo	House Wren †	Tennessee Warbler
Bobolink	Least Flycatcher	Tree Swallow
Bohemian Waxwing †	Lincoln's Sparrow	Veery
Boreal Chickadee	Magnolia Warbler	Vesper Sparrow †
Brown Creeper	Marsh Wren †	White-breasted Nuthatch
Brown-headed Cowbird	Mourning Warbler	White-throated Sparrow
Canada Warbler †	Nashville Warbler	White-winged Crossbill
Cape May Warbler	Nelson's Sparrow	Willow Flycatcher †
Cedar Waxwing	Northern Mockingbird †	Wilson's Warbler
Chestnut-sided Warbler	Northern Parula	Winter Wren
Chipping Sparrow	Northern Waterthrush	Yellow Warbler
Cliff Swallow §	Olive-sided Flycatcher †	Yellow-bellied Flycatcher
Common Grackle	Ovenbird	Yellow-rumped Warbler

Table 3. Birds potentially occurring in the Cape Chignecto / Cobequid Hills / Northumberland Strait Lowlands (Maritime Breeding Bird Atlas 2016).		
Ducks, Geese & Swans (Anseriformes, Anatidae)		
Canada Goose*	Common Goldeneye ‡*	Mallard ‡*
American Black Duck*	Common Merganser*	Red-breasted Merganser*
Blue-winged Teal ‡*	Green-winged Teal*	Ring-necked Duck*
Common Eider §*	Hooded Merganser ‡*	Wood Duck*
Pheasants, Grouse and Turkeys (Galliformes, Phasianidae)		
Gray Partridge	Ring-necked Pheasant	Spruce Grouse
	Ruffed Grouse	
Loons (Gaviiformes, Gaviidae)) and Grebes (Podicipediformes, Podicipedidae)		
Common Loon		Pied-billed Grebe ‡
Hérons, Egrets and Bitterns (Ciconiiformes, Ardeidae)		
American Bittern		Great Blue Heron §
Cormorants (Pelicaniformes, Phalacrocoracidae)		
Double-crested Cormorant §*		Great Cormorant § ‡*
Hawks & Eagles (Accipitridae), Falcons (Falconidae), and Osprey (Pandionidae)		
American Kestrel	Merlin	Osprey
Bald Eagle ☐	Northern Goshawk	Red-tailed Hawk
Broad-winged Hawk	Northern Harrier	Sharp-shinned Hawk
Woodpeckers (Order Piciformes, Picidae)		
Black-backed Woodpecker	Hairy Woodpecker	Pileated Woodpecker
Downy Woodpecker	Northern Flicker	Yellow-bellied Sapsucker
Owls (Strigiformes, Strigidae) and Barn Owls (Strigiformes, Tytonidae)		
Barred Owl	Long-eared Owl †	Northern Saw-whet Owl
Great Horned Owl	Northern Hawk Owl †	Short-eared Owl †
Pigeons and Doves (Columbiformes, Columbidae)		
Mourning Dove		Rock Pigeon

Table 3. Birds potentially occurring in the Cape Chignecto / Cobequid Hills / Northumberland Strait Lowlands (Maritime Breeding Bird Atlas 2016).		
SHOREBIRDS – Plovers (Charadriiformes, Charadriidae), Sandpipers & Snipes (Charadriiformes, Scolopacidae)		
Killdeer	American Woodcock	Wilson's Snipe
Semipalmated Plover †	Spotted Sandpiper	Willet
Rails (Gruiformes, Rallidae)		
Virginia Rail †		Sora ‡
Kingfishers (Coraciiformes, Alcedinidae)		
Belted Kingfisher		
Swifts (Apodiformes, Apodidae) and Hummingbirds (Apodiformes, Trochilidae)		
Chimney Swift †		Ruby-throated Hummingbird
Nighthawks (Caprimugiformes, Caprimulgidae)		
Common Nighthawk †		
Gulls, Terns, Skuas (Charadriiformes, Laridae)		
Herring Gull §*		Great Black-backed Gull §*
Auks, Murres, Puffins (Charadriiformes, Alcidae)		
Black Guillemot § ‡ *		
† and ‡ indicate rare species in Maritimes ‡ a regionally rare species and § a colonial species * aquatic species likely only as a flyover		

Habitat types in and around the study site include mature deciduous and mixed forest, deciduous regenerated forest, blueberry fields, open quarry, as well as wetland areas. Surveys at the site included: site walkovers and a night owl survey June 11-12, 2017; and ten-minute dawn point count surveys at ten sites conducted on June 12, 2017 (Figure 33).

Barred Owl were heard at the site during the June overnight owl survey; while the June early-morning point-count survey documented 45 bird species (Table 4). The most common and abundant species at the site were Swainson's Thrush, Magnolia Warbler, American Robin, White-throated Sparrow, American Redstart, and Blue-headed Vireo which occurred in all habitat types (Table 4); while Common Yellowthroat, Black-throated Green Warbler, Red-eyed Vireo, Black and White Warbler and Hermit Thrush—which were also relatively abundant—each occurred in 3-4 of the habitats (Table 4). Most species (22-28) occurred in sites associated with mature deciduous forest, where the dominant species (most common and abundant) included American Redstart, American Robin, Least Flycatcher and Magnolia Warbler, Red-eyed Vireo, Swainson's thrush and White-throated Sparrow. Relatively high numbers of several species and overall highest counts of birds were observed in the regenerating deciduous forest at the edge of the quarry (Site 10), where important species included American Robin, Common Yellowthroat, Magnolia Warbler, Hermit Thrush, Swainson's Thrush and White-throated Sparrow (Table 4). Other species noted as occurring at or in the vicinity of the site included: American Woodcock, Barn Swallow (observed near the highway); and Belted Kingfisher (flying over the south part of the study area).

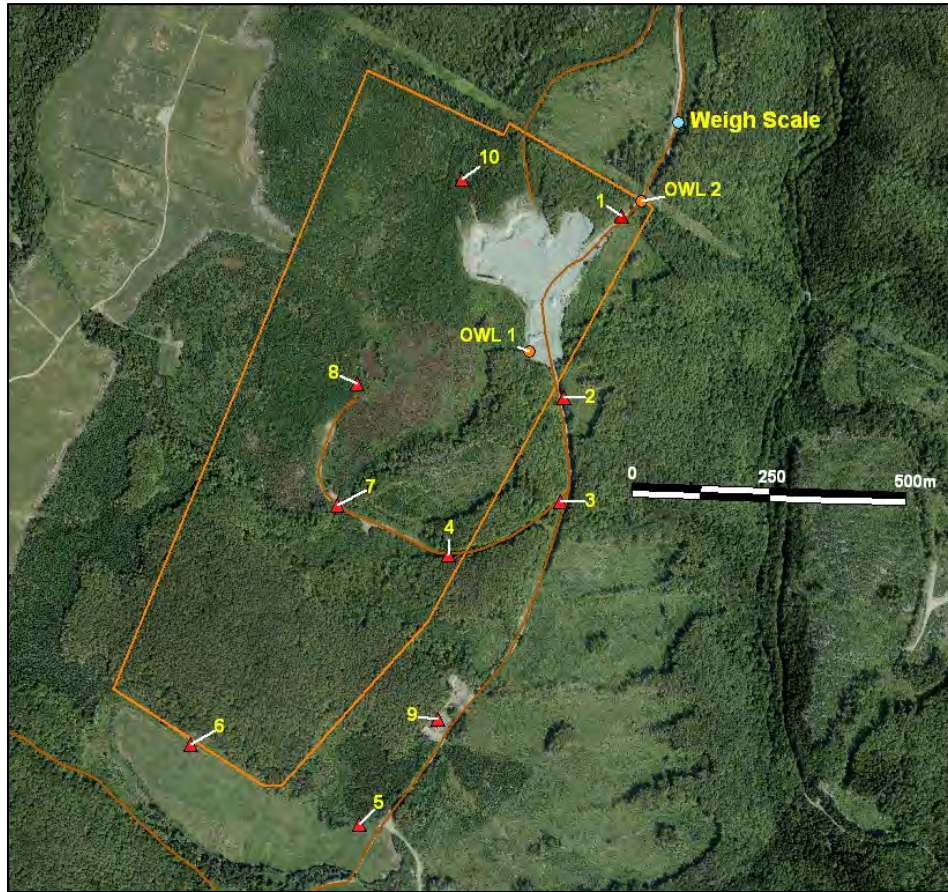


Figure 32. Bird survey locations, Williamsdale Quarry, June 2017.

Table 4. Bird species heard or observed during dawn bird surveys conducted June 12, 2017 between 04:30 and 08:00 am at the Williamsdale Quarry study site. For locations of observation points, see Map A-4.

Bird Species	Mature deciduous forest		Mature deciduous forest and blueberries		Mature deciduous forest with adjacent clearcut		Deciduous forest cutover		Regenerating deciduous forest and quarry	
	(Sites 1,2,3,4)		(Sites 5, 6)		(Sites 7 & 9)		(Site 8)		(Site 10)	
	Number of Sites	Average Count/10 min	Number of Sites	Average Count/10 min	Number of Sites	Average Count/10 min	Number of Sites	Average Count/10 min	Number of Sites	Average Count/10 min
PASSERIFORMES										
Alder Flycatcher	1	0.25	2	1.5	0	0	0	0	1	1.0
American Crow	0	0	0	0	1	1.0	1	1.0	1	2.0
American Goldfinch	0	0	0	0	0	0	0	0	0	0
American Redstart	4	9.25	1	2.0	2	2.0	1	1.0	1	5.0
American Robin	3	6.25	2	5.0	2	3.0	1	3.0	1	10.0
Black-and-white Warbler	2	0.75	2	1.0	3	3.0	1	2.0	0	0
Blackburnian Warbler	0	0	0	0	0	0	0	0	0	0
Black-capped Chickadee	1	0.25	1	1.0	1	0.5	0	0	1	2.0
Black-throated Green Warbler	2	0.75	0	0	1	2.0	1	10.0	1	1.0
Blue Jay	0	0	1	1.0	1	1.0	0	0	0	0
Blue-headed Vireo	2	1.25	2	2.5	2	3.0	1	3.0	1	1.0
Brown Creeper	1	0.75	0	0	0	0	0	0	0	0
Canada Warbler	0	0	0	0	0	0	0	0	1	1.0
Cedar Waxwing	0	0	0	0	1	0.5	3	1	0	0
Chestnut-sided Warbler	0	0	0	0	0	0	1	6.0	1	2.0
Common Yellowthroat	2	1.75	2	1.5	1	1.0	0	0	1	12.0
Dark Eyed Junco	4	1.5	1	0.5	0	0	0	0	0	0
Downy Woodpecker	0	0	0	0	1	0.5	0	0	0	0
Eastern Wood Pewee	1	0.25	0	0	0	0	0	0	0	0
Hermit Thrush	2	1.5	2	1.0	2	1.5	0	0	1	6.0
Least Flycatcher	3	4.0	0	0	1	4.0	0	0	0	0
Magnolia Warbler	4	3.75	2	5.0	2	3.5	1	5.0	1	25.0
Mourning Dove	0	0	0	0	0	0	0	0	1	1.0
Mourning Warbler	1	1.25	0	0	0	0	0	0	0	0
Northern Parula	1	0.25	0	0	0	0	0	0	0	0

Table 4. Bird species heard or observed during dawn bird surveys conducted June 12, 2017 between 04:30 and 08:00 am at the Williamsdale Quarry study site. For locations of observation points, see Map A-4.

Bird Species	Mature deciduous forest		Mature deciduous forest and blueberries		Mature deciduous forest with adjacent clearcut		Deciduous forest cutover		Regenerating deciduous forest and quarry	
	(Sites 1,2,3,4)		(Sites 5, 6)		(Sites 7 & 9)		(Site 8)		(Site 10)	
	Number of Sites	Average Count/10 min	Number of Sites	Average Count/10 min	Number of Sites	Average Count/10 min	Number of Sites	Average Count/10 min	Number of Sites	Average Count/10 min
Ovenbird	3	4.0	1	1.0	1	1.0	0	0	1	2.0
Palm Warbler	0	0	0	0	1	0.5	0	0	0	0
Pine Grosbeak	0	0	0	0	0	0	0	0	0	0
Pine Siskin	0	0	0	0	0	0	0	0	0	0
Purple Finch	1	0.25	0	0	0	0	0	0	1	1.0
Red-breasted Nuthatch	1	0.25	1	1.0	0	0	0	0	0	0
Red-eyed Vireo	3	7.5	2	3.5	2	2.0	0	0	0	0
Rose-breasted Grosbeak	1	0.25	0	0	0	0	0	0	0	0
Ruby-crowned Kinglet	0	0	0	0	0	0	1	1	0	0
Savannah Sparrow	0	0	1	1.5	0	0	0	0	0	0
Swainson's Thrush	4	4.5	2	6.5	2	4.0	1	6.0	1	19.0
Veery	0	0	0	0	0	0	0	0	1	1
White-throated Sparrow	4	4.75	1	1.5	1	1.0	1	2.0	1	15.0
Winter Wren	2	0.5	0	0	1	0.5	0	0	0	0
Yellow-rumped Warbler	1	0.25	0	0	0	0	0	0	0	0
Yellow-bellied Flycatcher	0	0	1	1.0	0	0	1	2.0	1	1.0
PICIFORMES										
Hairy Woodpecker	1	0.75	0	0	0	0	0	0	0	0
Pileated Woodpecker	0	0	1	0.5	0	0	0	0	0	0
Northern Flicker	1	0.25	0	0	1	1.0	0	0	0	0
Yellow-bellied Sapsucker	1	0.25	0	0	2	1.5	0	0	0	0
SUMMARY										
Total Count/10 min		57.8		40.5		39.0		46.0		108.0
Total Number of Species		28		22		23		14		19
Average No. of Species		14.5		15.0		16.0		14.0		19.0

4.2.7 MAMMALS

Various large and small mammals, including game and furbearing species, are found in Cumberland County. Mammal species occurring regularly or occasionally at the quarry site are expected to reflect the community of the surrounding areas which includes coniferous, deciduous and mixed forest. Black Bear are common in the area and one was seen during the survey near the quarry along the Wentworth Collingwood Road, while bear scat was noted in the study area during walkovers. Other typical species for the area included White-tail Deer (one sighting and droppings and tracks observed); Eastern Coyote (scat observed); Red Fox seen recently by personnel at the site; and individual Red Squirrel, Eastern Chipmunk and Snowshoe Hare seen during surveys. Although Moose occur in the area, no sightings or sign were noted during the survey. Other mammals known to occur in the general area and within 100 kilometers of the study site include carnivores such as Canada Lynx, American Marten (both which are provincially-listed as 'Endangered') and Fisher; as well as rodents and small mammals including lemmings (Southern Bog Lemming), squirrels (Southern Flying Squirrel—designated federally as Special Concern), shrews (Long-tailed Shrew (designated federally as 'Special Concern'), American Water Shrew and Maritime Shrew), and bats (Eastern Pipistrelle, Little Brown Myotis and Northern Long-eared Myotis—federally and provincially designated as Endangered)(ACCDC, 2016). Slopes in the East Branch River Philip valley at the site serves as a deer-wintering area (NS DNR 2016). Species less likely to be seen on casual surveys include Little Brown and Northern Long-Eared Bats, which use the general area for foraging and may migrate through the area. Populations of both species are diminished at present due to the White Nose Syndrome in North America (S. Weseloh-McKeane, Nova Scotia Museum, personal communication, 2016). North of the site is a deer-wintering area and moose can occur in the general area (the study area is within a Special Management Practice Zone for mainland moose) (NS Significant Species & Habitats Database, 2017).

4.2.8 REPTILES AND AMPHIBIANS

Many of the common Nova Scotian amphibians and reptiles are expected to occur at the site. Although little wetland and open water habitat is present, there is suitable habitat in adjacent areas and most of the typical species for Nova Scotia likely occur from one time to another. Species observed or heard during site visits include Wood Frog and American Toad. Most of the common other amphibians including various frogs, salamanders, and snakes, are expected at the site. The absence of permanent ponds in the study area would limit the occurrence of some of the frog and salamander species. Habitat is not present at the site for reptile and amphibian species of conservation concern such as Wood Turtle or Blanding's Turtle. Nova Scotia species and potential for occurrence at the site are shown in Table 5.

Table 5. Potential for occurrence of Nova Scotia amphibians and reptiles at Williamsdale Quarry. Species in bold were found at the site or potentially could breed at the site. Other species are unlikely to occur or breed due to the absence of permanent ponds or other suitable habitat. Source: Gilhen (1984).		
FROGS	SALAMANDERS	SNAKES
Eastern American Toad Northern Spring Peeper Bullfrog Green Frog Mink Frog Wood Frog Northern Leopard Frog	Yellow-spotted Salamander Blue-spotted Salamander Eastern Redback Salamander Four-toed Salamander	Maritime Garter Snake Eastern Smooth Green Snake Northern Ringneck Snake Northern Redbelly Snake Northern Ribbon Snake
TURTLES		NEWTS
Snapping Turtle Wood Turtle Blandings Turtle Eastern Painted Turtle		Red-spotted Newt (Red Eft)

4.2.9 SPECIES AT RISK

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 level of concern regarding the conservation of a species in Canada, is assessed both nationally and at a regional level. Nationally, 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.

Species of conservation concern listed under federal or provincial legislation, as well as those with general status, which occur within five kilometres of the Williamsdale Quarry study site, include both animals and plants. Of the animals of conservation concern in the general vicinity of the site, only the mainland population of moose is of concern due to low numbers, and the species can occur in the general vicinity of the study area. Bird species include: Chimney Swift, Olive-sided Flycatcher and Canada Warbler (both listed under the federal *Species at Risk* and provincial *Endangered Species acts*); Barn Swallow, Bobolink,

and Eastern Wood-Pewee (all listed provincially); and Bank Swallow designated as ‘Threatened’ by COSEWIC (ACCDC 2016).

Eastern Wood Pewee, a species of Special Concern (COSEWIC) having Provincial ‘Vulnerable’ status and national (S3S4) status (ACCDC 2016), was heard in bird surveys at the site in its preferred habitat of mature deciduous forest on the southwest section of the site. Barn Swallow also occurs in the area, and an individual was seen along the Wentworth Collingwood Road at the Ray McCormick and Sons quarry aggregate storage area. The species typically builds cup-shaped mud nests in protected areas under the eaves of buildings, and agricultural land—wetlands along River Philip, including a marsh along the highway in the area, would be suitable foraging habitat; however suitable habitat is not available at the Williamsdale Quarry. A Canada Warbler was heard in the northern part of the site in woods adjacent to the quarry. Treed and shrubby grassy swamps around bog/fen wetlands are typical habitat for Canada Warbler, none of which occur at the site; however occurrence at the site may indicate locally suitable habitat.

The remaining bird species of concern potentially occurring at the site, were not observed and are unlikely to occur at the site due to the absence of suitable habitat. Little natural forest is left in the study area due to logging and agricultural production of blueberries, although some of the forest at the site is regenerating and parts of the quarry expansion area support mature deciduous forest. Chimney Swift would feed over forested areas and potentially could nest in cavities in old deciduous trees; however the species was not seen at the site. Suitable habitat for Olive-Sided Flycatcher—treed (black spruce) sphagnum bogs and wetlands surrounded by mature softwood forest stands—does not occur at the site. Bank Swallow requires exposed banks, which also were not found at the site, although there may be suitable habitat along River Philip. Bobolink occupies open field environments such as are provided by agricultural cropland in hay and grain crops—neither of these habitats is found in the proposed expansion area for the Williamsdale quarry.

Other animals of conservation concern in this part of Nova Scotia include Canada Lynx and American Marten, which are currently listed as “Endangered” under the NS Endangered Species Act; Southern Flying Squirrel and Long-tailed Shrew, which are designated federally as a species of “Special Concern”; and bat—Eastern Pipistrelle, Little Brown Myotis and Northern Long-eared Myotis—which are federally and provincially designated as “Endangered”. None of these animals have been documented within a 5 km radius of the study site (ACCDC, 2016). Wood Turtle, a federally-listed species and “Threatened” in Nova Scotia, is documented as occurring within the watershed of the study area and documented habitat (River Philip) occurs in neighbouring areas north and west of the study site (K. George, DNR Regional Biologist, personal communication, 2016; Nova Scotia Significant Species & Habitat Database). This species usually occurs along higher order rivers and there are no records within five kilometres of the study area (ACCDC 2016). Blacknose Dace (*Rhinichthys atratulus*), a minnow species which has a Vulnerable (S3) status in Nova Scotia (www.natureserve.org) principally due to its restricted distribution in Nova Scotia (in the Cobequid Highlands in both the Northumberland Strait and Bay of Fundy watersheds) occurs in the River Philip watershed in the area (Gilhen and Hebda 2002).

No federally- or provincially-listed plant species of concern have previously been found or reported within five kilometres of the study area (ACCDC 2016); however one federally listed plant species of conservation concern—the Prototype Quillwort (*Isoetes prototypus*)—is known to occur in the general Williamsdale area (S. Weseloh-McKeane, NS Museum of Natural History, personal communication, 2016). Two plant species, with a general status within Nova Scotia as Sensitive (Yellow)—Fringed Blue Aster (*Symphyotrichum ciliolatum*) and Boreal Aster (*Symphyotrichum boreale*)—and Showy Lady’s Slipper (*Cypripedium reginae*) with a general status rank of “May be at Risk” (Red) have been observed within a 5 km radius of the study area (Table 6) (ACCDC 2016) and provincially listed species within 10 km of the site (Table 7). None of these species were noted during the spring and fall botany surveys of the study area. Two species with a Nova Scotia status as Sensitive (Yellow), however, were observed in both fall 2016 and spring 2017 botanical surveys—Tender Sedge (*Carex tenera*) and Blood Milkwort (*Polygala sanguinea*) (Appendix B). A third species, Yellow Ladies’-tresses (*Spiranthes ochroleuca*) which has an S3 (Vulnerable) status was seen in both botany surveys. All three species were found in disturbed habitats, the former in areas disturbed by logging and the others by construction of a logging road. A list of plants and animals of concern within a 100-kilometer radius of the study site are included in Appendix C.

Table 6 Records of species of concern within a 5 km radius of Williamsdale Quarry, Cumberland County. Atlantic Canada Conservation Data Centre (ACCDC) Database, November 2016.							
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)	
PLANTS							
Asteraceae	<i>Symphyotrichum ciliolatum</i>	Fringed Blue Aster				3 Sensitive	G5, S2
	<i>Symphyotrichum boreale</i>	Boreal Aster				3 Sensitive	G5, S2?
Orchidaceae	<i>Cypripedium reginae</i>	Showy Lady's-Slipper				2 May Be At Risk	G4, S2
BIRDS							
Apodidae	<i>Chaetura pelagica</i>	Chimney Swift	Threatened	Threatened	Endangered	1 At Risk	G5, S2B,S1M
Cardinalidae	<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak				3 Sensitive	G5, S2S3B
Charadriidae	<i>Charadrius vociferus</i>	Killdeer				3 Sensitive	G5, S3B
Corvidae	<i>Perisoreus canadensis</i>	Gray Jay				3 Sensitive	G5, S3
Emberizidae	<i>Pooecetes gramineus</i>	Vesper Sparrow				2 May Be At Risk	G5, S2B

Falconidae	<i>Falco sparverius</i>	American Kestrel				4 Secure	G5, S3B
Fringillidae	<i>Carduelis pinus</i>	Pine Siskin				3 Sensitive	G5, S2S3
	<i>Coccothraustes vespertinus</i>	Evening Grosbeak				4 Secure	G5, S3S4B, S3N
Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow		Threatened	Endangered	1 At Risk	G5, S3B
	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow				2 May Be At Risk	G5, S2S3B
	<i>Riparia</i>	Bank Swallow		Threatened		2 May Be At Risk	G5, S2S3B
Icteridae	<i>Dolichonyx oryzivorus</i>	Bobolink		Threatened	Vulnerable	3 Sensitive	G5, S3S4B
Mimidae	<i>Dumetella carolinensis</i>	Gray Catbird				2 May Be At Risk	G5, S3B
Paridae	<i>Poecile hudsonica</i>	Boreal Chickadee				3 Sensitive	G5, S3
Parulidae	<i>Dendroica castanea</i>	Bay-breasted Warbler				3 Sensitive	G5, S3S4B
Parulidae	<i>Dendroica striata</i>	Blackpoll Warbler				3 Sensitive	G5, S3S4B
	<i>Wilsonia canadensis</i>	Canada Warbler	Threatened	Threatened	Endangered	1 At Risk	G5, S3S4B
	<i>Vermivora peregrina</i>	Tennessee Warbler				3 Sensitive	G5, S3S4B
Picidae	<i>Picoides arcticus</i>	Black-backed Woodpecker				3 Sensitive	G5, S3S4
Regulidae	<i>Regulus calendula</i>	Ruby-crowned Kinglet				3 Sensitive	G5, S3S4B
Scolopacidae	<i>Actitis macularius</i>	Spotted Sandpiper				3 Sensitive	G5, S3S4B
	<i>Gallinago delicata</i>	Wilson's Snipe				3 Sensitive	G5, S3B
Sittidae	<i>Sitta canadensis</i>	Red-breasted Nuthatch				4 Secure	G5, S3
Turdidae	<i>Catharus fuscescens</i>	Veery				4 Secure	G5, S3S4B
	<i>Catharus ustulatus</i>	Swainson's Thrush				4 Secure	G5, S3S4B
Tyrannidae	<i>Contopus cooperi</i>	Olive-sided Flycatcher	Threatened	Threatened	Threatened	1 At Risk	G4, S3B
	<i>Contopus virens</i>	Eastern Wood-Pewee		Special Concern	Vulnerable	3 Sensitive	G5, S3S4B
	<i>Empidonax flaviventris</i>	Yellow-bellied Flycatcher				3 Sensitive	G5, S3S4B

OTHER							
Margaritiferidae	<i>Margaritifera</i>	Eastern Pearlshell				3 Sensitive	G4, S2
<p>1. <u>NPROT, National conservation status of species, as designated by COSEWIC.</u> 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.</p> <p>2. SPROT=Provincial Rank/Status of Taxon.</p> <p>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).</p> <p>4. Atlantic Canada Conservation Data Centre (ACDC).</p> <p>5. <u>GRANK, Global rarity rank of species, using CDC/NatureServe methods</u></p> <p>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 of 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).</p> <p>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.</p> <p>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).</p> <p>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</p>							

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.
- 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 7. Provincially listed species of concern with potential to occur within 10 km of the project site. Nova Scotia Museum records (S. Weseloh Mckean, NS Museum, pers. comm., 2016).

Scientific Name	Common Name	SARA	COSEWIC (NPROT ¹)	NS ESA (SPROT ²)	General Status of Wild Species Rankings ³	ACCDC ⁴ Rankings (GRANK, SRANK ⁵)
PLANTS						
<i>Alopecurus aequalis</i>	Short-awn Foxtail				4 Secure	-, S3
<i>Asplenium trichomanes-ramosum</i>	Green Spleenwort				3 Sensitive	-, S3
<i>Bromus latiglumis</i>	Broad-Glumed Brome				2 May be at Risk	-, S1
<i>Calamagrostis stricta</i> (C. neglecta)	Slim-stemmed Reed Grass				3 Sensitive	-, S2
<i>Campanula aparinoides</i>	Marsh Bellflower				3 Sensitive	-, S3
<i>Carex hirtifolia</i>	Pubescent Sedge				3 Sensitive	-, S2 S3
<i>Caulophyllum thalictroides</i>	Blue Cohosh				2 May be at Risk	-, S2
<i>Conioselinum chinense</i>	Chinese Hemlock-parsley				3 Sensitive	-, S2
<i>Cypripedium reginae</i>	Showy Lady's Slipper				2 May be at Risk	-, S2
<i>Elymus wiegandii</i>	Wiegand's Wild Rye				2 May be at Risk	-, S1
<i>Eriophorum gracile</i>	Slender Cottongrass				3 Sensitive	-, S2 S3
<i>Fallopia scandens</i>	Climbing False Buckwheat				3 Sensitive	-, S3
<i>Fraxinus nigra</i>	Black Ash			Threatened	1 At Risk	-, S1 S2
<i>Galium boreale</i>	Northern Bedstraw				2 May be at Risk	-, S2
<i>Hypericum majus</i>	Large St. John's-wort				3 Sensitive	-, S2
<i>Isoetes prototypus</i>	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	3 Sensitive	-, S2
<i>Laportea canadensis</i>	Canadian Wood Nettle				3 Sensitive	-, S3
<i>Lilium canadense</i>	Canada Lily				2 May be at Risk	-, S2
<i>Limosella australis</i>	Southern Mudwort				4 Secure	-, S3
<i>Rhamnus alnifolia</i>	Alder-leaved Buckthorn				4 Secure	-, S3
<i>Thuja occidentalis</i>	Eastern White Cedar			Vulnerable	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 & 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).

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 Williamsdale area was occupied first by Mi'kmaq and then by settlers of European and American origin, the latter who developed the landscape, establishing communities based on agriculture and logging. Much of the local landscape has been modified by these activities, and remaining parcels of original forest are fragmented through the area. Two larger collections of Crown Land Parcels in the general area of the site form wilderness areas either proposed or established by the province—the Economy River Wilderness Area and the Portapique River Wilderness area, representing intact forest stands and landscapes (Figure 34). Forest stands in the proposed study area are small and not connected to other, similar stands. The animal population of large carnivores and omnivores reflects the general absence of population and urban development, and use of the multiple landscape types in the area. Residents in the area experience nature and wildlife daily and it is part of the local cultural environment.

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 requesting that proponents of industrial development projects consult with the Mi'kmaq concerning proposed industrial projects and activities. Dexter Construction has contacted First Nations representatives concerning the present Williamsdale Quarry expansion project. The nearest Mi'kmaq community to Williamsdale is Millbrook First Nation, located approximately 50 km southeast of Williamsdale; and the unoccupied Franklin Manor-22 Mi'kmaq reserve is in Cumberland County north of Parrsboro, approximately 42 km west of the study site. The 4.1 km² Franklin Manor reserve is managed by two bands, Pictou Landing First Nation and Paq'tnkek First Nation.

The study area was once part of the greater Mi'kmaq territory known as *Sipekne'katik*, meaning 'Where the Wild Potatoes Grow'. Typically lakes and watercourses would have been important transportation corridors, providing a resource base for the Mi'kmaq, their ancestors and predecessors prior to the arrival of European settlers (CRM 2016). Mi'kmaq would have used the general area of the site to various degrees such as for traditional use (e.g. gathering and hunting). Some Mi'kmaq records for the area show nearby rivers as being traditionally used for fishing, and a point east of the study area coincident with Sugarloaf

Mountain has a traditional place name of *Kini'skwatek*, meaning “pointed mountain” (KMKNO from CRM 2016). River Phillip is known as *Ksu'skipukwek* meaning “flowing through hemlock” (KMKNO 2016 in CRM 2016). There are historical records of Mi'kmaq living in the vicinity of River Philip to Collingwood Corner from 1783 onwards (CRM 2016).

There are two Mi'kmaq tribal councils 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 people 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 represents Mi'kmaq. 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, 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 and the Mi'kmaq Confederacy of PEI in Charlottetown is 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.

4.3.2 POPULATION AND ECONOMY

Local economies in Cumberland County are tied primarily to agriculture and forestry, and their communities face some of the same challenges as elsewhere in rural Nova Scotia, including lack of economic growth and an aging population (Nova Scotia Open Data Portal 2016). Agriculture is dominated by wild blueberry harvesting. Oxford Frozen Foods, located in Oxford (the “blueberry capital of Canada”) 20 kilometers north of Williamsdale, operates a processing plant and 12,000 acres of blueberry land. They are the largest employer in Cumberland County, with over 1000 staff, and are the largest global supplier of quality frozen blueberries. Health care and social assistance, mineral resources, and construction are also significant sectors in Cumberland County providing important sources of income. Local residents of Williamsdale indicated that the majority of resident jobs are in mineral resource extraction, health care, and wild blueberry harvesting and processing. The annual median income for the County is \$38,433 CDN—lower than the median family income for Nova Scotia (\$73,900) (Statistics Canada Online 2017).

Cumberland County has a rural population of approximately 30,005 people, with a low population density of approximately 7.0/km² (2016, Statistics Canada). The population has been slowly declining for the past several decades and has decreased 4.3% since 2011. Collingwood Corner is the nearest community, located west of the site, and the Town of Oxford (population 1190, located approximately 20 kilometers north) is the closest major centre. Springhill and Amherst (population 9,700) are approximately 13 and 33 kilometers northwest of Williamsdale respectively.

4.3.3 WATER SUPPLY AND RESIDENTIAL WELLS

A single non-residential drilled well is documented in the Nova Scotia well log database occurring within one kilometer of the study site (Kennedy and Fisher 2013), and dug wells supply residences in the general vicinity of the Williamsdale Quarry.

4.3.4 LAND USE

Land in the vicinity of the quarry is predominantly rural agricultural but includes forestry, agricultural, and commercial use (e.g. quarries) as well as permanent residences. Population density is low and a handful of residences are located along the Wentworth Collingwood Road. Main uses of land in the area include blueberry production, forestry, and maple sugar production (Map A-4). Most of the land in the vicinity of the Williamsdale Quarry is privately owned with several parcels of Crown land in the general vicinity (Map A-3).

4.3.5 HUNTING AND TRAPPING

Wildlife species characteristic of Cumberland County and Nova Scotia in general are expected to occur at the site, and lands in the vicinity of the Williamsdale Quarry is potentially used for hunting Black Bear and White-tailed deer, as well as for trapping various furbearer species (NS Significant Species & Habitats Database 2016). A summary of reported harvests for hunted game species in Cumberland County is presented in Table 8. Ruffed Grouse and muskrat are among the most trapped or hunted upland game and furbearer species within Cumberland County, with White-tailed deer, Snowshoe Hare and beaver also commonly hunted and trapped. Black Bear are common in the region, and Cumberland has the highest calculated harvest of Black Bear for the province. Deer harvest in Cumberland County is fifth highest for the province.

Table 8. Five-year cumulative summary of wildlife harvested in Cumberland County and Nova Scotia (2011 – 2016).			
Animal	Cumberland Harvest	Provincial Harvest	(%) of Provincial Harvest
LARGE MAMMALS			
Deer (2010 – 2015)	3872	58,099	7.0
Black Bear (does not included snaring)	248	1737	12.0
UPLAND GAME			
Snowshoe Hare	5871	352,605	1.7
Ruffed Grouse	16,011	222,699	7.2
Ring-necked Pheasant	1695	23,604	7.2
FUR HARVEST			
Beaver	3103	22,114	14.0
Muskrat	16,745	82,662	20.3
Otter	132	2370	5.6
Mink	396	7424	5.3
Bobcat	269	4107	6.5
Fox	500	2585	19.3
Racoon	2003	11,197	17.9
Skunk	25	293	8.5
Squirrel	442	8269	5.3
Weasel	394	3742	10.5
Coyote	1106	10,347	10.7
Lynx	3	58	5.2
Marten	0	36	0.0
Fisher	176	815	21.6
Total Furbearers	25,294	156,019	16.2

4.3.6 FORESTRY

Forestry is historically one of the main uses of land in Cumberland County. Presently, about 7.5% (approximately 540 individuals) of Cumberland County’s workforce is employed in forestry, agriculture, hunting and fishing (Nova Scotia Open Data Portal, 2017).

4.3.7 RECREATIONAL, COMMERCIAL, AND MI’KMAQ FISHING

Recreational fishing provides an important resource and pastime for residents of Cumberland County. Second River, which is less than one kilometre east of the quarry, is a tributary of River Philip which is an important river for Atlantic Salmon and other species. The watershed, in general, is used for recreational

fishing, and Mi'kmaq in the area likely use the resource as well. River Philip supports Atlantic Salmon, trout (rainbow, brown, and brook trout), and largemouth bass, and recreational fishing is permitted downstream from the Mountain Road Bridge (Spencers Bridge) in the Community of River Philip. There are no commercial fisheries in the vicinity of Williamsdale Quarry.

4.3.8 HISTORICAL, ARCHAEOLOGICAL AND PALAEOANTHROPOLOGICAL RESOURCES

The study area was once part of the greater Mi'kmaq territory known as *Sipekne'katik*, and Mi'kmaq would have used the area before European settlement in the late-1700s to early 1800s. A review of the Maritime Archaeological Resources Inventory (MARI) maintained by the Nova Scotia Museum of Natural History, determined that there are no registered archaeological sites within a one kilometre radius of the study area (CRM 2016). Based on the area being steeply sloped, the lack of any on-site water sources, no known Native land use, and a review of property history, the immediate study area has low potential for the occurrence of Pre-contact and/or early historic Native archaeological or historic Euro-Canadian archaeological resources (CRM 2016). Field reconnaissance confirmed the lack of Mi'kmaq or historic Euro-Canadian resources at the site (CRM 2016). With the exception of the CRM (2016) screening, no historical/cultural studies have been done, and there are no records of archaeological sites in the proposed expansion area, but there are sites both to the east and west (S. Weseloh-Mckeane, Coordinator, Special Places, personnel communication, 2016). Historic maps indicate possible settlement near the mouth of Second River (immediately east of study site) and at River Philip (northwest of the study site) (S. Weseloh-Mckeane, Coordinator, Special Places, personnel communication, 2016).

4.3.9 PARKS AND PROTECTED AREAS

Local residents and visitors to Cumberland County access lakes, rivers and forest areas in the vicinity of the quarry for outdoor recreation such as boating (e.g. kayaking and canoeing), camping, hiking, snowshoeing, swimming, as well as hunting and fishing (Nova Scotia Department of Environment, Online, 2017). There are wilderness or protected areas in the Cobequid Hills in general area of the quarry site, including: Portapique River Wilderness Area (pending designation for expansion); Economy River Wilderness Area (pending designation); Polly Brook Wilderness Area (designated); Slade Lake Protected Area (designated); and Steepbank Brook Nature Reserve (pending designation) (Figure 34).

Portapique River Wilderness Area is located in Cumberland and Colchester counties approximately 6 kilometers southeast of the quarry site. The Area covers 2,060 hectares and provides protection for old forests; habitat for a rare fish species (Blacknose Dace); source waters for the Portapique River—a significant salmon river—and represents the unique geological landscape of the Cobequid Highlands. This regionally significant wilderness area provides good opportunities for recreational use such as hiking and fishing. An additional 1,096 hectares are pending designation on the east, southeast and west boundaries of the existing wilderness area.

Economy River Wilderness Area is located in Cumberland and Colchester counties, less than 10 kilometers southwest of the quarry site. The existing designated area covers 6,063-hectares and there are an additional 5,747-hectares currently pending designation as wilderness area. The area encompasses the steep escarpment of the Cobequid Fault, significant waterfalls, flat hilltop features with occasional lakes, rare and uncommon flora, sensitive lichens, and species at risk fauna. This area is considered important recreationally as an excellent location for wilderness hiking and camping. It is linked with other trail systems via a footbridge above Economy Falls (Figure 34).

Of the remaining wilderness and recreational areas in the general vicinity of the Williamsdale Quarry, the newly designated Polly Brook Wilderness Area is northwest of the quarry and consists of a 781-hectare wilderness area in Cumberland County (Figure 34). The area is considered ideal for hiking and camping. A small nature reserve area surrounding Slade Lake in Cumberland County (Figure 30) is located approximately 16 kilometers northwest of the study site. Slade Lake Nature Reserve is a prime ecological area consisting of a forested area with karst topography (i.e. sink holes and vernal pools) and rare flora, including Eastern White Cedar, a Provincially-listed species at risk. Steepbank Brook Nature Reserve (203 hectares) is located in Cumberland County, approximately 14 km north-northwest of the quarry site (Figure 34). It encompasses a mixed forest area, which includes Eastern White Cedar, as well as small wetlands.

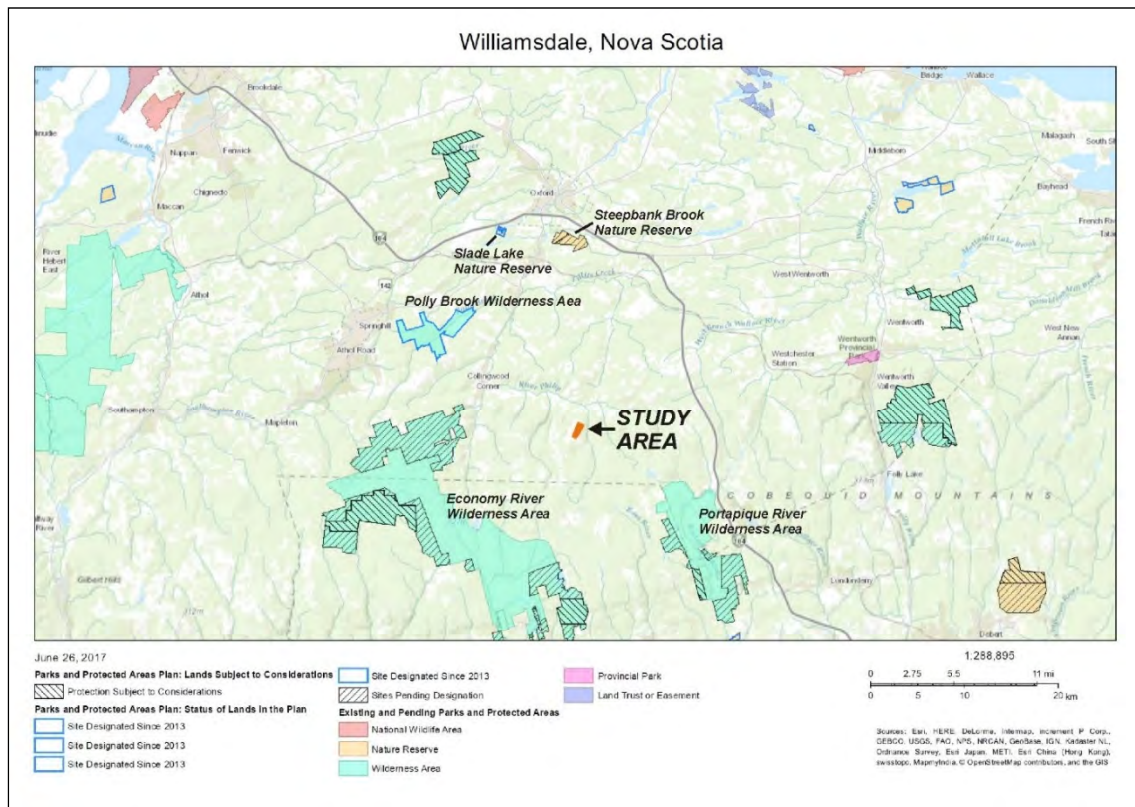


Figure 33. Parks and protected areas in the vicinity of Williamsdale Quarry.

4.3.10 RECREATIONAL/CULTURAL FEATURES

Local residents and visitors of the Cumberland County occasionally access the surrounding forest, lakes and rivers within the vicinity of the quarry study site for outdoor recreation such as boating (e.g. kayaking and canoeing), camping, hiking and snowshoeing, swimming, as well as some hunting and fishing (Nova Scotia Department of Environment, Online, 2017). Existing woods roads and other small side roads allow woodland access (i.e. Second River Falls trail), and designated park reserves provide outdoor recreation opportunities (Figure 34). A series of waterfalls (Second River Falls and Great Falls) occurs on Second River about 1 km southeast and 3 km of the study area respectively and are destinations for hiking. Two local residents indicated that dog-walking is a common activity along roadways, and young people occasionally fish recreationally in the rivers (A. Brown; B. Halliday, personal communication, 2017). There are no notable recreation or cultural businesses in the area. Neighboring wilderness areas and trail systems within emphasize the importance of outdoor recreation and nature appreciation for the area and in Nova Scotia.

4.3.11 RESIDENTIAL USE

Private single-family residences, cottages, and farms are present in an overall low density along main roads, with a number of residences concentrated along the Wentworth-Collingwood Road in the immediate vicinity of the site (Maps A-2 & A-3), reflecting the original population centre in the community of Jackson.

4.3.12 COMMERCIAL/INDUSTRIAL DEVELOPMENT

Aggregate and asphalt from the Williamsdale Quarry is used locally, in particular for highway maintenance⁴. Commercial establishments in the vicinity of the study area and neighbouring areas include Braggs Lumber Company Limited (1536 Wyvern Rd, Collingwood Corner, NS B0M 1E0), McCormick's syrup (820 Rodney Rd, Springhill, NS B0M 1X0), National Trailer Sales (3548 Windham Hill Rd, River Philip, NS B0M 1V0), and Doug Bragg Enterprises (96 Bragg Rd, Collingwood Corner, NS B0M 1E0). The Collingwood & District Volunteer Fire Department is also close by (70 Wentworth-Collingwood, Cumberland, Subd. B, NS B0M 1E0). Industrial development in the area mainly includes quarries, gravel pits, and blueberry fields.

A smaller quarry operated by Ray McCormick and Sons Ltd. is located between the Williamsdale Quarry and the Wentworth-Collingwood Road; and a quarry operated by Chapman Brothers Construction Limited, is located on the Westchester Road approximately 8 km east of the quarry site. No other industrial developments are noted for the neighbouring area.

⁴ During the survey period for this project, the Williamsdale Quarry was producing aggregate and finished asphalt for a resurfacing project on the Westchester to Oxford section of Highway 104.

4.3.13 TOURISM AND VIEWSCAPE

The Wentworth-Collingwood Road is not a major tourist route but it is readily accessible from Highway 104 and its connections with the scenic Wentworth Valley may lead to more tourist use of the study area in future. Second River trail, which runs along the east side of the river, and Second River Falls located upstream is an attraction for hikers. The Williamsdale Quarry is not visible from the Wentworth-Collingwood Road or from any side road in the vicinity.

4.3.14 TRANSPORTATION

The Wentworth-Collingwood Road is a connector highway that runs east-west through the Cobequid Hills, in particular connecting the Williamsdale area and the quarry site with Highway 104 on the east, and with the Springhill and Oxford area on the north. When the quarry is operating and transporting aggregate or finished asphalt, truck traffic volume from the quarry on the Wentworth-Collingwood Road increases, both increasing the likelihood of truck interactions with vehicles and wear on the highways. Transport of crushing and asphalt production equipment to and from the site prior to and after a production phase leads to short-term delays in traffic caused by the often slower-moving equipment. Heavy trucks moving through the area and trucks turning can be a hazard to local traffic, particular in sections of the highway approaching the quarry from the east, where there are sudden turns and valleys which reduce sight lines; while sightlines on approaches from the west are better due to the presence of an open work and aggregate storage area associated with the Ray McCormick and Sons Quarry. Traffic volumes on the Williamsdale Collingwood Road are expected to be low. The connecting Oxford-Wyvern highway (at Collingwood Corner), had only moderate average daily traffic volumes (ADT) in summer in 2007, 2013 and 2016 of 1,508, 734, and 1,480 vehicles/day respectively (NSTIR Traffic Volumes Data, Nova Scotia Open Data Portal 2017). Annual average daily traffic for that section was 1,130, 530, and 1,140 vehicles/day in those years respectively (Nova Scotia Open Data Portal 2017). Traffic is expected to be generally local. When in operation, the quarry will contribute truck traffic and some heavy equipment traffic (e.g. crushers, asphalt trucks etc.) in the vicinity of the site, typically in the summer / fall construction season, consistent with previous operational traffic activity.

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)⁵ (also known as VCs)⁶, 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 9. 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 10 & 11.

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	Land Use and Value
Wetlands	Transportation
Fish & Fish Habitat	Agriculture
Flora & Fauna & Habitat	Residential Use
Species at Risk	Commercial /Industrial Use
Natural Areas & Wilderness	Water Supplies & Residential Wells
	Parks & Protected Areas
	Forestry, Hunting & Trapping

5 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.

6 Valued Environmental Components (VECs) and Valued Components (VCs) are equivalent. Use of the acronym VC is occurring more commonly as a result of its use in environmental assessments carried out under the federal environmental assessment process under the Canadian Environmental Assessment Act (2012).

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 (T. Gaudet, KMKNO, personal communication 2014). Mi'kmaq occupied much of Nova Scotia prior to European contact, and lands were used to varying degrees for habitation, hunting and fishing. In more recent times, treaties made with the British and continued through Canadian law have maintained their rights. The location of the quarry, which is inland in Cumberland County along the north slope of the Cobequid Hills, including the valley comprised of River Philip and its tributaries, would have been used by the Mi'kmaq; however there is low potential for occurrence of archaeological resources at the site (CRM 2016).

Williamsdale Quarry will use land that would otherwise be occupied by terrestrial ecosystems and not likely to be used by Mi'kmaq, or by local residents. Best management practices 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 there are no significant 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 walking/hiking, camping, hunting, fishing, and general enjoyment of home-based recreation (e.g. gardening) as well as sight-seeing (e.g. use of Second River trail). River Philip which is used in fishing and water-based recreation, is removed and well-buffered from activities at the quarry. Except for homes located in the immediate vicinity of the quarry, operational noise and blasting would not be heard by locals and would be buffered by the forest cover along the Second River trail. Operations at the quarry would be cyclic, likely occupying several weeks to months annually during the construction season when the site is active, and the facilities are well maintained. Although quarry operations could likely be heard and residents would experience increased truck traffic and other effects of quarry operations, the frequency and scope of activities at 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

The quarry would have little influence on tourism and viewscape. The property is located approximately one kilometer from the Wentworth-Collingwood Road, and is not currently visible from the highway; access roads are nondescript and similar to other minor roads in the area. Truck and equipment traffic accessing and exiting onto the Wentworth-Collingwood Road is expected to be the main interaction with tourists. This traffic is expected to 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. The quarry access road entrance on the

Wentworth-Collingwood Road (from the Ray McCormick and Sons quarry) has good sightlines from the west but is not as easily seen on approaches from the east, and is well maintained. Overall the impacts on viewscape and tourism are expected to be negligible.

5.3.4 RECREATIONAL, COMMERCIAL & MI'KMAQ FISHING

Fishing by visitors and local residents, including from Mi'kmaq communities in the area, may occur from time to time in East Branch River Philip and Second River, although the latter is not a prime fishing area. As the Williamsdale Quarry has been in operation for many years, and the future scope of activities are not expected to change, no changes in flow regime or water quality in these waterways are expected as a result of the quarry operation. Water quality of the runoff from the quarry is likely to be good for salmonids including low turbidity and neutral pH, which would lead to good quality of waters downstream for fish. Even 'flashy' flows during sudden rainfall events is unlikely to result in significant changes in water quality such as increases in turbidity, and are not likely to impact downstream water quality significantly. Overall a negligible impact of the quarry on 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. Consequently the project is not likely to discover or disturb cultural/historical/archaeological features.

5.3.6 LAND USE AND VALUE

Forestry, mixed agriculture, aggregate production, wildlife resources for hunting and trapping, as well as small rural-residential properties, are the major land uses in area. The land on the site is not good for agriculture, and aggregate production, forestry and blueberry production are among the only potential commercial uses of the area. The existing quarry does not interfere with access to adjacent blueberry fields and does not interfere with production. The area has a moderate value for wind energy extraction but the two uses could be accommodated, particularly after site restoration has been completed. Areas not required for the quarry will be preserved if possible to assist in maintaining forest ecosystems for forestry production, and to buffer adjacent areas from quarry activities. Quarry activities are not expected to impact existing residential, agricultural, industrial or conservation use of nearby areas. As the quarry has been in operation for many years and the scope and frequency of activities are not expected to change from past use, residential property values in the Williamsdale area are not expected to change significantly. The existing quarry has been operating at the site with little to no impact on the local residential and farm community, while providing economic development and a source of aggregate for local construction projects.

5.3.7 TRANSPORTATION

The quarry generates a fluctuating 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. Suitable advance signage along the highway to alert the general public and local farm operators, as well as the surrounding communities, particularly in the Jackson area where the road is winding and sightlines are relatively short, would help avoid dangerous situations. Overall the impact of the project on transportation and safety is expected to be minimal. Although movement of heavy equipment to the site for aggregate and asphalt production may lead to short-term delays, the duration will be less than experienced during typical roadwork projects and will be therefore insignificant.

5.3.8 RESIDENTIAL USE

Quarry activities can potentially interfere with normal use and enjoyment of nearby residential properties by creating background noise (truck and heavy equipment engines, back-up signals, engine brakes, generators, crusher operations), and through truck and equipment traffic, which some residents may find objectionable. The property is located approximately one kilometer from the Wentworth-Collingwood Road and is not visible from the road and the noise levels would be buffered to a degree. Normally low levels of noise experienced by homes in the area, resulting from low levels of traffic on the road, would likely be exceeded by noise from trucks entering and leaving the quarry and neighboring quarries. Residents of homes along the Wentworth-Collingwood Road in the vicinity of the quarry have indicated that there were no problems associated with the quarry, however engine-braking noise was noted. Activities at the quarry would be limited in time seasonally (approximately March to November) and during the day, although nighttime operations, but not blasting, may be required under some circumstances. Traffic volumes from the site would be moderate, and high frequency of truck traffic would be an irregular occurrence, depending on the supply requirements for particular projects. Dust from operations is unlikely to reach residential areas. Dust generation could be moderate due to the exposed high location of the site, but measures to control dust will be implemented and the adjoining forest areas would act as a buffer between the quarry and offsite receptors. Quarry activities such as blasting, are not expected to impact residential wells, as they are located at a significant distance from the site. Most operations at the site occur during daylight hours. On rare instances when they are undertaken at night, activities will involve minimal additional lighting and noise, and will be unlikely to be a significant disturbance to local residents. The quarry includes signage with phone numbers and contact information 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 AGRICULTURE

Blueberry production, limited maple sugar production and hay production contribute to overall agricultural uses of the study area. The present quarry, and the adjacent Ray McCormick and Sons Ltd. Quarry presently operate in cooperation with local blueberry farmers, with shared access for properties. Development of the quarry will interact to a limited degree with the other uses, principally through use of roads, although traffic volumes are not expected to increase over present levels.

5.3.10 COMMERCIAL/INDUSTRIAL USE

There are no major commercial operations / businesses in the area with the exception of the adjacent Ray McCormick and Sons Ltd. Quarry and a commercial blueberry plant on the Wentworth Collingwood Road near the Highway 104 interchange. Activities at the quarry site will contribute to traffic at the adjacent quarry site, but not likely affect the operation to a significant degree. Blueberry operations including trucking will encounter increased truck traffic along the Wentworth Collingwood Road and congestion when the quarry is operating at peak capacity. The quarry contributes to net economic benefit in the community through supporting local trucking operations and providing access to aggregate and other quarry products.

5.3.11 WATER SUPPLIES AND RESIDENTIAL WELLS

Residents of the adjacent communities use both drilled and dug wells; however no drilled wells are located within 800 m of the quarry. Quarry activities are not expected to impact residential wells, as they are located at a sufficient distance to avoid impacts from quarry operations, in particular occasional blasting. Groundwater recharge generated by the quarry is of high quality (low conductivity and dissolved solids and neutral in pH). Little of the watershed that would serve dug wells for residences along Williamsdale-Collingwood Road, is sourced from the proposed expansion area and consequently dug wells in the area are not expected to be affected. A groundwater monitoring program will be established to verify if there are any changes in the water quality or quantity in the area. Best management practices for operations will be undertaken to eliminate the potential for any contamination of aquifers at the site. There are no municipal water supplies in the area.

5.3.12 PARKS AND PROTECTED AREAS

The quarry site is sufficiently distant from Wilderness Areas in the Cobequid Hills (Portapique River and Economy River Wilderness areas) and is not on their watersheds, as to not interfere with them, or access to them. It is unlikely that noise from the quarry will reach these sites. There are no other parks or protected areas in the vicinity of the site.

5.3.13 RESOURCE USE—FORESTRY, HUNTING & TRAPPING

Use of the land for a quarry will remove the potential for logging the site for a long time, at least until after the quarry is closed and the land rehabilitated in future. Although the area occupied by the proposed expanded quarry is relatively small, the mature deciduous forest at the site is one of few remaining locations of natural vegetation in the local landscape, the remainder having been fragmented by agricultural activities and previous logging. The effect of the quarry on local landscape may be reduced by planning to retain some of the forest in buffers around the future pit areas. Apart from conservation importance, most of the site has been previously logged and the overall impact of the project on potential future economic returns from logging in the area is expected to be small.

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, operation of an asphalt plant, as well as onsite routine operations contribute to increased dust and particulate levels. Noise levels can impact human use and enjoyment of the environment. Dust emissions during the construction phase will be localized and short term, and are expected to be minimal from routine operations. Best management practices will be implemented to mitigate effects of dust emissions where necessary. 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.

Exhaust emissions will be generated from the operation of vehicles and equipment. Given 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, and the company will ensure that they do not exceed those specified in the Nova Scotia Pit and Quarry Guidelines. Blasting is expected to occur infrequently (1-2 times per year).

Light during nighttime operations particularly during times of low-hanging cloud and fog, and can attract migrating birds traveling overland along an important route from the Gulf of St. Lawrence / Northumberland Strait lowlands to the Bay of Fundy and southern 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 elsewhere on the property, or in adjacent areas. The amount of recharge area involved in project activities is extremely small in relation to the overall size of the aquifers in the Williamsdale area; and for the same reason, the effect on overall groundwater flow patterns will be small. The overall impact on hydrogeology at the site is therefore expected to be negligible.

5.4.3 HYDROLOGY

Expansion of the quarry will result in an artificial and managed regime of surface water movement and runoff at the site, mainly near the quarry and entering the watershed of Second River and East Branch River Philip east and northeast of the site. Expansion of the quarry into the area occupied by the permanent stream which flows across the site will require approvals for watercourse alteration if the streambed is to be disturbed, and otherwise maintenance of a suitable forested buffer (e.g. 20-30 m) as the project expands. Regulatory approvals are not expected to be required for alterations to several small intermittent streams, and for flows from the active quarry in the ditch along the quarry access road. Exposed surfaces in the quarry and on access roads lead to more sudden, 'flashy' runoff patterns during rainfall events. Presently the quarry floor offers only limited control of runoff from sudden rainfall and snow melt events, and if such occurred during a period of active expansion of the quarry, sudden flows may reach Second River. Runoff from the quarry will be managed to ensure that it meets acceptable environmental standards by adherence to the terms of the industrial approval for the quarry, and runoff will be managed to minimize damage to the local surface waters.

5.4.4 WATER QUALITY

Water quality downstream of the site is important for fish habitat in the lower watershed, which includes Second River and East Branch River Philip. Quality of water leaving the site and entering surface or groundwater is high, due both to the onsite flow management and the low-contaminant characteristics of the bedrock, which is mainly igneous granites and basalt, and metamorphic rocks. Quarry rock is within acceptable limits for sulphur and acid-generating potential. Blasting is not expected to result in groundwater quality changes, particularly with efforts to reduce releases of other chemicals such as nitrates used in blasting. Forest clearing and grubbing activities can lead to releases of fines from the soil, resulting locally in elevated suspended sediment levels but slopes in the area are gradual. Release of other contaminants such as oils and lubricants from operating equipment, as well as contaminants which may be found in material, such as recycled asphalt, which may be stored at the site, will also be moderated by the lack of abrupt slopes, but is also expected to be mitigated by normal precautions on equipment operations and fuelling locations, and measures to reduce runoff from storage piles. Contaminants arising from operations of the quarry and entering surface waters are expected to be exceedingly low. All activities will conform to the Nova Scotia Environment Erosion and Sedimentation Control Handbook (NSE 1988) and the Nova Scotia Pit & Quarry Guidelines (NSE 1999). Impact of the quarry on water quality in adjacent streams and other waters is expected to be negligible.

5.4.5 FRESHWATER AQUATIC ENVIRONMENTS

A single permanent stream and a number of small surface flowages drain the site and the watershed is small, located entirely within the study area. These watercourses are not considered fish habitat although they are suitable for aquatic life, including aquatic insects and other invertebrates, as well as amphibians, which are food for birds and other animals in the local ecosystem. Waters from the site are a small component of the watershed of Second River located adjacent to the site. All surface runoff from the quarry

will continue to be directed towards Second River, with quantities of runoff arising from the site in future 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 downstream habitat.

5.4.6 WETLANDS

Several small wetlands may be removed during expansion of the Williamsdale Quarry. Some of the wetlands have been affected in past by logging (e.g. those which now occasionally dry out in summer), while others remain in largely a natural state. In each case, an approval for wetland alteration will be required from Nova Scotia Environment prior to expansion of the quarry into that area. At that time, a wetland delineation and functional assessment will be conducted on each wetland, and an arrangement made with the Province to compensate for wetland loss. Measures can be taken to mitigate the changes in hydrological regime (i.e. surface water runoff) resulting from the removal of wetlands, such as moderating flow by use of detention ponds, artificial stream channels, etc.

5.4.7 FISH AND FISH HABITAT

None of the proposed project activities will physically impact potentially fish bearing streams, including Second River, River Philip and its tributaries north and east of the project site. Blasting occurs infrequently at the site and is sufficiently separated from Second River to eliminate harm to fish. Water quality in runoff from the quarry will be monitored and is expected to continue 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

The existing terrestrial ecosystem (plants and animals) will be removed in areas covered by the footprint of the quarry. During development and use of the quarry, and after it has reached its useful life, the footprint will be remediated according to agreements made with the Nova Scotia government 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 similar to pre-existing types to allow development of normal plant communities for the area. During recovery and revegetation of abandoned areas, the forest succession will provide habitat for a moderate diversity of species. The removal of forest cover which is a feature of quarry development in general, is similar to forest cutting and road construction for logging, which affects local ecosystems to a moderate degree. Species affected include migratory birds and other wildlife species, many of which need undisturbed forest to live and reproduce naturally. Expansion of the Williamsdale Quarry will result in only a comparatively small reduction in the coverage of natural and mature forest stands in the area, and will 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 such as nighthawks, bank swallows, and other wildlife such as bats. Interactions of the project with these and other wildlife can be mitigated by

educating employees on the need to check for wildlife activity and nests before undertaking activities. Night operations and lights have various effects, including attracting migrating birds; and 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. Night operation lighting during migration periods (August-September) would attract migrating birds. Best management practices to mitigate potential influence of artificial light on behavior of migratory birds will be implemented as necessary.

5.4.9 SPECIES AT RISK

Several plant and songbird species with conservation status occur in the study area, including: Tender Sedge (*Carex tenera*) and Blood Milkwort (*Polygala sanguinea*)—species with Sensitive (Yellow) status in Nova Scotia; and a third species, Yellow Ladies'-tresses (*Spiranthes ochroleuca*) which has an S3 status. Eastern Phoebe and Canada Warbler, both species with conservation status, were also found at the site, although nesting was not observed. Best management practices regarding operations in the vicinity of these species, including adherence to recommendations from Provincial government specialists, will be employed to mitigate habitat impacts related to expansion of the quarry.

5.4.10 NATURAL AREAS & WILDERNESS

Natural areas in the vicinity of the site are appreciated by locals and tourists alike, while forests at the site are important in supporting wildlife populations, and nearby undeveloped areas are appreciated by society as a whole, evidenced by their designation for parks and protected areas. The immediate vicinity of the Williamsdale Quarry is not pristine, having been used for agriculture, forestry, and aggregate extraction as part in the mix of activities in the area. Two Provincial Wilderness areas are relatively close to the site and the Second River trail and Second River Falls represent relatively pristine natural environments. Efforts should be made to minimize the footprint and effects of the quarry—in particular to reduce traffic, noise, dust and light from quarry operations—to reduce interference with natural conditions in these areas. Activities at the quarry will be carried out with a view to minimizing impacts on the adjacent environments, natural and otherwise, and ensuring that as much as possible of the quarry is restored in the future. 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, through its nature and design, which includes site water management. The vicinity of the quarry is known to experience more thunderstorm and shower activity than other nearby areas because of the local rapid change in elevation due to the Cobequid Highlands; consequently surface water runoff should be managed to handle 'flashy' flows. Aggregate and other rock products stored at the site are stable under varying

conditions of rainfall and 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

All the potential impacts of the quarry operation (dust, surface runoff, noise, lights, blasting, and traffic volume) may be compounded by the operations of the smaller, adjacent Ray McCormick and Sons Ltd. quarry. Some of the activities in the smaller quarry such as crushing and stockpiling are carried out beside the Wentworth-Collingwood Road. Surface water runoff from the Dexter Williamsdale quarry is separate from that generated from the Ray McCormick and Sons Ltd. Quarry, and therefore cumulative effects on nearby surface waters (e.g. Second River) will not be magnified. Since Williamsdale quarry site operations are not expected to increase in frequency or scope from past use, the cumulative effect of both quarries is not likely to increase

from past levels. Additionally, it is unlikely that all quarries would be operating at the same time, as there are unlikely to be multiple large construction projects occurring concurrently nearby, that would necessitate both sites being active. The quarries are comparatively small, and produce relatively small aggregate volumes annually, and the expected rate of production is expected to remain at current levels⁷. Traffic generated along the Wentworth-Collingwood Road by the Williamsdale quarry, however, will compound with other quarries in the area, such as the Chapman Brothers Construction Ltd. Quarry located in the area near Highway 104 and others in the area. In the longer term, the geological formations in the Cobequid Hills provide ideal source material for aggregate, and are likely to be sought after for quarry development—overall, quarries and their associated impacts are likely to continue and perhaps increase in the area in future.

⁷ Effects of other nearby competing wayside quarries were not assessed. We assumed that the production volume and longevity of the quarry would remain similar to that at present.

Table 10. Potential interactions between project activities and operations and Valued Environmental Components (VECs) for Williamsdale Quarry expansion.																				
Project Component (potential interactions shown by '✓')	General Category of VEC																			
	Biophysical								Socioeconomic											
	Air Quality, Noise and Light	Groundwater & Hydrology	Water Quality	Aquatic Environments and Wetlands	Natural Areas & Wilderness	Fish and Fish Habitat	Flora & Fauna Species & Habitat	Species at Risk	Mi'kmaq	Cultural/Historical	Recreation, Tourism & Viewscape	Residential Use	Agriculture	Recreational, Commercial & Mi'kmaq Fishing	Water Supplies/ Residential Wells	Land Use and Value	Transportation	Commercial /Industrial Use	Parks & Protected Areas	Forestry Hunting /Trapping
CONSTRUCTION																				
Site Acquisition and Infrastructure	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Site Preparation, Clearing/Grubbing	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓				✓	✓	
Drilling	✓	✓			✓		✓			✓	✓			✓				✓		
Blasting	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		✓				✓		
Lights	✓				✓		✓	✓		✓	✓							✓		
OPERATION																				
Moving/Transporting Rock and Product	✓				✓		✓			✓	✓	✓			✓	✓	✓	✓		
Crushing	✓				✓					✓	✓							✓		
Washing		✓	✓	✓		✓														
Lights	✓				✓		✓	✓		✓	✓							✓		
Site Runoff Management		✓	✓	✓		✓							✓	✓						
Portable Asphalt Plant	✓				✓		✓			✓	✓							✓		
Onsite Materials Storage			✓	✓										✓						
Accidents (Fires/Oil & Fuel Spills)	✓	✓	✓	✓	✓	✓	✓			✓	✓			✓				✓	✓	

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale 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 logging and grubbing.	Significant	Negative	Take measures to reduce equipment noise.	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 neighboring areas.	Significant	Negative	Use directional lighting with downward and lateral focus to minimize light leaving the quarry at night.	Not significant.
	Operation	Noise and dust from drilling and blasting; equipment for moving rock and aggregate; crusher; heavy equipment operation; Noise during trucking product to market.	Significant	Negative	Monitor noise levels and undertake to avoid exceedances' of regulatory levels. Institute measures for dust control. Monitor and maintain asphalt plant to minimize emissions. Take steps to reduce noise sources such as engine braking.	Not significant.

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale Quarry Expansion.						
VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
		Air-borne emissions from asphalt plant and finished asphalt during transport.	Negligible	Negative	Adequately cover hoppers and truck loads to minimize emissions. Avoid worker exposure to asphalt volatiles.	Not significant.
		Light from the quarry can be seen in neighbouring areas.	Negligible	Negative	Use directional lighting with downward and lateral focus to minimize light leaving the quarry at night.	Not significant.
Groundwater/ Hydrology	Construction	Forest and soil removal changes surface and groundwater flows. Exposed surfaces lead to more 'flashy' flows.	Negligible	Negative	Use site runoff management to minimize impacts of 'flashy' surface water flows.	Not significant.
	Operation	Blasting fractures bedrock, disturbs till, and changes groundwater flow patterns.	Negligible	Negative	Drilled wells and surface wells in area are unlikely to be disturbed. Monitor groundwater quality and movement to determine changes.	Not significant.
	Operation	Quarry and work areas change surface water flows. Increased peak stormwater flows. Washing product creates turbid surface flows.	Significant	Negative	Onsite water management to moderate extreme surface water runoff and suspended sediment levels; measures to maintain normal flow regime.	Not significant.

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale Quarry Expansion.						
VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
	Operation	Accidental hydrocarbon spills; blasting residues contaminate surface water.	Negligible	Negative	Measures to minimize danger of spills; onsite emergency contact numbers, spill kits etc. Avoid refueling near watercourses. Special precautions refueling crusher, asphalt plant equipment and generators.	Not significant.
Water Quality	Construction	Altered surface water flows and turbidity in watershed flowages.	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.

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale Quarry Expansion.						
VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
	Operation	Water chemistry changes in runoff from materials stored on site.	Negligible	Negative	Best management practice allows leaving aggregate storage 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.	Negligible	Negative	Area affected is small in relation to remaining natural areas; is not visible from roads and nearby natural environments; and landscape has been fragmented by previous agriculture and forestry, diminishing natural and wilderness value of the vicinity. Attempt to minimize footprint, include buffer areas, and avoid damage to adjacent areas. Manage light, noise, and releases of dust.	Not significant.

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale Quarry Expansion.						
VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
Freshwater Aquatic Environments	Construction	Occurrences of high suspended sediments and nutrient levels from grubblings, and locally diverted flows.	Negligible	Negative	Preserve wooded buffer areas adjacent to quarry; maintain wooded buffer on permanent stream as possible as quarry expands. On-site water management and sedimentation controls to moderate surface water runoff and suspended sediment levels.	Not significant.
	Operation	Changes in surface runoff quality and quantity. Reduced normal flows in watercourses adjacent to site.	Negligible	Negative	Maintain forested buffers. Onsite water management to moderate runoff off site. Minimize unvegetated areas.	Not significant.
	Operation	Higher 'flashy' peak flows and suspended sediment during activities.	Significant	Negative	Onsite water management to store sudden runoff. Preserve woodland in buffer areas of quarry.	Not significant.

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale Quarry Expansion.						
VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
	Operation	Runoff from access roads.	Negligible	Negative	Use of ditching and artificial channels, to carry peak flows and additional site runoff. Sedimentation controls.	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	Routine releases and accidental spills of hydrocarbons on site.	Significant	Negative	Provide pollution prevention and emergency measures.	Not significant.
Wetlands	Construction	Grubbing, road construction, pit preparation	Significant	Negative	Avoid work and/or development near wetlands and maintain buffers if possible. If damage is unavoidable, delineate wetlands and compensate for loss. Maintain natural hydrological regime of wetlands during construction.	Not significant.
	Operation	Dust, nutrient inputs from runoff, changes to hydrology, changes to forest communities.	Negligible	Negative.	Maintain a significant forest buffer; maintain hydrological regime.	Not significant.

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale Quarry Expansion.						
VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
Fish & Fish Habitat	Construction	Change runoff patterns at site in local and adjacent watersheds.	Negligible	Negative	Sedimentation and flow controls on site runoff. Maintain forested buffer around quarry.	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 prevent sudden flows to Second River.	Not significant.
	Construction & Operation	Nominal 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 from truck highway accidents.	Negligible	Negative	Recommend truck traffic use safe driving practices and reduce speed in vicinity of quarry and Wentworth Collingwood Road Provide pollution prevention and emergency measures.	Not significant.

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale Quarry Expansion.						
VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
Terrestrial Flora & Fauna & Habitat	Construction	Removal of Existing Communities	Negligible	Negative	Restore damaged and unused parts of the site (e.g. grubblings 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.	Not significant.
	Construction & Operation	Accidental releases, contamination of habitat.	Significant	Negative	Provide pollution prevention and emergency measures & response capability. Remediate any permanent 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 resource (i.e. wildlife habitat)	Negligible	Negative	Minimize footprint of quarry. Restore and rehabilitate areas not used. Leave mature standing trees where possible as nest cavities.	Not significant.

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale Quarry Expansion.						
VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
		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	Plant species at risk in the proposed footprint of the quarry.	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.
	Operation	Sound from blasting can harm bats and birds.	Negligible	Negative	Implement best management practices to minimize impacts of blasting activity during breeding and migratory periods.	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 areas and grubblings piles occupied by nesting species such as nighthawks and bank swallows.	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.

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale Quarry Expansion.						
VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
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 and alteration of flow regime of streams may affect fish populations 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.	Not significant.
Archaeological, Cultural and Historical Significance	Construction	Expansion may affect undiscovered artifacts.	Not significant	Negligible	Unlikely that artifacts occur at site. Minimize project footprint. Inform authorities if any are found.	Not significant.
Recreation	Construction & Operation	Quarry traffic & activities affects local light recreation (e.g. walking).	Not significant	Negative	Users of road and Second River Trail, will be aware of activity at quarry but will not be otherwise impacted by it.	Not significant.
Tourism and Viewscape	Construction & Operation	Truck traffic interferes with tourist use of roads in area.	Negligible	Negative	Quarry cannot be seen from road. Ensure safe movement of trucks and equipment on roads in vicinity.	Not significant.
Residential Use	Construction & Operation	Noise; light pollution; dust; odours;	Significant	Negative	Use best management practices to	Not significant.

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale Quarry Expansion.						
VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
		operation of trucks and transportation of heavy equipment.			reduce disturbance to nearby residents. Inform residents about quarry operations. Provide community with safety information for truck traffic on Wentworth Collingwood Road	
Agriculture	Construction & Operation	Loss of potential growing area for blueberries; interference with movements of agricultural vehicles and implements	Negligible	Negative	Relatively small area affected compared with existing blueberry production. Use best management practices and communication to reduce disturbance to nearby blueberry farmers.	Not significant.
Recreational and Mi'kmaq Hunting and Fishing	Construction & Operation	Accidental hydrocarbon spills and blasting residues contaminate surface waters.	Negligible	Negative	Provide pollution prevention, emergency measures & response capability. Identify and control contaminant releases.	Not significant.

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale Quarry Expansion.						
VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
	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.	Not significant	Negative	Develop monitoring plan in consultation with NSE.	Not significant.
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 while moderate are not likely to increase.	Not significant.
	Operation	Collisions with trucks and equipment on Wentworth Collingwood Road.	Not significant	No Change	Use good directional signs for slow moving vehicles, and speed policy in vicinity of quarry. Safety training for truck drivers.	Not significant
Industrial & Commercial Use	Operation	Competition with other Quarries	Negligible	Neutral	Quarry operations are in a competitive environment; cooperate if possible.	Not significant.
Resource Use Forestry, Hunting & Trapping	Construction & Operation	Removes woodland; game habitat.	Not significant	Negative	Relatively small area is used.	Not significant.

Table 11. Summary of impacts and mitigation on Valued Environmental Components, Williamsdale Quarry Expansion.						
VEC	Project Component	Nature of Effect	Significance	Nature of Impact	Mitigation	Significance after Mitigation
Parks and Protected areas	Construction & Operation	Exposure to noise and light pollution of Economy River Wilderness Area, Portapique River Wilderness area and other protected areas in the general area.	Not significant	Neutral	Employ best management practices for all aspects of quarry operation, in particular control of light, dust and particulate emissions, and odours leaving the site.	Not significant.

8 MONITORING

Monitoring of hydrological conditions at the site, as well as water quality monitoring, may be conducted to ensure conditions have been maintained by quarry operations. Routine monitoring of noise levels will be done if required by NS Environment. Onsite groundwater monitoring may be conducted, at the request of NSE.

9 PUBLIC CONSULTATION

In addition to contacts already made in developing this assessment and in conducting operations in Williamsdale, the Proponent will undertake to consult with local and provincial government officials, and 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

Brown, A. Williamsdale resident, June 2017.

Gaudet, T. KMKNO, personal communication 2014

Halliday, B. Williamsdale resident, June 2017.

Mr. Sean Weseloh-McKeane, NS Museum of Natural History, Coordinator, Special Places, 2017.

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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 September 2016-July 2017 and the generally accepted assessment practices of our industry. No other warranty is made.