Stantec Consulting Ltd.
102- 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

Final Report: Environmental Assessment Registration for the Hardscratch Quarry Extension Project

Aberdeen Paving Limited
Hammonds Plains Rd
Halifax, NS B4B 1B1

File: 121510237

July 2010

Table of Contents

LIST OF TABLES

LIST OF FIGURES

1.0 PROPONENT AND PROJECT IDENTIFICATION

1.1 PROPONENT INFORMATION

Name of the Proponent:	Aberdeen Paving Limited
Postal Address:	Hammonds Plains Road Halifax, NS B4B 1B1
Tel.:	(902) 835-3342
Fax:	(902) 835-9576

Registry of Joint Stocks for the proponent company is included in Appendix A.

Company President and/or Environmental Assessment Contact

Name:	Mr. Bill Ross
Official Title:	Owner/President
Address:	As Above
Tel.:	(902) 835-3342
Fax:	(902) 835-9576

Environmental Consultant Contact

Name:	Robert Federico, MPA
Official Title:	Senior Project Manager
Address:	Stantec Consulting Limited 102 – 40 Highfield Park Drive Dartmouth, NS B3A 0A3
Tel.:	(902) 468-7777
Fax:	(902) 468-9009

Bill Ross — JUNE 22, 2010

Signature of Company Owner/President — Date

1.2 PROJECT INFORMATION

Name of the Undertaking:	Hardscratch Quarry Extension Project
Location of the Undertaking:	Yarmouth, Yarmouth County, NS

2.0 PROJECT INFORMATION

2.1 DESCRIPTION OF THE UNDERTAKING

Aberdeen Paving Limited (Aberdeen Paving; the Proponent) owns and operates the Hardscratch Quarry, located in Yarmouth, Yarmouth County, Nova Scotia (Figure 1). The quarry property is in the Yarmouth municipal district. It is currently operating under an Industrial Approval (Approval No. 2009-067070) that was obtained from Nova Scotia Environment (NSE), pursuant to Division V of the Activities Designation Regulations. The current Approval is effective from July 2009 until July 31, 2019. A copy of the Approval permit is appended to this report (Appendix A).

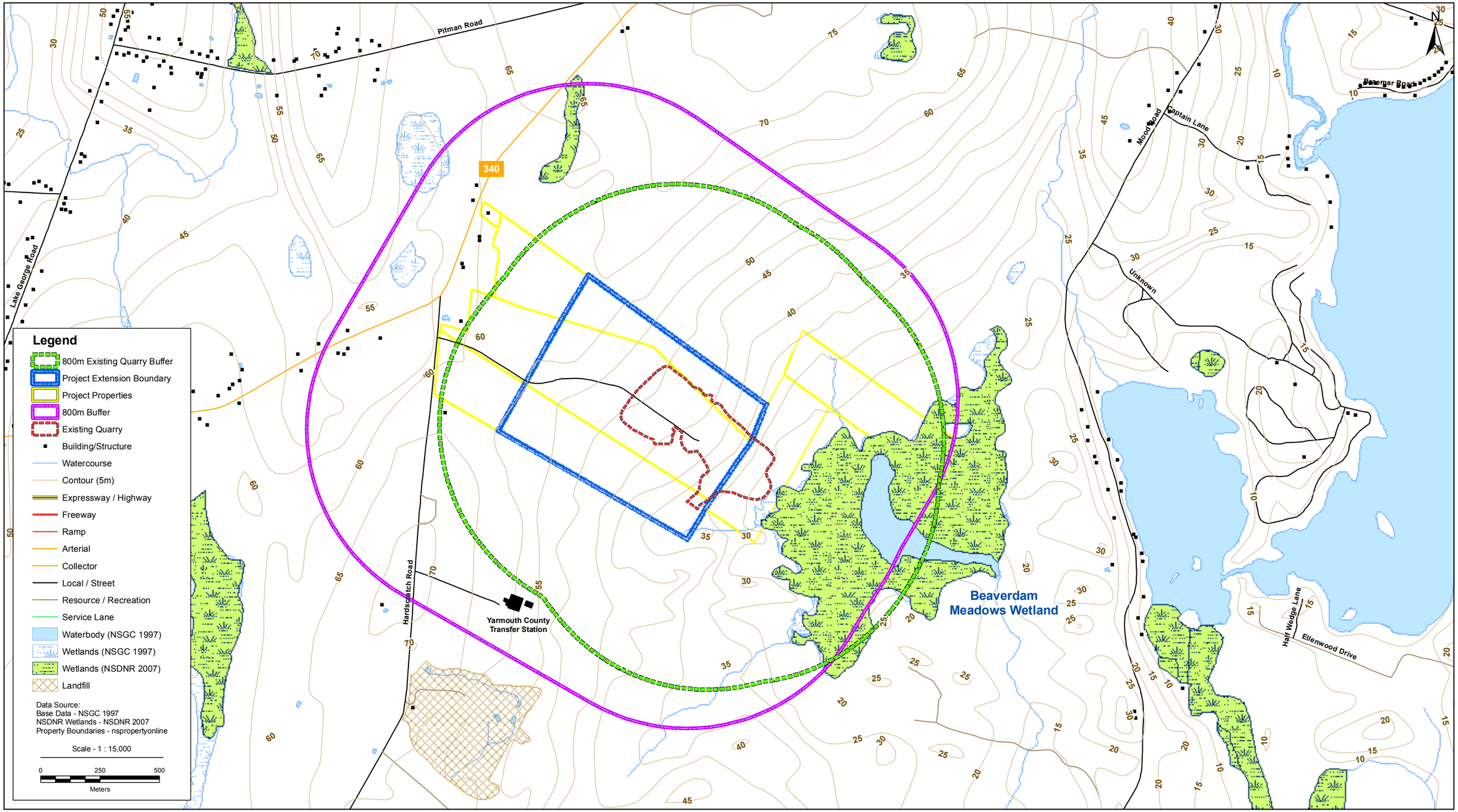
Aberdeen Paving proposes to extend the approved quarry site to occupy 65 ha of land, in total, to allow for continued aggregated production (blasting, crushing, and stockpiling) and will supply granite to local gravel and concrete markets as well as asphalt aggregates. Over the next ten years, however, the extension will advance in the north and northeast direction (refer to Figure B1 in Appendix B). As well, the southern portion of the Project area will be set aside as a wetland conservation zone.

The Proponent owns the existing quarry lands as well as the adjacent proposed extension land area. The existing quarry has been in operation since 1997, with a total disturbed area to date of approximately 14 ha. The quarry has produced more than approximately two million tonnes of aggregate. Topsoil and overburden have been stripped prior to drilling and blasting.

As a result of field and desktop studies undertaken in support of this environmental registration document, the extension area has been located, in part, to reduce potential environmental impacts including impacts to local residents. The anticipated average production rate is approximately 200,000 tonnes per year; with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting; the current and anticipated operating schedule is 12 hrs/day, five days/week, 48 weeks/year or more, depending on the demand for aggregates. Based on current estimates, there are over 6 million tonnes of rock reserves within the proposed extension area. Depending on market demand, the proposed quarry operations will take place over an extended period of time until the material is exhausted. The extended site could therefore sustain aggregate production for as much as 30 years or more.

2.2 GEOGRAPHIC LOCATION

Hardscratch Quarry is in the community of Yarmouth (situated southwest of Halifax), Yarmouth County, Nova Scotia (Figure 1). It is located along Hardscratch Road, and is accessed via a private road that branches off from the main public road. The quarry and proposed quarry extension area are situated on lands that are owned by the Proponent. The surrounding lands are mostly undeveloped.



DATE: May 26, 2010	Hardscratch Quarry Extension Project	FIGURE NO.: **Figure 1**
PREPARED BY: G. MESHEAU	**Project Location**	Stantec

The majority of the Project area is comprised of forest which is at an early stage of successional development following tree harvesting activities which has taken place within the last 20 years. Whereas much of the upland forest is naturally regenerating, evidence of silviculture activities, in the form of plantings and pre-commercial thinning (PCT), is prevalent. Some small pockets of immature-mature upland forest exist at the site (Figure 2). An abundance of wetlands are also found in the Project area including some remnants of treed swamps (mixedwood and coniferous types) and low shrub swamp habitat. Additional habitats include those provided by a small anthropogenic pond, watercourses, old roads, and disturbed areas which surround and contain the various activities related to present quarry operations.

Based on available mapping and aerial photography, residential development in the immediate vicinity of the existing Hardscratch Quarry is relatively low. There are approximately 15 structures unrelated to the existing quarry within 800 m (Figure 1).

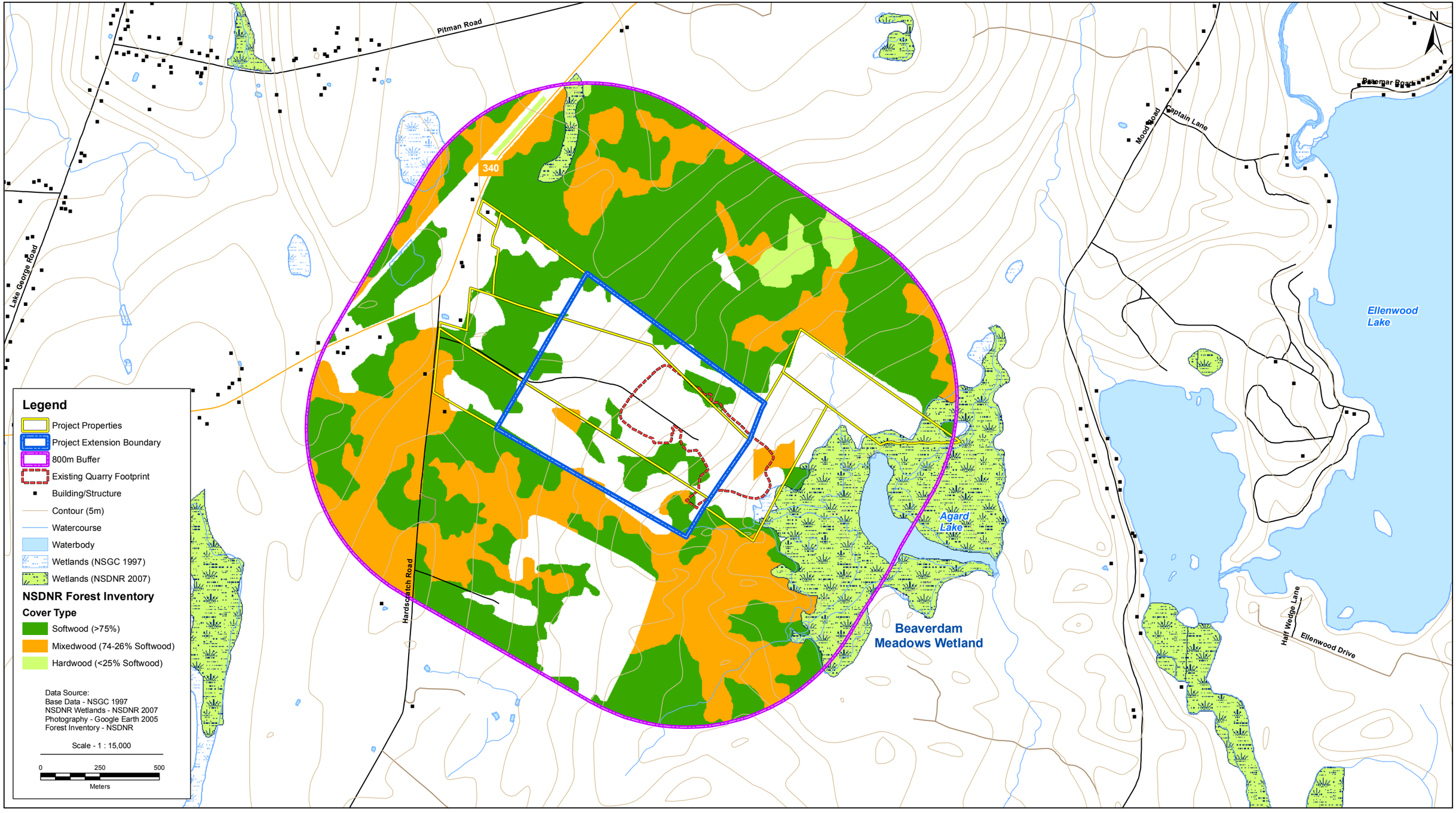
The quarry is located on land that is zoned for “Rural Development”.

2.3 PROJECT COMPONENTS

The existing quarry operations consist of a laydown area for the portable crushing equipment, screening, washing, various aggregate stockpiles, quarry floor and working face, settling ponds, weight scales, and a private access road off of Hardscratch Road. The existing property currently does not have liquid asphalt permanently stored on site; it is delivered to the site while making asphalt and it is removed thereafter. Currently there are four 3,500 litre diesel fuel tanks stored on site, one 20,000 litre and one 1,000 litre furnace oil tanks and six ten pound propane tanks. There is no planned storage of other hazardous materials.

Topsoil, grubbing material and overburden that have been stripped prior to drilling and blasting is stored on-site. These materials have been stabilized for subsequent use during site reclamation. The piles have been hydroseeded to reduce potential for erosion and sedimentation. Similar practices will continue throughout the development and operation of the proposed extension area.

The laydown area is located on the quarry floor. The rock is processed by portable crushing equipment that is transported to the site as required (*i.e.,* after blasting). Once the quarry is extended, portable crushing equipment is expected to be on-site for 40 weeks per year. Aggregate stockpiles are currently located at various locations within the quarry limits. As the quarry is extended, and additional space is created, a dedicated stockpile area will be created.



DATE: February 04, 2010

PREPARED BY: G. MESHEAU

AP LTD.

Headscratch Quarry Extension Project

Forest Inventory

FIGURE NO.: **Figure 2**

Stantec

Quarry drainage and surface runoff collection and controls will be in place for the extended quarry. Surface runoff and quarry drainage are collected on the quarry floor and conveyed to two settling ponds located to the southeast corner of the existing operation within a rainwater trench that directs runoff off site. Additional settling pond volume will be developed with the extension, as required. Details regarding the amount of additional settling pond volume required for proposed quarry operations is presented in Appendix C and will be further refined at the Industrial Approval amendment stage. Excavation will not take place below the groundwater table.

The general direction of quarry advancement will be northwest from the existing quarry face.

2.4 SITE PREPARATION AND CONSTRUCTION

The existing quarry has been in operation for 12 years. Access to the existing quarry development is along existing roads. To minimize the potential for erosion and sedimentation, grubbing and removal of overburden has been and will continue to be conducted on an as needed basis, to accommodate drilling and blasting activities. Topsoil, grubbed material and overburden are stockpiled on site and have been stabilized with hydroseed for subsequent use during site reclamation. These, or similar stabilization procedures will continue throughout the operations of the proposed extension.

Quarry drainage and surface runoff collects on the quarry floor. Overflow from the quarry floor is currently directed to two settling ponds located in the southeast corner of the existing developed area within a rainwater trench that directs rainwater off site. Additional surface water management capacity will be created, as needed, as the quarry develops. There is little overflow from the settling ponds as the majority of the water collected on the quarry floor and in the settling pond infiltrates, evaporates and/or is directed off site (refer to Appendix C for the Hydrology Study). Water that has pooled on the quarry floor will be used to provide a water supply for dust suppression during crushing in dry periods.

2.5 OPERATION AND MAINTENANCE

The proposed Project activities will be consistent with the current quarry operations approved by NSE (Approval No. 2009-067070) and will be in accordance with the Pit and Quarry Guidelines (NSE 1999). These guidelines apply to all pit and quarry operations in the province of Nova Scotia and provide:

- Separation distances for operations, including blasting;
- Liquid effluent discharge level limits;
- Suspended particulate matter limits;
- Sound level limits; and
- Requirements for a reclamation plan and security bond.

Aggregate production begins with drilling and blasting. It is anticipated that blasting and crushing of aggregate will occur three to five times a year. This is consistent with current approved operations. A qualified blasting company will conduct this work. The blasting sub-contractor is responsible for blast designs and methods in accordance with the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). Blasting activity will be conducted in accordance with the Pit and Quarry Guidelines. Details of a blast design plan and blast monitoring program will be provided to support the application for Industrial Approval. Where appropriate, consideration will be given to recommendations provided in Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky 1998).

The blasted rock will be processed by portable crushing equipment that will be on-site. The various aggregate products will be stockpiled in designated areas within the quarry. Piles will be built in layers to minimize segregation and prevent contamination by mixing of different piles. Material is hauled and moved within the quarry with a loader. Other equipment will likely include an excavator. Products will be transported from the quarry via tandem and tractor trailer trucks along the existing truck route. The average number of trucks hauling aggregates from the quarry could be up to 40 per day, depending on market demand. This is consistent with current truck volume at the existing quarry and could increase, for a short period, if a large aggregate supply contract were awarded.

The anticipated average production rate is approximately 200,000 tonnes per year; with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule may be 12 hrs/day, five days/week, 48 weeks/year or more, depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

The existing quarry currently employs 12 employees throughout the year, and this number can fluctuate by four depending on the activities taking place on site. Employment levels are expected to remain the same following site extension. Drilling and blasting activities involve additional resources; these activities are sub-contracted to a professional blasting company. Hauling of materials from the quarry also involves additional labour and equipment requirements. Hauling (or trucking) is typically arranged through the Proponent.

2.6 EFFLUENTS AND EMISSIONS

The implementation and use of environmental devices, techniques and regulations now used in the construction industry will minimize any potential environmental damage to the area. Devices such as diversion ditches, check dams, siltation ponds, straw hay mulch and hydroseeding will be used if necessary to control sedimentation. All operations will be carried out in a controlled environment to ensure sound, vibration, dust and sediment parameters are met to all Provincial and Federal guidelines and regulations.

In accordance with best practices and standard NSE requirements, runoff controls will be in place to ensure that effluent generated during operations is managed appropriately. Surface runoff at the quarry collects on the quarry floor. Overflow from the quarry floor drains to two settling ponds constructed in the southeast corner of the developed area. Additional pond volume will be installed, as required, in accordance with NSE's Erosion and Sedimentation Control Handbook for Construction Sites (NSE 1988) and the quarry's approval to operate, and in consultation with NSE's engineers/inspectors. Details regarding the amount of additional settling pond volume required for proposed extended quarry operations is discussed in Appendix C and will be further refined at the Industrial Approval amendment stage.

Currently, overland flow drains into two settling ponds which ultimately infiltrates, evaporates and/or is trenched offsite. It is expected that the effects on the downstream flows and on water quality associated with the proposed ultimate level of quarry development can be fully mitigated using the placement of free-draining material (*i.e.,* rock/gravel) and properly sized flow retention/siltation treatment areas. Following the use of these mitigative measures, the remaining residual effects on downstream water quality are expected to be minor.

Overflow, if any, will be monitored and sampled according to the terms and conditions of the existing approval (and future updates) and the Pit and Quarry Guidelines to ensure total suspended solids levels do not exceed the approved final effluent discharge limits as outlined in the facilities Approval permit (Appendix A). In the unlikely event that overflow, in the event of a significant rain fall, exceeds final effluent discharge limits as determined through monitoring, contingency measures may include pumping of sediment laden water to vegetated areas (away from watercourses) or through filter bags for additional filtration and/or use of additional filtration devices or structures. A stormwater management plan will be submitted as part of the quarry development plan during the Industrial Approval application process.

Dust emissions will be controlled with the application of water, obtained from the water contained in the settling ponds or water that is pooled on the quarry floor. To minimize generation of dust, the working areas and laydown areas will be covered with blasted rock. Stockpiled topsoil and overburden material will be seeded and covered with hay. Dust generated by rock movement along the access road will be minimized by speed control, proper truck loading, application of dust suppressants, proper construction of on-site roads, and/or other means as required by NSE.

Monitoring of airborne particulate emissions (dust) will be conducted at the request of NSE and in accordance with the Pit and Quarry Guidelines, the Nova Scotia Air Quality Regulations and the facilities Approval permit and shall not exceed the following limits at the property boundaries:

- Annual Geometric Mean 70 µg/m^3; and
- Daily Average (24 hrs) 120 µg/m^3.

Combustion emissions will be generated from the operation of vehicles and equipment during Project activities. Given the scope of the planned operations, these emissions will be minimal,

localized and similar in quantities to the operation of a small construction project using one or two pieces of heavy equipment. Emissions will be reduced through proper equipment maintenance and inspection practices to ensure efficient operation. Consideration will be given to methods to reduce truck and equipment idling, as feasible.

As per the Pit and Quarry Guidelines, sound levels from quarry operations will be maintained at a level not to exceed the following sound levels (L_{eq}) at the property boundaries:

- L_{eq} 65dBA 0700-1900 hours (Days);
  60dBA 1900-2300 hours (Evenings); and
  55dBA 2300-0700 hours (Nights).

Sound monitoring will be conducted at the request of NSE.

Light emissions will be generated from road and parking lot lighting, and for the safety of employees. Emissions will be minimized by shielding lights to shine down only where it is needed, without compromising safety. Road and parking lot lighting will also be shielded so that little escapes into the sky and it falls where it is required. Generally, exterior decorative lights such as spotlights or floodlights with a function of highlighting features of buildings, *etc.* will be avoided, or the time of their operation restricted to where only necessary to ensure safety of employees.

As there will not be permanent office or buildings located on this site, there will be minimal solid waste generated. All solid waste will be properly collected and stored until such time that it can be transported to a provincially approved waste disposal facility.

Details of any monitoring programs required by NSE (*e.g.,* surface water, noise, dust) will be developed in consultation with NSE and outlined in the Industrial Approval amendment application.

During crushing and screening operations, the only hazardous materials anticipated on-site will be those associated with the normal operation of construction equipment. These substances include: gasoline, diesel fuel, lubricants and antifreeze liquid. Except for diesel fuel, no on-site storage of such materials is anticipated, since all maintenance will be carried out off site.

A qualified company will be contracted to conduct regular maintenance of equipment. Used oil and filters are currently removed from the site and this practice will continue with the proposed extension.

Refuelling of equipment will be conducted on-site on a regular basis via the existing diesel fuel tanks which are re-filled by a tanker truck. Refuelling activities will not be conducted within 100 m of any surface water, and equipment operators will remain with the equipment at all times during refuelling in accordance with the Petroleum Management Regulations of the Nova Scotia *Environment Act*.

In the event of a leak or spill during refuelling, maintenance, or general equipment operation, immediate action will be taken to stop and contain the spilled material. All contaminated material will be collected and stored in an appropriate manner so as not to be re-released to the environment until such time as it will be transported to an approved treatment/disposal facility. All spills will be reported to the 24-hour environmental emergencies reporting system (1-800-565-1633) in accordance with the Emergency Spill Regulations. A Spill Contingency Plan will be developed in support of the application for amendment to the existing Industrial Approval.

2.7 DECOMMISSIONING AND RECLAMATION

Aberdeen Paving will undertake a progressive rehabilitation program at the quarry site by striving to reclaim every two years during operation where practical. In this progressive reclamation process, only the area needed for quarry extension in any one year would be grubbed. All areas affected by quarry activities, including the quarry floor, will be eventually rehabilitated. The subsoil, topsoil and root mat of this area would be placed in a portion of the pit that is no longer in use. Overburden will be stockpiled for use in future reclamation.

Since this site is under sporadic work schedules, the Proponent shall strive to ensure all overburden is piled in an area that will eliminate and control any surface water runoff. Stockpiles of overburden not necessary for site development may quite possibly be removed for operational purposes.

Hydroseeding stockpiles, as conducted for current operations, will be an acceptable alternative to utilizing root mats in future activities. This approach would provide a source of native plant species well adapted to local soil and climatic conditions and would greatly reduce the need to fertilize the reclaimed pit. If it is necessary to seed reclaimed areas where grubbings have not produced sufficient plant biomass to stabilize soils, wherever practical, native plants should be used for site reclamation. In lieu of native species, seed mixes containing naturalized species which are well established in Nova Scotia and which are not aggressive weeds in the plant communities which are present in the area should be used for reclamation.

As distinct areas within the quarry become inactive, the earthen areas will be graded to a stable slope (max 2:1) or rock slopes (max 1:1), where required, or leveled to allow future commercial, industrial, recreational, or residential land use. These inactive areas will be covered with overburden and seeded in the absence of laying a root mat. Generally the rehabilitation will also consist of, but not be limited to: grading and contouring of all slopes and exposed rock faces in consideration of rock falls, slope stability, and safety; spreading existing stockpiled topsoil; and hydroseeding in the absence of laying a root mat.

As for the areas that have been stripped clean of all overburden and have been worked to the appropriate level of elevation, called the quarry floor, they will form part of the staging area for the stockpiles of newly exposed and blasted rock. Once the operations reach a stage where the storage area can be reduced, these areas will be rehabilitated as per the above requirements.

A reclamation plan will be developed for the extended site and submitted to NSE as part of the quarry development plan, to be included in the Industrial Approval amendment application. The reclamation plan will include information on such things as the proposed final topography, maximum slopes, revegetation plans and an outline of the plan for progressive reclamation at the site.

3.0 SCOPE

3.1 SCOPE OF THE UNDERTAKING

Section 2.0 describes the scope of the undertaking (*i.e.,* the proposed Project) that is the subject of the environmental assessment including spatial assessment boundaries (*e.g.* Project footprints and zones of influence) and temporal assessment boundaries (*e.g.,* Project time frames).

3.2 PURPOSE AND NEED FOR THE UNDERTAKING

The purpose for the Project is to allow Aberdeen Paving Limited to extend the existing quarry footprint and continue operations at their quarry in Yarmouth. The quarry is currently operating under an Industrial Approval (No.2009-067070), issued by NSE and effective until July 2019. A copy of the NSE Approval permit is included in Appendix A.

The aggregates produced at the quarry are an important requirement in construction projects in the region and are of an appropriate quality for highway construction and maintenance projects. The Proponent anticipates the source material in the proposed extension area to be of similar quality to the material currently extracted at the existing quarry.

The quarry under consideration as well as other quarries in Nova Scotia are an important component of the natural resource sector of the economy and provide essential raw materials to the province's construction industry. The quarry also provides direct and indirect employment for its workers and suppliers, as well as for the transportation and construction industries.

3.3 PROJECT ALTERNATIVES

Other methods for carrying out the undertaking may include different methods of extraction of the resource and alternative facility locations. The current method of aggregate extraction at the Hardscratch Quarry is drilling and blasting. Alternative methods for extraction of the rock (*i.e.,* mechanical means) are not practical or feasible in this instance due to the nature and characteristics of the rock (*e.g.,* hard and dense). Therefore, there are no feasible alternatives to drilling and blasting as a means of extracting this material.

An alternative facility location is also not a feasible alternative. The extension is occurring in an area that has been previously disturbed and is already exposed to mining/quarrying activities. Extension of the quarry will not require immediate construction of any new facilities (*i.e.,* roads or buildings), as the existing facilities are at present sufficient for the current and extended operations. Additional flow retention structures will be installed/constructed, if required, as the quarry develops to accommodate the additional surface runoff and quarry drainage. Relocation of the quarry to another location may likely require development of a new site, construction of new facilities, and would potentially have greater effect on the surrounding biophysical and socio-economic environment.

The Proponent proposes to extend the approved quarry site to occupy 65 ha of land, in total, to allow for continued aggregated production (blasting, crushing, and stockpiling) and will supply granite to local gravel and concrete markets as well as asphalt aggregates. Over the next ten years, however, the extension will advance in the north and northeast direction (refer to Figure B1 in Appendix B). As well, the southern portion of the Project area will be set aside as a wetland conservation zone.

The Proponent had originally considered extension into a larger portion of the property but the proposed extension was scaled back in consideration of the nearby residents.

3.4 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

The proposed Project must be registered for environmental assessment under the Environmental Assessment Regulations of the Nova Scotia *Environment Act* as a Class I Undertaking. This report fulfils the primary requirements for project registration under this legislation, and includes revisions made as a result of government comments on the Draft EA document, which was submitted to NSE in March 2010. A disposition table presenting all received government comments and comment responses has been included in Appendix J.

Other relevant provincial regulations and guidelines include the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996) and the Nova Scotia Pit and Quarry Guidelines (NSEL 1999). Relevant federal legislation and policies include the *Fisheries Act*, the *Species at Risk Act*, and the *Migratory Birds Convention Act*.

The scope of the environmental assessment in relation to the proposed Project has been determined by the Proponent and their consultant and is based upon the proposed Project elements and activities, the professional judgment and expert knowledge of the study team, consultations with the public and regulatory authorities on this and similar projects, and the results of field studies conducted in support of this environmental assessment. The Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia (NSEL 2008) was also used to determine/focus the scope of the assessment. The Proponent and their consultant met with NSE on August 20, 2009 to discuss the location of proposed extension, and elements and activities associated with the proposed Project, in an effort to further focus the scope of the assessment. Landowners adjacent to the quarry were also contacted (see Section 4.0) for the purpose of issues identification.

This environmental assessment evaluates the potential environmental effects of the proposed Project elements and activities, for all Project phases, with regard to each Valued Environmental Component (VEC). By assessing potential impacts on VECs within the study boundaries, a meaningful evaluation of project effects on relevant environmental aspects is achieved. The following VECs were identified based on government guidance, consultation, and professional judgment of the study team:

- Surface Water Resources;
- Rare and sensitive flora;
- Wetlands;
- Wildlife;
- Groundwater;
- Archaeological and heritage resources;
- Air quality; and
- Socio-economic environment.

4.0 PUBLIC INVOLVEMENT

4.1 METHODS OF INVOLVEMENT

In late November 2009 approximately twenty-two Project Information Bulletins (Appendix D) were distributed to landowners and some local businesses within approximately 1.0 km of the quarry. The purpose of the bulletin was to advise local residents and businesses close to the existing quarry and proposed Project site (*i.e.,* those who are potentially most affected) and provide them with opportunity to comment on the proposed undertaking.

Information letters were also sent to the Confederacy of Mainland Mi'kmaq, the Native Council, the Mi'Kmaq Rights Initiative, and the Union of Nova Scotia Indians to encourage the submission of comments, concerns, and questions regarding the Project (Appendix D).

4.2 STAKEHOLDER COMMENTS AND STEPS TAKEN TO ADDRESS ISSUES

To date, no comments have been received from the public as a result of the Project Information Bulletin.

On November 18, 2009 a letter was received from the Native Council advising Aberdeen Paving that they have forwarded the Project information to the members in the Yarmouth area and will be advising of concerns, if any, by the end of the year.

The EA Registration document will be subject to a public review process as required under provincial legislation. The document will be posted on the NSE website with paper copies at several locations including near the Project area. Publication dates and Registration document locations will be advertized in one Province-wide newspaper and one local newspaper. Public comments will be solicited by NSE as part of this process.

5.0 VALUED ENVIRONMENTAL COMPONENTS AND EFFECTS MANAGEMENT

5.1 METHODOLOGY

Field studies were conducted by Stantec between August 25-27, 2009 and October 29, 2009, to investigate and establish the existing conditions and to determine appropriate mitigation, if necessary, to manage environmental effects from the proposed extension Project. These surveys consisted of: vegetation survey; wetlands survey; breeding bird survey; mammal survey; and herpetile survey. These surveys were undertaken by a qualified terrestrial ecologist employed by Stantec. An aquatic field survey was undertaken by qualified aquatic specialists. An assessment of potential archaeological and heritage resources was undertaken by a qualified archaeologist. Additional information, in support of the field studies and the assessment, was gathered through a review of: air photos; site mapping; and other information sources, such as the Nova Scotia Museum, Statistics Canada, the Nova Scotia Department of Transportation and Infrastructure Renewal, and the Nova Scotia Department of Natural Resources (NSDNR). It is our understanding that the NSDNR ranks are in a review process. Any nomenclature chance is not extected to change the results of this report with respect to risk to species.

Temporal and spatial boundaries encompass those periods and areas within which the VECs are likely to interact with, or be influenced by, the Project. Temporal boundaries are generally limited to the duration of, and for a period of time after, the Project activities. Spatial boundaries are generally limited to the immediate project area unless otherwise noted.

To assess the potential environmental effects of a project and determine the significance of an effect, it is important to consider the magnitude, frequency, duration, geographical extent and reversibility of the potential effect. The study team has considered these elements for each VEC and has applied professional judgment with respect to the prediction of residual environmental effects (*i.e.,* effects remaining after application of proposed mitigation measures).

5.2 SURFACE WATER RESOURCES

Surface Water was selected as a VEC because of the potential for Project activities to interact with the freshwater environment. Indicators of the VEC include aquatic life, fish habitat and surface water quality, as well as potential water uses for agriculture, recreation, industry or potability. Water quantity is discussed as part of the Groundwater Resources VEC (Section 5.6). There are no known agricultural, recreational, industrial or potable uses of the surface water located on the Aberdeen Project property. Both watercourses on the property feed Agard Lake, which is anticipated to support fish and is likely used for recreational fishing, canoeing and kayaking. Agard Lake is located outside the Project boundary but mitigation is suggested below to prevent downstream effects from the watercourses located on site known to feed the lake. The remainder of the Surface Water VEC discussion will focus on surface water quality, aquatic life and fish habitat within all watercourses located in the Project property.

5.2.1 Description of Existing Conditions

Fieldwork was conducted on October 29, 2009 by two Stantec aquatic scientists. Field-based stream assessments included a fish habitat survey and water quality sampling within the two defined watercourses and one drainage channel inside the Project boundaries. Provincial mapping did not show any watercourses on the site other than an open water area/holding pond (Figure 3, Sensitive Areas). Field investigations lead to the initial discovery of a watercourse drainage system on the property. The dominant watercourse (WC-1) on the site originates from a large wetland (WL07/06/08), passes through multiple other wetlands (WL05, WL02, and WL01) while winding through the Project Area and eventually drains into a Ducks Unlimited (Beaverdam Meadows) wetland and pond system outside the Project Area. WC-1 is fed by a natural watercourse (WC-2) in the southern end of the Project Area that drains through a wetland (WL03). It is also fed by a roadside drainage channel (DC-1) leading from an up-gradient wetland (WL05) and connecting to WC-1 outside the existing quarry boundaries. There is a second drainage channel (DC-2) on the property but outside the proposed extension area. WC-1 and WC-2 fall within a wetland conservation zone that will be established on the site. No quarry development will occur within this wetland buffer area. Figure 4 provides a summary of all field-delineated watercourses and drainage channels as well as the wetland buffer area.

NSE 921674

Pitman Road

340

NSE 000931

NSE 941804

NSE 971550

NSE 060998

Hardscratch Road

Ellenwood Lake Provincial Park

Ellenwood Lake

Agard Lake

Beaverdam Meadows Wetland (Ducks Unlimited Wetland)

Braemar Road

Mood Road

Captain Lane

Half Wedge Lane

Ellenwood Drive

N

Legend

- Open water area
- Yellow nodding ladies'-tresses *Spiranthes ochroleuca*
- Boreal American-aster *Symphyotrichum boreale*
- Drilled Wells
- Project Properties
- Existing Quarry
- Project Extension Boundary
- 800m Buffer
- Building/Structure
- Contour (5m)
- Watercourse
- Field Identified Streams
- Waterbody
- Wetlands (NSGC 1997)
- Wetlands (NSDNR 2007)
- Field Delineated Wetlands

Nova Scotia Protected Wildlife Area

- Migratory Bird
- Of Concern
- Species at Risk

Designated Provincial Parks

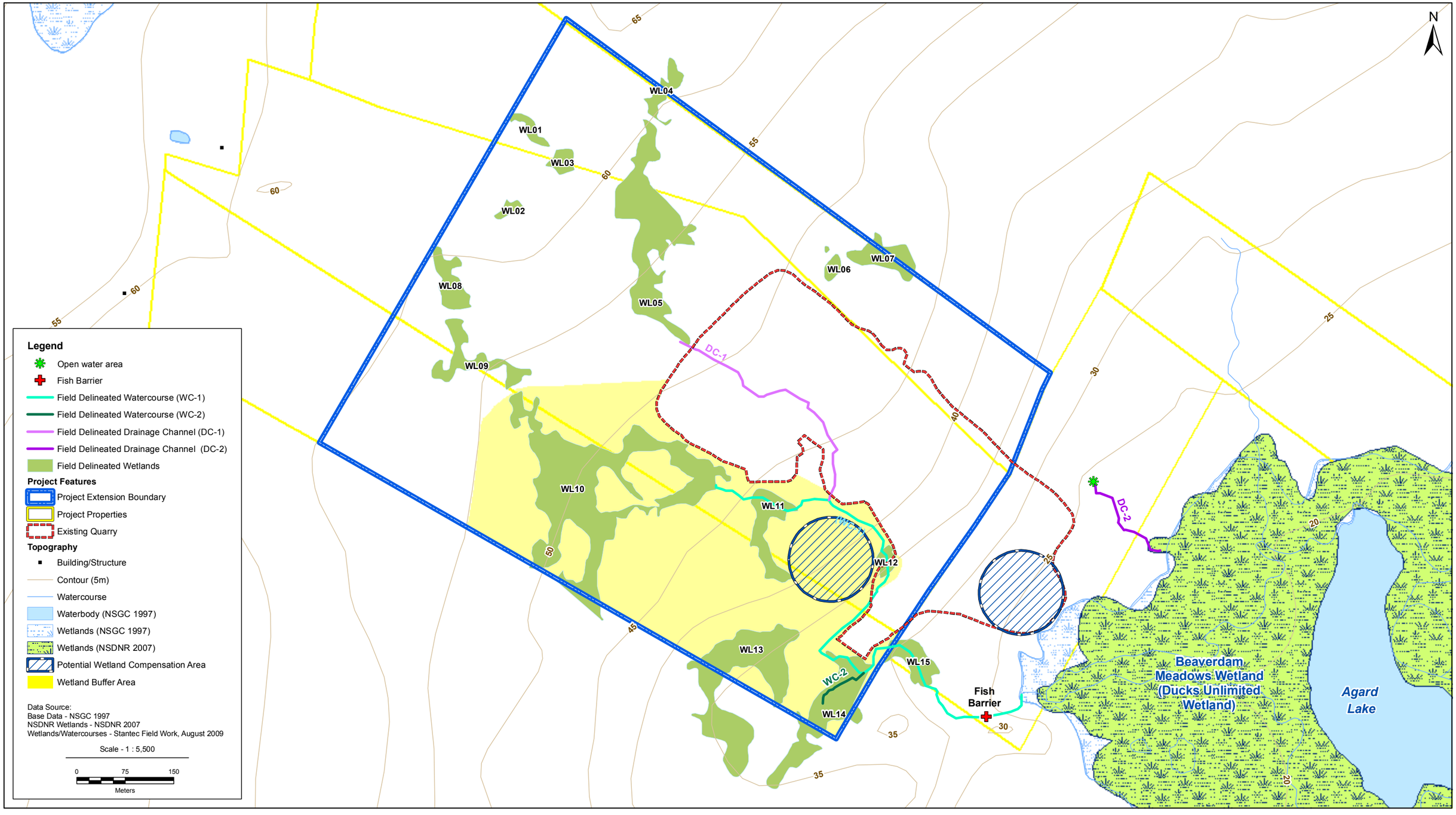
- Ellenwood Lake Provincial Park

Data Source:
Base Data - NSGC 1997
NSDNR Wetlands - NSDNR 2007
Photography - Google Earth 2005
Provincial Park - NSDNR 2007
Wildlife Areas - NSDNR 2007

Scale - 1 : 15,000

0 250 500
Meters

DATE: May 06, 2010 PREPARED BY: G. MESHEAU	Hardscratch Quarry Extension Project **Sensitive Areas**	FIGURE NO.: **Figure 3**



DATE: May 26, 2010

PREPARED BY: G. Mesheau

Hardscratch Quarry Extension Project

Wetland and Watercourse / Drainage Locations

FIGURE NO.: **Figure 4**

Stantec

Watercourse descriptions are provided below for the two assessed streams. This information details the watercourse survey results and characterizes each watercourse. By characterizing the watercourses, Aberdeen Paving can ensure that appropriate mitigation is identified and implemented. The following discussion of the aquatic habitat, fish resources and water quality in the vicinity of the project includes both the field methodology and the presentation of findings.

Aquatic Habitat

The habitat surveys were conducted using internal Stantec sampling protocol. The internal protocol used was based on multiple existing protocols including the Environment Canada CABIN protocol (Canadian Aquatic Biomonitoring Network; Reynoldson *et al.* 2007), the Ontario Benthos Biomonitoring Network (OBBN) protocols (Jones *et al.* 2005), and the modified New Brunswick Department of Natural Resources (NBDNR) and Fisheries and Oceans Stream Assessment Protocol (Hooper *et al.* 1995). The stream assessment included the identification of physical units (*i.e.,* run, riffle, or pool), designation of substrate type, and description of the riparian zone. The presence or absence of macrophytes, algae, over-head cover, and woody debris was recorded. The depth and width of the stream were also taken and the presence of existing anthropogenic impacts was noted.

The aquatic field personnel assessed connectivity of WC-1 (and therefore WC-2, as well) to potential fish-bearing watercourses downstream, outside the proposed extension area. Site photos were also taken along the stream reach and can be found in Appendix E

Watercourse 1 (WC-1) is located within the wetland buffer area along the western edge of the existing quarry boundaries and flows south, eventually turning east and draining into Agard Lake. Watercourse 2 (WC-2) is also located within the wetland buffer area and feeds WC-1 in the southeast corner of the proposed project extension area (Figure 4). Both can be characterized as clear-water streams supporting multiple substrate types and flow patterns, and draining from wetlands. WC-1 drains from wetland WL05 and through wetlands WL02, WL03, and WL01 before entering the Agard Lake wetland system downstream of the proposed project extension boundary. WC-2 originates outside the project extension boundary and drains through wetland WL03 where it connects with WC-1.

WC-1 is under the influence of anthropogenic effects in multiple sections as a result of the existing quarry activities and associated road system. Anthropogenic effects include the channelization and bank rocking of one section of WC-1. Habitat features and water quality downstream of this channelized section are directly comparable to the aquatic environment upstream of the channelization. The substrate is mixed throughout the watercourse and includes areas dominated by fines combined with rock and boulder dominated substrate. The flow pattern includes runs, riffles and cascades as well as a few small pool areas. Instream aquatic vegetation (*i.e.,* macrophytes) was observed throughout the watercourse. Riparian vegetation was dominated by moss but included cover from trees and shrubs in some areas or bare ground in sections dominated by streamside boulders.

The assessment of the section of WC-2 located within the proposed project extension area confirmed that the watercourse can be characterized as a deep, darkly tea-stained meandering stream draining through a wetland. The substrate is dominated by fines, riparian vegetation is comprised almost entirely of grasses and the flow pattern at the time of the assessment was that of a slow-moving run. Additional physical habitat features are summarized for each watercourse in Table 5.1. These measurements were collected during a single sampling event and can be expected to vary seasonally.

Table 5.1 Summary of Aquatic Habitat Assessments at Hardscratch Quarry

Date & Time	29-Oct-09	29-Oct-09
Site Coordinates	**738526E 4867414N**	**738718E 4867104N**
Site Description	WC-1: Unnamed Tributary to Agard Lake	WC-2: Unnamed Tributary to WC-1
Site Measurements and Characteristics		
Precipitation Previous 24 hours	None	None
Wetted Width average (m)	1.5	1
Bankfull Width average (m)	2	1.5
Depth (min. - max. range) (cm)	15 - 20	50
Woody Debris	Present	Present
Macrophytes	Present	Present
Algae	Present	Present
Canopy Cover (%)	0 - 70	30
Riparian Vegetation (Dominant)	Forest, Mainly Coniferous and Cleared Quarry Area	Forest, Mainly Coniferous

Fish Resources

Neither watercourse (WC-1 or WC-2) was electrofished during the survey. An assessment of the connectivity of WC-1 (and therefore WC-2) to potential fish-bearing watercourses confirmed the presence of a fish passage barrier outside the proposed extension boundary (Figure 4). More specifically, a gradient prohibitive to fish passage was found just upstream of the wetland boundary surrounding Agard Lake. An additional cascade was found at the start of wetland WL01 (Figure 4), which would also present a barrier to fish passage as a result of the steep gradient change over a short distance. While neither watercourse on the Project site is expected to bear fish as a result of the multiple barriers to fish passage, the water contained in the watercourses does have direct connection downstream to Agard Lake. As such, appropriate mitigation must be undertaken to prevent downstream effects on fish and fish habitat. By adopting mitigative measures to prevent downstream effects on fish and fish habitat, the physical stream habitat upstream of the barriers to fish habitat will also be protected. This ensures prevention of effects on other forms of aquatic life (*e.g.*, benthic invertebrates) inhabiting the stream, including any potential resident small-bodied fishes that may inhabit the stream above the fish passage barriers.

Water Quality

Key water quality results are outlined for each watercourse. Given the length of WC-1, multiple locations throughout the watercourse were sampled. The range of WC-1 water quality results recorded is provided in Table 5.2 below (see Appendix E for raw field data collected at each

sampling location). The intent of the water quality discussion is to compare the results with applicable guidelines from the Canadian Council of Ministers of the Environment (CCME). Specifically, results are compared with the CCME guidelines for the protection of freshwater aquatic life (CCME-FAL 2007) to determine the potential for each watercourse to support aquatic life. Additionally, the collection of water quality data prior to proposed Project activities helps to establish a baseline against which pre-, during-, and post-construction water quality data can be compared. The water quality parameters collected *in-situ* using a handheld multimeter (YSI 556) includes dissolved oxygen, pH, specific conductivity and water temperature. These parameters experience natural variation on a seasonal and annual basis. The results presented in the current report represent the surface water quality in each watercourse at a single point in time.

Table 5.2 Summary of Water Quality in Two Streams at Hardscratch Quarry

Date & Time	29-Oct-09	29-Oct-09
Site Coordinates	**738526E 4867414N**	**738718E 4867104N**
Site Description	WC-1: Unnamed Tributary to Agard Lake	WC-2: Unnamed Tributary to WC-1
Water Quality		
DO (mg/L) (min. - max., when available)	8.28 - 10.55	7.4
DO (%) (min. - max., when available)	69.2 - 89.1	62.9
Water Temperature (˚C) (min. - max., when available)	7.53 - 8.0	8.23
pH (min. - max., when available)	5.13 - 5.48	5.02

The *in situ* water quality results collected in each stream (Table 5.2, above) confirm that both WC-1 and WC-2 have the potential to support aquatic life when compared to the CCME-FAL guidelines. As is often observed in various areas in Nova Scotia, the pH levels measured in both watercourses was somewhat acidic (5.02 – 5.48). The pH fell below the CCME guidelines of 6.5-9.0 but is within the range known to support aquatic life in Nova Scotia. Low pH or acidic waters are common in various areas of the province. Acidification can be caused by a variety of combinations of anthropogenic and natural soil composition conditions such as high sulfur content, which, once becoming oxidized leaches into the ground and surface water, lowering pH (Goodwin, 2004). The dissolved oxygen (DO) recorded in both watercourses at the time of the survey met the CCME guidelines for the lowest acceptable DO concentration for early and other life stages of aquatic life.

Two anthropogenic drainage channels were also observed on the site (DC-1 and DC-2, Figure 4). DC-1 is a narrow, shallow drainage channel running alongside the main access road for the existing quarry. The ditch-like channel drains from wetland WL05 and is likely dry during low flow conditions. DC-1 connects directly to WC-1 and appropriate mitigation must be undertaken to prevent downstream effects to water quality. DC-2 is a ditch that drains from a quarry ponding area outside the proposed project extension boundary. It is a defined channel until it reaches the edge of the wetland area surrounding Agard Lake. Photos of the drainage channels are included in Appendix E.

None of the watercourses identified on the Project property are known to interact with drinking water supplies or other protected surface waters. The closest known reservoir lake is Lake Vaughan to the east, which is not part of the Agard Lake drainage system (Service Nova Scotia 2006). The assessment presented below concerning hydrogeology and groundwater on the site (*i.e.* Section 5.6.2), discusses a water well review for the Project property. Available mapping information was reviewed to determine the probable locations of water wells within 800 m of the Project area. Multiple buildings were confirmed to be located in the vicinity of the Project area. In rural areas, each residence, farm or commercial property is assumed to have a dug or drilled water supply well. Further consideration of water wells in the Project Area is presented in Section 5.6.2 below.

There is one known Protected Water Areas (PWA) in the vicinity of the Project property (see Figure E1, Appendix E). The Lake George Watershed Protected Water Area (PWA) is located to the north of the Project property. The Lake George PWA boundary extends south to highway 340 (N.S. Reg. 196/2006 2006), which is north of the Hardscratch Quarry site. Therefore, the Lake George PWA does not extend to the Project property. With implementation of the mitigation described herein to protect on-site surface water and prevent effects downstream in Agard Lake, no impact to surface waters is anticipated to result from the proposed Project Activities.

Summary

During the October sampling period, two watercourses and two drainage channels were confirmed on the Aberdeen Paving quarry site. Both watercourses exhibited clear, flowing water and in stream habitat capable of supporting aquatic life at the time of the survey. A barrier to fish passage was located in the downstream area of the main watercourse, outside the proposed project extension boundary. As such, fish are not anticipated to inhabit either of the watercourses. The water from both watercourses and one drainage channel has a direct connection downstream to Agard Lake which is expected to be fish-bearing. Therefore, the potential for downstream effects within Agard Lake must be mitigated.

5.2.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

The primary potential effects on the surface water VEC from quarry activities result from erosion and sediment control. Erosion and sedimentation can occur whenever soil is exposed. Sedimentation (increased sediment load in stream water and deposition in downstream sediments) is perhaps the most common environmental effect of quarry activities on fish and aquatic habitat, including water quality. The environmental effects of sedimentation are well studied and understood; therefore, detailed mitigation measures to protect watercourses from these effects have been developed. Sedimentation can result in physical changes to the aquatic environment, including the accumulation of fines on stream substrate. Sedimentation and siltation of surface water can also degrade surface water quality (*e.g.,* oxygen levels, light penetration, water temperature, water chemistry such as organics and metals) leading to

potential changes in primary production and food availability (Anderson *et al.* 1996 and Trow Consulting Engineers Ltd. 1996).

Other potential environmental effects on surface water quality that may occur during quarry activities include increases in total suspended sediments (*i.e*., increased turbidity), a change in hydrologic conditions, and changes in pH from runoff. These changes in surface water quality can lead to effects on the benthic invertebrate community, in addition to potential physical effects resulting from sedimentation and siltation.

The potential for erosion and sedimentation effects in WC-1 and WC-2 is anticipated to be minimal as a result of the mitigation proposed below and as a result of the wetland buffer area that will buffer the streams (and several wetlands in the area) from being within the vicinity of future quarry development. The close proximity of WC-1 to the wetland buffer area and existing quarry boundaries does necessitate continued commitment to erosion and sediment control on the site. Therefore, the following mitigation discussion focuses on the prevention and control of erosion and sedimentation during quarry activities. Mitigating for potential effects of erosion and sedimentation serves to protect aquatic habitat, fish resources and water quality simultaneously. Therefore, the discussion is not separated into the individual components of the surface water VEC.

As specified in Nova Scotia Pit and Quarry Guidelines, no active quarry components will be located within 30 m of the banks of all streams identified on the property (*e.g.,* WC-1 and WC-2) without prior government approval. If avoidance of watercourses is not possible in the future, approval to alter watercourse must be granted under the Nova Scotia Activities Designation Regulation. Prior to filing a Watercourse Alteration Approval application, a site visit may be needed to update the stream habitat assessment and fish survey (including the evaluation of fish passage barriers between Agard Lake and the Project property). Streams are dynamic environments subject to physical and chemical change over time and as such should be reassessed if more than two years have passed since the initial assessment. It is not anticipated that quarry activities will approach the watercourses on site within the next ten years.

Fisheries and Oceans Canada (DFO) has developed the Policy for the Management of Fish Habitat (DFO 1986), which applies to all development and industrial projects in or near watercourses that could harmfully alter, disrupt, or destroy (HADD) fish habitat by chemical, physical, or biological means. The guiding principle of this policy is to achieve no net loss of the productive capacity of fish habitats. No fish are expected to inhabit the watercourses within the proposed project extension boundaries as a result of the barrier to fish passage located outside the proposed project extension boundary at the time of survey. However, the water within both WC-1 and WC-2 has a direct connection to Agard Lake, which is expected to support fish. Therefore, appropriate mitigation is required to prevent downstream effects on fish and fish habitat.

No Project-related vehicles will be driven through streams. Clearing, grubbing, and topsoil stripping activities can increase the potential for sediment erosion and deposition down gradient, particularly during periods of heavy rainfall or snow melt. These activities will also result in a

reduction of evapotranspiration and a corresponding increase in surface runoff, which in turn increases potential for sediment erosion and deposition. The concern with this Project is the potential sedimentation effects on fish habitat present down gradient, outside the proposed project extension boundaries, but to which WC-1 and WC-2 connect.

The placement of free-draining material (*i.e.,* blasted rock) over disturbed areas and the use of properly sized flow retention structures are expected to mitigate erosion and sedimentation effects. As the quarry develops, exposed soil capable of producing sediment laden-runoff will be stabilized with blasted rock, and stockpiles of topsoil and overburden will be stabilized with hydroseed or root mat. Additional retention capacity on the quarry floor will be created as the quarry develops and a settling pond will be installed, if required. A stormwater management plan will be submitted as part of the quarry development plan during the Industrial Approval amendment application process.

A phased approach to the extension of the quarry will allow for an adaptive approach to monitoring and management of potential effects to surface water and groundwater resources which in turn may affect fish habitat downstream. As well, the southern portion of the Project area will be set aside as a wetland conservation zone (*i.e.*, the wetland buffer area) which will also provide protection for the watercourses on site and downstream of the site (see Figure 4). Linking site extension to environmental effects management performance criteria is an effective mitigation strategy to deal with uncertainties and ensure sustainable development.

Based on the results of the watercourse assessment, the use of a wetland buffer area, and the mitigation proposed, there is very low potential for quarry activities to interact with fish and fish habitat and significant Project-related effects on fish and fish habitat are not likely to occur.

5.3 RARE AND SENSITIVE FLORA

5.3.1 Description of Existing Conditions

The site was surveyed by Stantec botanists during August 25 -27, 2009. A vascular plant inventory of the Project area was compiled during the survey and habitat descriptions were performed.

The majority of the Project area is comprised of forest which is at an early stage of successional development following tree harvesting activity which has taken place within the last 20 years. Whereas much of the upland forest is naturally regenerating, evidence of silviculture activities, in the form of plantings and pre-commercial thinning (PCT), is prevalent. Some small pockets of immature-mature upland forest may be found along the periphery of the Project area (Figure 2). An abundance of wetlands, which are best characterized as swamps according to the Canadian Wetland Classification System (Warner and Rubec 1997), are also supported by the Project area (Figure 4). Whereas most of the swamps would have been treed prior to forestry activities, early-successional vegetation types now predominate. Some remnants of treed swamps are still present however, and include both mixedwood and coniferous treed types. A low shrub swamp habitat which has been subject to minimal anthropogenic influence is also represented within

the Project area. Additional habitats include those provided by a small anthropogenic pond, watercourses, old roads, and disturbed areas which surround and contain the various activities related to present quarry operations.

Recently harvested forest stands have a low and often intermittent tree cover comprised of red maple (*Acer rubrum*), black spruce (*Picea mariana*), and red spruce (*Picea rubens*). Shrub cover is extensive within this habitat and primarily comprised of sheep-laurel (*Kalmia angustifolia*). Other common shrubs include highbush blueberry (*Vaccinium corymbosum*), brambles (*Rubus spp.*), spruce, and red maple. Bracken fern (*Pteridium aquilinum*) is the most prominent herbaceous species, although dwarf dogwood (*Cornus canadensis*), crinkled hairgrass (*Deschampsia flexuosa*), and teaberry (*Gaultheria procumbens*) also form an important component of the ground vegetation. Red-stemmed moss (*Pleurozium schreberi*) provides moderate cover on the forest floor, along with lesser amounts of broom moss (*Dicranum spp*.) and braided moss (*Hypnum spp.*).

Regenerating forest stands which have been subject to silviculture activities (planting and / or PCT) are prominent within the western end of the Project area. Such stands are typically dominated by regenerating balsam fir (*Abies balsamea*), but red spruce and red maple are also common in places. Sheep-laurel, bristly dewberry (*Rubus hispidus*), and red raspberry (*Rubus idaeus*) provide intermittent shrub cover amongst the regenerating trees. A moderate herbaceous layer is primarily provided by dwarf dogwood and twinflower (*Linnaea borealis*), although a number of other species are also common, including wild sarsaparilla (*Aralia nudicaulis*) and partridge-berry (*Mitchella repens*). Moss coverage varies considerably within this habitat type but is primarily comprised of red-stemmed moss, braided moss, and broom moss.

Some small pockets of immature-mature upland forest stands are found within the Project area, particularly along its periphery. These mixedwood and coniferous forest stands are dominated by red spruce and red maple, although paper birch (*Betula papyrifera*), balsam fir, and American larch (*Larix laricina*) are also common. Shrub coverage is primarily comprised of balsam fir, red spruce, black huckleberry (*Gaylussacia baccata*), and sheep-laurel. Herbaceous vegetation is generally of low prominence, with the most prominent species being wild sarsaparilla and bracken fern. A well-developed moss layer is predominantly comprised of red-stemmed moss, although a number of other taxa, particularly stair-step moss (*Hylocomium splendens*) and broom moss are also common.

Mixed treed swamp habitats have a moderate tree canopy formed predominantly by red maple and balsam fir, although American larch and black spruce are also common. These tree species are also important contributors to a moderate shrub layer, along with narrow-leaved meadow-sweet (*Spiraea alba*), bristly dewberry (*Rubus hispidus*), sheep-laurel, highbush blueberry, and black holly (*Ilex verticillata*). Herbaceous cover is primarily provided by graminoids and ferns, particularly three-seed sedge (*Carex trisperma*), fowl manna-grass (*Glyceria striata*), cinnamon fern (*Osmunda cinnamomea*), New York fern (*Thelypteris noveboracensis*), soft rush (*Juncus effuses*), and eastern hay-scented fern (*Dennstaedtia punctilobula*). Although of lesser abundance, a number of forbs are common, particularly swamp loosestrife (*Lysimachia*

terrestris) and hybrid white panicled American-aster (*Oclemena X blakei*). Peatmoss (*Sphagnum spp.*) coverage is extensive throughout this habitat.

In addition to the vegetative community previously described, extensive patches of mannagrasses are also present within the mixed treed swamps. These areas, which are comprised of both northern mannagrass (*Glyceria laxa*) and fowl mannagrass have minimal tree cover. The abundance of other herbaceous taxa is low within these pockets, but a number of species are scattered throughout, including soft rush, rough-leaf goldenrod (*Solidago rugosa*), blue-joint reedgrass (*Calamagrostis canadensis*), and swamp loosestrife. Similarly, shrub cover within these habitats is almost exclusively comprised of bristly dewberry, although a number of other species are found in low abundance.

Patches of coniferous treed swamp are dominated by an overstory comprised predominantly of black spruce, with lesser amounts of American larch and red maple being present. Shrub coverage is very minimal and includes scattered occurrences of tree species and sheep-laurel. Herbaceous coverage is primarily comprised of graminoids, particularly three-seed sedge and northern mannagrass . This habitat-type has a well developed moss layer comprised of a mixture of peatmoss and red-stemmed moss.

Extensive tree harvesting activities throughout the Project area have resulted in much of the swamps being converted to a very early successional stage. Within such habitats, overstory coverage is minimal, but scattered occurrences of trees, particularly red maple, are present. Although shrub coverage is primarily provided by bristly dewberry, regenerating trees and other shrubs are also present. The dominant vegetation within this seral stage is currently comprised of graminoids. In particular, cottongrass bulrush (*Scirpus cyperinus*) is particularly extensive along with fowl manna-grass, soft rush, and three-seed sedge. A number of forbs are also common, including cinnamon fern, new Belgium American-aster (*Symphyotrichum novi-belgii*), northern bugleweed (*Lycopus uniflorus*), swamp loosestrife, rough-leaf goldenrod (*Solidago rugosa*), and New York fern. Although varied, peatmoss forms an extensive carpet throughout the cut swamps.

Tall shrub swamp habitats are present where tree regeneration following harvesting operations is advanced and / or where forestry operations have acted in a selective manner (*i.e.,* overstory canopy removed but smaller trees uncut). Although scattered occurrences of red maple, black spruce, American larch, and balsam fir do provide some tree coverage, these species mostly contribute to the well-developed shrub layer that characterizes this habitat type. Other common shrubs includes narrow-leaved meadow-sweet, bristly dewberry, highbush blueberry, heart-leaved paper birch (*Betula cordifolia*), possum-haw viburnum (*Viburnum nudum*), and sheep-laurel. An extensive herbaceous layer is comprised of a diversity of species, particularly soft rush, New York fern, cinnamon fern, cottongrass bulrush, parasol white-top, fowl manna-grass, and three-seed sedge. Peatmoss and hair-cap moss (*Polytrichum spp*.) are the dominant bryophytes within this habitat.

A low-shrub swamp found within the Project area is dominated almost exclusively by large cranberry (*Vaccinium macrocarpon*) and blue-joint reedgrass. Cottongrass bulrush is also common within this habitat, whereas several other herbs are scattered about, including soft rush and marsh St. John's-wort (*Triadenum fraseri*). Peatmoss is also an important component of this habitat's vegetation.

Quarry operations are extensive throughout much of the Project area, and as such, anthropogenic habitats, such as are created by infilling and disturbance, are abundant. These habitats typically have exposed sand – cobble substrate and a vegetative community comprised of weedy plants. Whereas exotic plants comprise much of this vegetation, a high diversity of native species adapted to open, disturbed conditions are also present. Forbs and graminoids such as colonial bentgrass (*Agrostis capillaris*), pearly everlasting (*Anaphalis margaritacea*), black starthistle (*Centaurea nigra*), and poverty oat-grass (*Danthonia spicata*) dominate this habitat-type, but a number of shrubs are also present, including narrow-leaved meadow-sweet and northern bush-honeysuckle (*Diervilla lonicera*).

A small pond is present within the Project area and is anthropogenic in nature, as evidenced by the character of its banks. This small waterbody is surrounded by mixed upland forest and was largely devoid of vegetation, except for some herbaceous cover along its northern margin. The lack of vegetation within the pond is indicative of its steep banks and deep water levels. Herbaceous species present along the margin of the pond include creeping spike-rush (*Eleocharis palustris*), northern St. John's-wort (*Hypericum boreale*), sensitive fern (*Onoclea sensibilis*) and royal fern (*Osmunda regalis*).

Watercourses provide an additional habitat type for plants within the Project area. Drainage channels flow through wetlands, upland forest, and anthropogenic habitat types of the Project area. Vegetation along the fringes of these watercourses varies with the type of habitat through which they flow as well as their own hydrological character. The quarry pit is drained by a dug channel that supports extensive coverage of broad-leaf cattail (*Typha latifolia*) in its upper, slow-moving section. Where it becomes more confined, sedges (*Carex spp*.) and rushes (*Juncus spp*.) are abundant along the margins of the channel which eventually spills over into the forest surrounding the large wetland complex to the southeast of the Project area.

Rare Vascular Plants

A rare plant modeling exercise was performed to determine the likelihood of presence of rare or sensitive plants within the Project area. As part of the modeling exercise, all records of vascular plant species listed by NSDNR as at risk (Red listed) or sensitive to human activities or natural events (Yellow listed) (NSDNR 2007a) within a radius of 100 km were compiled by means of an Atlantic Canada Conservation Date Center (ACCDC) data search. The habitat requirements of these species were compared to the habitat descriptions compiled for the Project area to determine if suitable habitat was present for these taxa. Knowledge of the habitats present within the Project area was determined through an interpretation of aerial photography, topographic, and geological mapping. In instances where appropriate habitat was present for a

particular species, that species was considered to be potentially present and the suitable habitat in the Project area was identified as a target for future field surveys. The seasonal aspects and ease of identification of each of the species potentially present in the Project area was also incorporated into the model in order to determine the best times to conduct the future field surveys.

The plant modeling exercise identified a total of 102 rare or sensitive vascular taxa within 100 km of the project area, 50 of which were considered to be potentially present within the Project area. Of these, NSDNR (2007a) considers the populations of 19 to be at risk and 31 to be sensitive. Several federally and/or provincially listed “species at risk” were identified as being potentially present within the Project area, including coast pepper-bush (*Clethra alnifolia*), golden crest (*Lophiola aurea*), and northern white cedar (*Thuja occidentalis*). Although two endangered coastal plain flora species, rose coreopsis (*Coreopsis rosea*) and plymouth gentian (*Sabatia kennedyana*), are known to occur within close proximity to the site (~4 kms), the Project area does not provide the shoreline conditions that these species are associated with. The results of the model suggested that there is potential for all habitats in the Project area to support rare or sensitive vascular plant species. However, certain areas are more likely to support rare and sensitive species than others, including the wetland habitats and the riparian zones of small streams that drain the Project area. In particular, the swamps of the Project area could potentially support all three of the aforementioned “species at risk”. Table F1 in Appendix F provides information on the rare species which were identified as potentially present during the modeling exercise.

All vascular plants encountered during the surveys were identified to species (when possible) and their population statuses in Nova Scotia were determined through a review of the species status reports prepared by NSDNR (NSDNR 2007a), ACCDC (ACCDC 2009), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2009), and Species at Risk in Nova Scotia (NSDNR 2007c). No “at risk” species, as identified by COSEWIC or the provincial *Endangered Species Act* were found during the surveys, despite the timing of the field visit being ideal for identifying those that were highlighted by the modeling exercise. Two species that are considered sensitive by NSDNR, and are therefore of conservation concern, were encountered within the Project area (both of these were identified as target species by the modeling exercise). In addition, four species are assigned a ranking of “S3” by the ACCDC indicating that they are uncommon within the province. A list of the 214 vascular plant taxa found on the site during field surveys is provided in Appendix G.

Yellow nodding ladies'-tresses (*Spiranthes ochroleuca*) is considered sensitive by NSDNR and is assigned a ranking of “S2” by the ACCDC indicating that it is rare throughout its range in the province. Within Nova Scotia, yellow nodding ladies'-tresses are typically associated with the dry sand barrens in southwestern counties but are also found in other habitats such as roadsides and fields, as well as along rivers (Zinck 1998). Within the Project area, several individuals of this species were observed (Figure 3) within the sandy –clay substrate provided by a spoil bank above a ditch. In addition, individuals which had intermediate characteristics between this species and the more common nodding ladies’-tresses (*Spiranthes cernua*), to

which it resembles (and which was also found within the Project area) were made at several other locations - although these populations likely reflect hybridization between the two taxa, they were considered to be *S. cernua*, based on expert recommendation (Hinds 2000). According to the ACCDC data search, the closest recorded population of yellow nodding ladies'-tresses is 3 km away from the Project area and two more have been recorded within 20 km. Two of these occurrences have been associated with anthropogenic habitats, including the sandy edge of a campsite and a gravely roadside edge. Because yellow nodding ladies'-tresses are associated with habitat conditions that are often promoted by quarry activities, the Project is not expected to cause a significant adverse affects to its population.

Boreal American-aster (*Symphyotrichum boreale*) is considered sensitive by NSDNR and is assigned a ranking of “S2?” by the ACCDC indicating that it is rare throughout its range in the province, but that there is uncertainty regarding its population status. Within Nova Scotia it is associated with the gravelly soil of lake beaches, along streams and the edges of bogs (Zinck 1998). Within the Project area, a population of more than 10 individuals of boreal American-aster was encountered within a cut-over treed swamp (WL13, Figure 3). According to the ACCDC data search, the closest recorded population of boreal American-aster is approximately 11 km from the Project area, and two more are located within 20 km.

Although not considered sensitive or at-risk by NSDNR, the populations of woods-rush (*Juncus subcaudatus*) and highbush blueberry (*Vaccinium corymbosum*) are ranked “S3” by the ACCDC indicating that are uncommon within the province. NSDNR considers the populations of highbush blueberry to be secure (Green listed) within the province whereas the status of woods-rush is currently undetermined. Woods-rush is typically associated with wet woods and swamps of the province (Zinck 1998) and was encountered within two swamps of the Project area (WL10 and WL13). Highbush blueberry is associated with a variety of habitats within the southwestern part of Nova Scotia, including bogs, upland barrens, wet pastures, and lakeshores (Zinck 1998). Within the Project area it was an important component of the shrub cover within some regenerating upland forest stands and was also common amongst the wetlands. Both of these species (as well as several other “Green” listed taxa encountered in the Project area) are members of coastal plain flora.

5.3.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

The Project has the potential to influence the populations of several of the rare or uncommon plant species as a result of direct habitat loss and indirectly through changes in habitat conditions, such as may be brought about by altered hydrological regimes. Of greatest concern are the populations of yellow nodding ladies'-tresses and boreal American-aster, both of which are considered “sensitive” within the province. However, because yellow nodding ladies'-tresses are associated with the dry sandy substrates that are often promoted by quarrying activities, its population is not likely to be negatively affected by the Project. The local population of boreal American-aster has the potential to be negatively affected by Project activities that result in the direct loss of its wetland habitat through infilling or indirectly through hydrological alterations. If such activities are unavoidable, a contingency plan will be developed in association with

NSDNR to mitigate the effects of the Project on this species. The Project footprint has been reduced from that originally planned to reduce the loss and degradation of wetlands. That is, the southern portion of the Project area, which encompasses WL10 to WL15, will be set aside as a wetland conservation zone. See Section 5.5.2 and revised Figure B1 in Appendix B. Similarly, a 10 m buffer will be established around the known population of nodding ladies'-tresses. It is not expected that Project activities will cause a significant adverse effect on the populations of woods-rush or highbush blueberry, and as such, specific mitigative measures are not necessary for these species.

The late-summer plant survey was appropriate for identifying the majority of rare or sensitive taxa highlighted during the rare plant modeling exercise. In particular, the field survey would have been ideal for identifying all of the federally and/or provincially listed “species-at-risk” which were highlighted during the modeling exercise as being potentially present within the Project area. However, an additional plant survey will be conducted in the spring / early summer of 2010 to target those species which are more readily identified early in the growing season. This survey will focus on plants identified in Table F1 of Appendix F.

Standard mitigative measures to minimize the environmental effects of the Project on plant communities include the use of seed mixtures free of noxious weeds during site reclamation. Wherever practical, native plants should be used for site reclamation. In lieu of native species, seed mixes containing naturalized species which are well established in Nova Scotia and which are not aggressive weeds in the wetland and forest plant communities present in the area should be used for reclamation.

In summary, assuming recommended mitigative measures (including follow-up surveys); significant Project-related effects on rare and sensitive flora are not likely to occur.

5.4 WILDLIFE

5.4.1 Description of Existing Conditions

Information regarding use of the Project area by wildlife was derived from several sources including field surveys and review of existing data. Wildlife field surveys were conducted along with plant surveys during August 25 – 27', 2009. During these surveys, information was collected regarding the presence of birds, mammals and herpetiles (amphibians and reptiles). An ACCDC data search was conducted to determine if any rare or sensitive wildlife species have been recorded in the vicinity of the Project area. The ACCDC data were incorporated into a wildlife model to determine the likelihood that rare or sensitive wildlife species might inhabit the Project area. As part of the modeling exercise, all records of wildlife species listed by NSDNR as at risk (Red listed) or sensitive to human activities or natural events (Yellow listed) (NSDNR 2007a) within a radius of 100 km were compiled. The habitat requirements of these species were compared to the habitat descriptions compiled for the Project area to determine if suitable habitat was present for these species. In instances where appropriate habitat was present for a particular species, it was considered to be potentially present. The potential habitat

of any rare or sensitive wildlife species was identified as a target for field surveys. Additional references, such as the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992, MBBA 2009), Amphibians and Reptiles of Nova Scotia (Gilhen 1984), and the Nova Scotia Significant Habitat Mapping Database (NSDNR 2007b) were also consulted to provide records of wildlife in the vicinity of the Project area and to help direct field surveys.

The Project area has moderate wildlife habitat diversity. Due to extensive tree harvesting activities, most of the Project area is currently at an early stage of successional development. Small pockets of mixedwood and coniferous immature-mature forest stands exist, particularly towards the edges of the Project area. Whereas much of the early successional forest is naturally regenerating, some areas have been subject to silviculture activities, particularly plantings and PCT. The Project area supports an abundance of swamps, most of which have also been subject to extensive forestry activities and are at an early stage of successional development. Some remnants treed swamps are still present however, and include both mixedwood and coniferous treed types. Surface water within the wetlands is generally restricted to small pools and channels. Additional habitats found within the Project area include those provided by a small anthropogenic pond, watercourses, and the anthropogenically disturbed areas associated with present quarry operations.

Birds

Due to the site visit taking place in late summer, a complete breeding bird survey of the Project area was not performed. Instead, bird observations were limited to casual observations made during the botanical survey. The population status of all bird species encountered during the site visit were assessed using information from COSEWIC (2006), Species at Risk in Nova Scotia (NSDNR 2007c), the General Status of Wildlife in Nova Scotia (NSDNR 2007a), and the ACCDC database (ACCDC 2009).

The Maritimes Breeding Bird Atlas (MBBA) database (MBBA 2009) provides information on the distribution and abundance of birds across the Maritime Provinces of Canada. The MBBA square in which the Project is located (# 19GJ36) as well as those immediately adjacent to it (#'s 19GJ37, 20KP67, and 20KP66) were used to determine which species may be expected in the Project area and their breeding status. The breeding status of each species was determined from the criteria used in the MBBA (Erskine 1992). "Possible" breeders are generally those birds that have been observed or heard singing in suitable nesting habitat. "Probable" breeders are those birds that have exhibited any of the following: courtship behavior between a male and female; visiting a probable nest site; displaying agitated behavior; and/or male and female observed together in suitable nesting habitat. "Confirmed" breeders are those birds that exhibited any of the following: nest building or adults carrying nesting materials; distraction display or injury feigning; recently fledged young; occupied nest located; and/or adult observed carrying food or fecal sac for young. In addition, the population status of each bird species identified in the MBBA square was assessed using information from the General Status of Wildlife in Nova Scotia (NSDNR 2007a), Species at Risk in Nova Scotia (NSDNR 2007c), and

the ACCDC database (ACCDC 2009). The status of nationally rare species was obtained from COSEWIC (2009).

A total of 52 bird species have been recorded in the atlas squares for the Project area and nine were identified during the field visit. Of the taxa recorded by the MBBA, the breeding status of five has been confirmed, 16 identified as probable, and 26 have been classified as possible. An additional five species have been observed within the breeding bird atlas squares which exhibited no indication of breeding. Species identified during the field visit include ruby-throated hummingbird (*Archilochus colubris*), turkey vulture (*Cathartes aura*), cedar waxwing (*Bombycilla cedrorum*), eastern wood-pewee (*Contopus virens*), common raven (*Corvus corax*), swamp sparrow (*Melospiza georgiana*), blue jay (*Cyanocitta cristata*), common yellowthroat (*Geothlypis trichas*), and black-capped chickadee (*Poecile atricapillus*). Two of these species (cedar waxwing and black-capped chickadee) were classified as possible breeders whereas no indication of breeding was observed for the others. Three of the taxa identified during the site visit (ruby-throated hummingbird, turkey vulture, and cedar waxwing) had not been recorded within the MBBA squares. Appendix H lists all bird species identified within the breeding bird atlas square and the field surveys as well as their associated breeding status.

The populations of all bird species encountered during field surveys are considered secure (Green listed) within the province (NSDNR 2007a) except for turkey vulture which is regarded as an accidental. A single turkey vulture was observed flying over the Project area during the field survey. Turkey vultures are not known to nest within the province but are instead rare visitors from more southern and/or western localities. Therefore, although uncommon within the province, they are generally not considered of conservation concern.

Of the species identified by the MBBA, the populations of three are considered sensitive, 46 are secure, and three are exotic (NSDNR 2007a). Those species whose populations are considered sensitive to human activities or natural events include common loon (*Gavia immer*), barn swallow (*Hirundo rustica*), and gray jay (*Perisoreus canadensis*), all of which are regarded as possible breeders by the MBBA. Common loons are associated with large areas of open water including lakes and occasionally large rivers, and nest on small islands which are safe from predators. Barn swallows are typically found in farming districts where they build their nests in or on the outside of buildings such as barns. Due to the absence of appropriate common loon and barn swallow habitat within the Project area, it is very unlikely that they occupy the area. Gray jays are fairly common in coniferous woodlands of Nova Scotia where they build their nests in spruce or fir trees. Although the Project area would provide potential gray jay habitat, extensive tree harvesting operations have limited its availability, and it is unlikely that the area serves as important breeding habitat for this taxa. Because of the low likelihood that the aforementioned species inhabit the Project area, it is not expected that Project activities will cause significant adverse affects to any of their local populations.

The ACCDC modeling exercise identified a total of 17 Red or Yellow-listed avian species that have been recorded within 100 km of the Project site. Of these, seven species are considered “at risk” by COSEWIC (2009) or the Province of Nova Scotia (NSDNR 2007c). These include

short-eared owl (*Asio flammeus*), Barrow's goldeneye - eastern pop. (*Bucephala islandica*), Bicknell's thrush (*Catharus bicknelli*), rusty blackbird (*Euphagus carolinus*), harlequin duck (*Histrionicus histrionicus*), red knot rufa ssp. (*Calidris canutus rufa*), and roseate tern (*Sterna dougallii*). The remaining taxa identified by the ACCDC data search are all Yellow listed by NSDNR (2007a) and include northern goshawk (*Accipiter gentilis*), razorbill (*Alca torda*), brant (*Branta bernicla*), purple sandpiper (*Calidris maritima*), bobolink (*Dolichonyx oryzivorus*), Atlantic puffin (*Fratercula arctica*), black-crowned night-heron (*Nycticorax nycticorax*), eastern bluebird (*Sialia sialis*), common tern (*Sterna hirundo*), and arctic tern (*Sterna paradisaea*). In addition, although Green listed by NSDNR, whip-poor-will (*Caprimulgus vociferous*) is considered Threatened by COSEWIC and has been recorded approximately 100 km from the Project area. Only one of the species identified during the ACCDC data search, rusty blackbird, was highlighted by the modeling exercise as being potentially present within the Project area.

Rusty blackbird is considered of special concern by COSEWIC (2009) and is regarded as sensitive by NSDNR (2007a). Additionally, it is ranked as “S3B” by the ACCDC which indicates that it is an uncommon breeder within the province (ACCDC 2009). According to the ACCDC data search, the closest recorded population of rusty blackbird is approximately 16 km from the present Project area. During the breeding season, rusty blackbirds are typically associated with forest wetlands, such as slow-moving streams, peat bogs, sedge meadows, marshes, swamps, beaver ponds and pasture edges. In winter, this species primarily occurs in damp woodlands and cultivated fields. The primary cause of habitat loss for this species is the conversion of wetlands for agriculture and urban development (COSEWIC 2006). Many of the wetlands located within the Project area would provide potentially suitable habitat for this species. However, rusty blackbird observations are typically made in areas that are well removed from human activities. Due to extensive and ongoing anthropogenic activities within the Project area it is unlikely that this species currently occupies the site.

The Project area does not provide suitable habitat for any of the other provincially or federally designated “species at risk” that have been recorded within 100 km of the site. Red knot, roseate tern, Barrow's goldeneye, and harlequin duck are all associated with marine coastal habitats and could therefore not be supported by the Project area which is approximately 10 km’s from the ocean. The forest conditions of the Project area are not suitable for Bicknell's thrush which is confined to high-elevation regenerating clear-cuts and coastal areas with spruce-fir forests within the province. The regenerating forests which dominate the Project area would be unsuitable for the short-eared owl which occupies open, grassy areas of the province. Additionally, whip-poor-will is unlikely to occupy the Project area as it is associated with open deciduous or mixed forests. Similarly, habitat conditions are not suitable for any of the additional Yellow-listed species listed by the ACCDC as being within 100 km of the Project area.

A large Ducks-Unlimited wetland complex is immediately adjacent to the eastern end of the Project area and is recognized as important migratory bird habitat. This wetland complex receives input from watercourses that drain the Project area.

Mammals

Mammal observations were recorded concurrently with the botanical inventory during August of 2009. The field surveys provide a good indication of the presence of large mammal species in the Project area. Knowledge of the distribution of small mammals in the Project area is limited by their secretive nature. Fortunately, many small, rare mammals have very specific habitat requirements which can be used to predict areas where they are likely to be found.

The mammals recorded in the Project area are generally typical of upland habitats. Evidence of the following species was recorded during the field surveys: North American porcupine (*Erithizon dorsatum*), snowshoe hare (*Lepus americanus*), meadow vole (*Microtus pennsylvanicus*), white-tailed deer (*Odocoileus virginianus*), and red squirrel (*Tamiasciursus hudsonicus*). None of these species are Red or Yellow listed, or considered “at risk” by provincial or federal sources.

A total of six Red or Yellow-listed terrestrial mammal species have been recorded within 100 km of the Project area. Of these, three species are considered “endangered” by the province, including the mainland moose (*Alces americanus*), Canada lynx (*Lynx canadensis*), and American marten (*Martes americana*). These species are also Red listed within Nova Scotia and are assigned an ACCDC ranking of “S1” indicating that they are extremely rare throughout their range. The remaining three species are yellow listed by NSDNR and include southern flying squirrel (*Glaucomys volans*), fisher (*Martes pennant*), and eastern pipistrelle (*Perimyotis subflavus*). It is unlikely that the Project area provides important habitat for any of these species.

Moose are commonly associated with wilderness boreal and mixedwood habitats. Their preferred food are the twigs, stems and foliage of young deciduous trees and shrubs, as may be found within forest landscapes recently disturbed by fire, wind, disease or timber harvesting activities. In summer, moose prefer habitats interspersed with wetlands that allow access to submergent and emergent aquatic vegetation. Landscapes which support recently disturbed mixed forests for food and adjacent mature conifer cover for escape and shelter are preferred in winter. The Project area is located approximately 30 km from two core moose distribution areas, the Tobeatic and the Pubnico (Parker 2003) and the closest observation of moose is approximately 23 km away. Although the lack of intact forest stands within the Project area would prevent it from providing shelter for moose which may stray from the core distribution areas, the regenerating forests which dominate the Project area could offer some suitable browsing habitat. However, most of the regenerating forest of the Project area is dominated by coniferous saplings and ericaceous shrubs, and thus browsing opportunities are not ideal. No evidence of moose activity was observed during the field surveys. In summary, it is highly unlikely that the Project area provides habitat for moose.

Within Nova Scotia, Canada lynx live deep in coniferous forests near rocky areas, bogs and swamps. Although the lynx may have historically occupied southern parts of the province, it is now restricted to the Cape Breton Highlands and to areas of higher elevation in central and eastern Cape Breton (Parker 2001). The single ACCDC record of Canada lynx was 66 km from

the Project area and was made in 1978. Due to the absence of this species from southwestern Nova Scotia, it would be unlikely to utilize the Project area.

American marten prefer habitat containing large contiguous patches of mature softwood or mixedwood forest although mature hardwood forest is used as winter habitat in some portions of their range. In Nova Scotia, two distinct populations have been identified, one in the Cape Breton highlands and one in southwestern Nova Scotia. It is believed that the mainland American marten population is derived from New Brunswick individuals that were released in Kejimkujik National Park, and the current status of this population is considered "data deficient" (Nova Scotia American Marten Recovery Team 2006). The nearest known sighting of this species was made at approximately 19 km from the Project area. Due to extensive forest harvesting in recent years, the Project area provides very poor American marten habitat and it is unlikely that the Project will interact with this species.

Southern flying squirrels are considered sensitive within Nova Scotia and are ranked as "S2S3" by the ACCDC indicating that they are rare to uncommon throughout the province. Within Nova Scotia, they are restricted to southwestern counties where they are typically associated with pine and hardwood stands that provide suitable foraging and nesting habitat. The closest observation of this species to the Project area is 69 km away. Due to the absence of suitable forest stands within the Project area, it would not provide important habitat for the southern flying squirrel.

Fishers are considered sensitive within Nova Scotia and are ranked as "S2" by the ACCDC indicating that they are rare within the province. Fishers prefer large tracts of mature coniferous or mixedwood forest. However, they are somewhat adaptable and will also make use of second growth forests. Fishers have large home ranges and typically travel along regular hunting circuits that may be as much as 100 km long. These hunting circuits generally encircle their home range which may be up to 16 km in diameter. Fishers are relatively shy animals and typically inhabit areas remote from human habitation; however, there are reports of fishers moving into areas occupied by humans such as suburban areas. According to the ACCDC data, a single fisher observation has been made at approximately 100 km from the location of the Project. Due to lack of intact forests stands within the Project area and the absence of nearby populations, it is unlikely that the Project will interact with this species.

Eastern pipistrelles are considered sensitive within Nova Scotia and are ranked as "S1?" by the ACCDC indicating that they are extremely rare within the province, but that there is some uncertainty regarding their population status. They typically hibernate in cave walls or ceilings where there is minimal airflow. During summer, the sexes live separately; males are often solitary while females form small maternity colonies of 35 individuals or less in buildings, tree cavities, and rock crevices. The eastern pipistrelle forages along forest edges and over ponds and waterways for small insects, such as leafhoppers, ground beetles, flies, small moths, and flying ants. The single ACCDC record of eastern pipistrelle within the study area was approximately 80 km from the Project area. No hibernaculum sites are known in close proximity to the Project area and the provincial mineral resources land-use map indicates that the closest

abandoned underground mine openings are approximately 12 km away (NSDNR 2006a). Although the Project area could provide some foraging opportunities for eastern pipistrelles during the summer, it is not likely that the Project will have an important interaction with this species due to its distance from known or potential hibernaculum sites.

A review of the NSDNR significant habitat mapping database (NSDNR 2007b) did not reveal the presence of any rare or sensitive mammal species within the Project area or critical habitat such as deer wintering areas. In addition, all of the habitats present within the Project area are commonly encountered throughout the province and are unlikely to provide habitat for rare small mammal species.

Herpetiles

Information regarding amphibians and reptiles within the Project area was also collected during the field surveys. Field surveys were conducted concurrently with the botanical inventory during August of 2009.

Six herpetile species were encountered during the surveys, including five amphibians and one reptile. All amphibians were observed within the wetlands of the Project area and include yellow-spotted salamander (*Ambystoma maculatum*), American toad (*Bufo americanus*), spring peeper (*Pseudacris crucifer*), green frog (*Rana clamitans*), and pickerel frog (*Rana palustris*). The single reptile observed, smooths green snake (*Liochlorophis vernalis*), was found in an upland cut-over area. The populations of all of the herpetiles observed within the Project area are considered secure within the province and are ranked as “S5” by the ACCDC indicating that they are common.

A review of the ACCDC data search and *Amphibians and Reptiles of Nova Scotia* (Gilhen 1984) indicate that three rare herpetiles, Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), and the Atlantic population of the eastern ribbon snake (*Thamnophis sauritus* pop. 3) have been recorded within the study area. All of these herpetiles are considered “species at risk” by both COSEWIC and the Province of Nova Scotia.

Blanding’s turtle is listed as endangered under both SARA and the Nova Scotia *Endangered Species Act.* In addition, it is Red-listed by NSDNR and ranked as “S1” by the ACCDC indicating that they are extremely rare within the province. This species is typically found in still-water streams, swamps, marshes and bogs in south central Nova Scotia. Blanding’s turtles prefer water bodies with slow flowing water and muddy bottoms that support dense aquatic vegetation. Between early June and early July female Blanding’s turtles move to gravelly or sandy lake shores to lay their eggs. In the fall, Blanding’s turtles move to aquatic habitats where they hibernate underwater. The nearest known record of Blanding’s turtle is approximately 68 km from the current Project area. Although the Project area has an abundance of wetlands and several streams, the surface water characteristics of these habitats are not ideal for Blanding’s turtle. Although some summer foraging and hibernation habitat could be provided by the slow-moving portions of the watercourses located in the wetlands, there are

no lakes in the Project area that would provide suitable beach nesting sites. The Project area is also located outside of the known range of Blanding's turtle which is restricted to the Mersey and Medway watersheds (The Blanding's Turtle Recovery Team 2003). As such, it is unlikely that this species would be found within the Project area.

Wood turtles are considered threatened under SARA, vulnerable under the Nova Scotia *Endangered Species Act*, are ranked as S3 (uncommon) by the ACCDC, and are regarded as sensitive (*i.e.*, Yellow listed) by NSDNR. The nearest known record of wood turtle is approximately 63 km from the Project area. Wood turtles are typically associated with watercourses and the riparian habitats associated with them. They nest on sandy or gravelly river banks but will also make use of features such as sand pits and road embankments near water courses that provide a sandy or gravelly substrate. Deep pools in larger rivers are often used as hibernaculum sites during the winter. Riparian habitats along watercourses are typically used as feeding sites. Despite the presence watercourses within the Project area, the presence of wood turtles is considered unlikely. The lack of sandy banks along the watercourses limits nesting opportunities for the wood turtle and the shallow water depths are not suitable for hibernaculum sites. Furthermore, they have not been recorded within the Tusket River Watershed, within which the Project area is located (MacGregor and Elderkin 2003).

The eastern ribbon snake is listed as a threatened species under SARA and the Nova Scotia *Endangered Species Act*. In addition, it is regarded as sensitive by NSDNR and is assigned a ranking of "S2S3" by the ACCDC indicating that it is rare to uncommon within the province. This species is associated with sluggish streams, marshes, swamps, bogs and lake shores and are typically found within 30 m of open water. They prefer areas that have a heavy cover of aquatic vegetation that provides cover for them and the amphibians and small fish that they feed on. The nearest known record of eastern ribbon snake is approximately 67 km from the Project area. Some potential northern ribbon snake habitat is present within the wetlands of the Project area through which the watercourses flow. However, the Project area is located outside of the known range of eastern ribbon snake in Nova Scotia and as such the probability that this species is present is very low (Smith 2002).

5.4.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

Migratory birds are protected under the *Migratory Birds Convention Act* (MBCA). As such, it is illegal to kill migratory bird species not listed as game birds or destroy their eggs or young. Other bird species not protected under the federal Act, such as raptors, are protected under the provincial *Wildlife Act*. In order to avoid contravening these regulations, clearing of areas to be used for the Project will be conducted outside of the breeding season of most bird species (April 1 to August 1) so that the eggs and flightless young of birds are not inadvertently destroyed. If clearing has to occur during the breeding season, a contingency plan will be applied including nest surveys and exclusion of activities from active nesting areas to ensure compliance with MBCA.

The field surveys did not reveal the presence of any rare or sensitive bird species within the Project area. Due to the unavailability of appropriate habitat, it is unlikely that any provincially or federally designated “species at risk”, or other rare or sensitive birds would be found within the Project area. A breeding bird survey will be completed in the spring of 2010 to identify any additional mitigation that may be required; however the general mitigation for compliance with MBCA should be sufficient to protect breeding species. Although an important migratory bird habitat is located immediately east of the Project area, Project activities are to proceed in a westerly direction from the current extent of quarry activities. As such, encroachment into this habitat will be avoided.

The field surveys did not reveal the presence of any rare or sensitive mammal or herpetile species within the Project area. Furthermore, none are expected to inhabit the Project area due to lack of favorable habitat conditions and/or limitations in range distributions. Furthermore, the habitats present in the Project area are common throughout the province and are unlikely to provide habitat for rare small mammal species. No critical areas for mammals such as deer wintering areas or critical herpetile habitats are known to exist within the Project area.

As discussed in Section 5.3.2, the Project footprint has been revised to reduce the loss and degradation of wetlands. That is, the southern portion of the Project area will be set aside as a wetland conservation zone (refer to Figure B1 in Appendix B), and will therefore also protect wildlife habitat.

In summary, assuming recommended mitigative measures are applied (*i.e.,* to ensure compliance with MBCA), significant Project-related effects on wildlife are not likely to occur.

5.5 WETLANDS

5.5.1 Description of Existing Conditions

Fifteen wetlands are found within the Project area (Figure 4), all of which are swamps as recognized by the Canadian Wetland Classification System (Warner and Rubec 1997). None of these are depicted by the NSDNR Wetland Atlas mapping; but have been identified and delineated during field surveys conducted August 25 – 27, 2009.

Swamps are mineral wetlands or peatlands with standing water or water flowing slowly through pools or channels. The water table is generally at or near the surface of the swamp. There is internal water movement from the margin of the swamp or from other sources of mineral enriched waters. If peat is present, it consists mainly of well-decomposed wood, underlain at times by sedge peat. The vegetation typically consists of a dense cover of trees or shrubs, herbs and some mosses.

Table 5.3 Wetlands within the Project Area and Information on their Class, Form, Vegetation Type and Size

Wetland #	Class and Form(s)	Vegetation Type(s)	Size of wetland within Project area (ha)	Size of wetland outside of Project area (ha)
1	Basin swamp	Tall shrub / mixed treed	0.11	0.00
2	Basin swamp	Low shrub	0.07	0.00
3	Basin swamp	Tall shrub	0.12	0.00
4	Drainageway swamp	Tall shrub / mixed treed	0.10	0.10
5	Drainageway swamp	Tall shrub / mixed treed	1.54	0.00
6	Basin swamp	Graminoid (cut-over)	0.08	0.00
7	Basin swamp	Mixed treed	0.23	0.14
8	Basin / drainageway swamp	Mixed treed	0.30	0.00
9	Basin / drainageway swamp	Graminoid (cut-over)	0.43	0.00
10	Basin / drainageway swamp	Graminoid (cut-over) / mixed treed / coniferous treed	2.93	>0.10*
11	Basin / drainageway swamp	Graminoid (cut-over) / mixed treed	0.45	0.00
12	Riverine swamp	Mixed treed	0.11	0.00
13	Basin / drainageway swamp	Graminoid (cut-over) / mixed treed	0.85	0.69
14	Basin / riverine swamp	Graminoid (cut-over) / mixed treed	0.60	0.34
15	Riverine swamp	Mixed treed	0.01	0.31

*The full extent of Wetland 10 outside of the Project area was not delineated

Wetland Forms and Hydrological Character

The swamps found within the Project area include basin, riverine, and drainageway forms (Table 5.3), as identified in the Canadian Wetland Classification System. Basin swamps occur in topographically defined basins where the water is derived locally and by drainage from other parts of the watershed. Drainageway swamps have a sloping surface and are found in confined drainageways or water tracks. Water movement is generally as unilateral sheet flow but intermittent channels are often present. Riverine swamps occur on the banks of permanent or semi-permanent streams. The high water table within these wetlands is maintained by the level of water in the stream which floods during periods of high precipitation. Some of the wetlands of the Project area are complexes comprised of multiple wetland forms. Distinguishing individual wetland forms within such complexes is often challenging as a result of their gradation and interspersion. This is true for many of the wetland complexes within the Project area. As such, the wetland forms presented in Table 5.3, are meant to help convey the general hydrological and physical character of the wetlands, but are not necessarily identified in the field as discrete units.

Surface water within the wetlands was generally low (< 5 %) and confined to small pools (<5 m^2), such as may be found in basins or along drainage channels running through the swamps. Of exception, Wetland 3 had a large surface water pool (~ 40 m^2) and Wetland 2 was extensively covered (~40 %) by very shallow surface water (~ 10 cm deep) at the time of

visitation. Water coverage within the wetlands would fluctuate considerably, especially after periods of high precipitation or snowmelt.

Vegetative character

Vegetation types are derived from those outlined by the Canadian Wetland Classification System and is based on the general physiognomy of the dominant vegetation. Those identified within the Project area include mixed treed, coniferous treed, tall shrub, low shrub, and graminoid (cut-over) vegetation types. Wetland types are identified by combining these with wetland class and form (*e.g.,* mixed treed basin swamp). Many of the wetlands within the Project area are considered wetland complexes due to having multiple forms and/or vegetation types. Descriptions for each of these vegetation types within the Project area are provided (as previously described in Section 5.3).

Mixed treed swamp habitats have a moderate tree canopy formed predominantly by red maple and balsam fir, although American larch and black spruce are also common. These tree species are also important contributors to a moderate shrub layer, along with narrow-leaved meadow-sweet, bristly dewberry, sheep-laurel, highbush blueberry, and black holly. Herbaceous cover is primarily provided by graminoids and ferns, particularly three-seed sedge, fowl manna-grass, cinnamon fern, New York fern, soft rush, and eastern hay-scented fern. A number of forbs are also common, particularly swamp loosestrife and hybrid white panicled American-aster. Peatmoss coverage is extensive throughout this habitat.

In addition to the mixed treed swamp habitat previously described, areas with extensive mannagrass coverage are present. These patches are characterized by a continuous cover of northern mannagrass and/or fowl mannagrass under an intermittent tree cover. The abundance of other herbaceous taxa within this habitat is low, but soft rush, rough-leaf goldenrod, blue-joint reedgrass, and swamp loosestrife are present. Shrub cover within this vegetative community is almost exclusively comprised of the low-lying bristly dewberry, although a number of other species are scattered about in low abundance. This community type was extensive within basins of Wetland 10, but was also expressed within Wetlands 5, 11, 13, and 14.

Pockets of coniferous treed swamp have an overstory comprised predominantly of black spruce, with lesser amounts of American larch and red maple being present. Shrub coverage is very minimal and includes scattered occurrences of tree species and sheep-laurel. Herbaceous coverage is primarily comprised of graminoids, particularly three-seed sedge and northern mannagrass. This habitat-type has a well developed moss layer comprised of a mixture of peatmoss and red-stemmed moss.

Tall shrub swamp is found amongst wetlands where tree regeneration following harvesting operations is advanced and / or where forestry operations have acted in a selective manner (*i.e.,* overstory canopy removed but smaller trees uncut). Although scattered occurrences of red maple, black spruce, American larch, and balsam fir provide some tree coverage, these species mostly contribute to the well-developed shrub layer that characterized this habitat type. Other

common shrub species includes narrow-leaved meadow-sweet, bristly dewberry, highbush blueberry, heart-leaved paper birch, possum-haw viburnum, and sheep-laurel. An extensive herbaceous layer is comprised of a diversity of species, particularly soft rush, New York fern, cinnamon fern, cottongrass bulrush, parasol white-top, fowl manna-grass, and three-seed sedge. Peatmoss and hair-cap moss are the dominant bryophytes within this habitat.

Low-shrub swamp found within the Project area is dominated almost exclusively by large cranberry and blue-joint reedgrass. Other herbs scattered about this habitat include cottongrass bulrush, soft rush, and marsh St. John's-wort. Peatmoss is also an important component of this habitats vegetation.

The graminoid (cut-over) vegetation type is an early successional stage resulting from recent tree harvesting activities. Due to the prominence of forestry activities throughout the Project area, this vegetation type comprises an important component of many of the wetlands. Cottongrass bulrush is often the most dominant species within this vegetation type although a number of other graminoids, particularly fowl manna-grass, soft rush, and three-seed sedge are also common. Common forbs consist of cinnamon fern, new Belgium American-aster, northern bugleweed, swamp loosestrife, rough-leaf goldenrod, and New York fern. Overstory coverage is minimal within this vegetation type, but scattered occurrences of trees, particularly red maple, are present. An extensive low-lying shrub layer is provided by bristly dewberry whereas a number of regenerating trees and other shrub species are also present. Although varied, peatmoss forms an extensive carpet throughout the cut-over swamps.

The wetlands support several species with moderate to strong coastal plain affinity (*Glyceria obtusa, Carex bullata, Agalinis neoscotica, Juncus subcaudatus, Thelypteris simulata, and Vaccinium corymbosum*, among others). These vascular plants are diagnostic indicators of wet Coastal Plain Flora. Many species of Coastal Plain Flora, including those found within the Project area, are generally associated with open wetland ecosystem types (rather than those with well-established tree canopies) due to being poor competitors with other plants and being somewhat dependant on disturbance processes. As such, the ability of the treed wetlands within the Project area to provide habitat for coastal plain flora may not markedly increase with their successional development.

The plant species recorded in each wetland is presented in Table I1 in Appendix I.

Human Influences and Socio-Economic Value

Anthropogenic factors have had an important influence on the character of many of the wetlands in the Project area. The vegetation within many of the swamps is dominated by early-successional serial states as a result of extensive tree harvesting activities throughout the Project area. The boundaries of several of the wetlands have likely been influenced by past logging activities. In particular, old skidder trails appear to have opened new flow pathways in some of the wetlands and in doing so have caused an extension of their boundaries. Evidence for this type of altered drainage was observed in Wetlands 1, 9, 10 and 11. Some infilling of

wetlands has been performed to accommodate the roads which dissect the Project area. Wetlands 4 and 5, as well as 6 and 7 are dissected by abandoned roads and would likely have been contiguous prior to anthropogenic activities. Similarly, Wetlands 8 and 9 are currently separated by a gravel road used for access to the present quarry operation. Although they are no longer continuous, hydrological connectivity has been maintained through the use of culverts between Wetlands 4 and 5, and for 8 and 9. Apart from providing a source of merchantable wood, the swamps have little socio-economic value. No evidence of recreational use within the wetlands was observed during the field surveys.

Hydrological and Biogeochemical Functions

The swamps are moderately important for providing hydrological and biogeochemical functions. They contribute to surface water flow regulation by slowly releasing their stored water during dry periods, thereby augmenting the flow of watercourses. They may also help to reduce flooding by acting as a reservoir and by slowing surface flow when water levels are high. Many of the swamps may also help improve local water quality. In particular, several of the swamps at the southeastern end of the Project area are fed (at least in part) by streams or intermittent drainages that flow through the existing quarry (Wetlands 12, 14, and 15). Sediments or other contaminants carried by the surface waters could be retained within the swamps. Although wetlands are known to be quite efficient at removing sediment and metals from surface water, they are generally poor at retaining hydrocarbons, sodium and chloride ions. The ability of the swamps to provide such functions varies with their size and form. For example, Wetland 10 would be relatively important for providing hydrological and biogeochemical functions as a result of its large size and connectedness to other wetlands, waterbodies, and watercourses via the small streams that drain it. In contrast, many of the smaller basin swamps (Wetlands 1, 2, 3, 6, and 7) would have much less value for providing these functions.

Habitat Functions

A total of 140 vascular plant taxa were recorded within the wetlands of the Project area. Species richness within particular wetlands varied with their size and habitat diversity and ranged from 19 to 72 taxa. This level of diversity is not high and reflects; in part, relatively uniform environmental conditions throughout the wetlands. Exotic plants were rare within the wetlands and did not comprise an important component of any of their vegetative communities. Three provincially uncommon – rare plants were encountered within the wetlands. A population of >10 individuals of boreal American-aster was observed within Wetland 13. This species is considered sensitive by NSDNR (2007a) and is ranked as “S2?” by the ACCDC (2009) indicating that although rare within Nova Scotia, there is uncertainty regarding its present status. Woods-rush was located within two wetlands of the Project area (Wetland 6 and 10). Although the population of this species is considered secure by NSDNR, the ACCDC has assigned this species a ranking of “S3” indicating that it is uncommon. The population of highbush blueberry is also considered secure by NSDNR and is given a ranking of “S3” by the ACCDC. This species was recorded within eight of the wetlands (Wetlands 2, 3, 4, 5, 8, 9, 10, and 14) where it often comprised an important component of the shrub layer.

In general, the swamps are moderately important for providing habitat for wildlife. However, their ability to support a diversity of wildlife varies with their size and the availability of appropriate microhabitats, such as those formed by the pooling of surface water. Six bird species were identified within the swamps, including ruby-throated hummingbird, swamp sparrow, blue jay, common yellowthroat, and black-capped chickadee. However, the timing of the surveys was not ideal for identifying birds, and as such, many additional species are expected to be supported. Evidence of mammals was limited to three species: red squirrel, meadow vole, and North American porcupine, all of which are commonly associated with upland habitats and are not dependant on wetland conditions. Herpetiles were abundant within the swamps, with green frogs being particularly abundant. Spotted salamander, American toad, spring peeper, and pickerel frog were also observed. The ephemeral waters of all wetlands within the project area could provide some suitable herpetile breeding habitat. However, wetlands with watercourses running through them and other permanent surface water features (such as those located in the southern corner of the Project area) would support a higher diversity of breeding herpetile specie's and are therefore more valuable in this regard. None of the populations of wildlife species encountered in the wetlands are considered rare or sensitive within the province.

The different bird species recorded in each wetland is presented in Table I2 in Appendix I.

5.5.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

In Nova Scotia, wetlands are protected under the Activities Designation Regulations made pursuant to the provincial *Environment Act*. Any loss of wetland habitat either through direct infilling or indirectly through alteration of wetland hydrology requires preparation of a wetland evaluation to establish the functional attributes of the wetland. Wetland alteration also requires proponent application and regulatory approval prior to alteration. Approval will be sought progressively as the quarrying area expands, and applications will be submitted six months prior to any quarrying activity occurring that may impact wetland habitat. If NSE grants approval to infill or alter the hydrology of any wetland in the Project area, it will be necessary to develop a compensation plan to replace the wetland functions lost as a result of damage to or loss of the wetland.

Due to the nature of quarry activities, complete avoidance of wetlands within the Project area is not possible. The entire Project has the potential to result in the complete or partial loss of the 15 wetlands located within the Project extension area over the duration of the Project. Over the next ten years however, the quarry will extend towards the north and northeast directions therefore only disturbing two wetlands (refer to Figure B1 in Appendix B). In addition, the Project footprint has been revised to reduce the loss and degradation of wetlands. That is, the southern portion of the Project area, which encompasses WL10 to WL15, will be set aside as a wetland conservation zone (refer to Figure B1 in Appendix B).

The setting aside of the aforementioned conservation zone, coupled with on-site wetland compensation initiatives (discussed below) will reduce impacts of the Project on species of Coastal Plain Flora. Appropriate on-site coastal plain species will be used to help vegetate created wetlands, either through a propagation method or direct transplanting.

It should be noted that many species of Coastal Plain Flora including those found within the Project area are generally associated with open wetland ecosystem types (rather than those with well-established tree canopies) due to being poor competitors with other plants and being somewhat dependant on disturbance processes. As such, the ability of the treed wetlands within the Project area to provide habitat for Coastal Plain Flora may not markedly increase with their successional development.

As shown on Figure B1 in Appendix B, one option for compensation is to enhance, restore, or create wetland habitat on-site. There are many opportunities for on-site compensation, as there are a number of watercourses that can supply the hydrology needed to support created wetland habitat. Wetlands that may have been altered by previous quarrying activity would lend themselves well to enhancement. On-site compensation should be completed at the same time as wetland alteration, as the substrate of the altered wetland can be collected and used as a seed bank in newly created habitat.

Another compensation opportunity could involve creating off-site wetland habitat. In particular, there is a large wetland (Beaverdam Meadows) to the south-east of the Project site that is currently being managed by Ducks Unlimited Canada (DUC). There is likely an opportunity to provide support to DUC to further enhance this large wetland, or increase the functioning of the wetland.

Existing wetlands could also be indirectly influenced through changes in hydrology, nutrients, or sediment input. However, mitigative measures will be taken during Project activities to prevent cutting off any watercourses that flow into to the wetlands or see them become repositories of significantly increased water flow, nutrients, or sediments. This will be accomplished through the use of flow retention structures and energy dissipation measures.

In summary, assuming the application of proposed mitigation measures, including maintaining existing site drainage conditions and providing compensation for loss of wetland functions, significant Project-related effects on wetland functional attributes are not likely to occur.

5.6 GROUNDWATER RESOURCES

5.6.1 Description of Existing Conditions

Groundwater, an integral component of the hydrologic cycle, originates from percolation of rain, snowmelt, or surface water into the ground. This infiltrating water fills voids between individual grains in unconsolidated materials and fills fractures developed in consolidated materials. The upper surface of the saturated zone is called the groundwater table. The groundwater table intersects the surface at springs, lakes and streams where interaction between the groundwater

and the surface water environment can occur. Groundwater flows through soil and bedrock from areas of high elevation (recharge areas) to areas of low elevation (discharge areas) where it exits the sub-surface as springs, streams, and lakes. There is a dynamic interaction between groundwater resources and surface water resources in Nova Scotia. Groundwater generally sustains the base flow of springs, streams and wetlands during dry periods of the year. More rarely, surface water bodies can contribute to groundwater storage under specific hydrogeological conditions.

The groundwater yield of dug or drilled water wells can vary greatly, depending on the hydraulic properties of overburden or bedrock aquifers into which the wells are constructed. An aquifer is a geological formation or group of formations that can store or yield useable volumes of groundwater to wells or springs. Natural groundwater quality is directly influenced by the geochemical composition of the aquifer materials through which it passes, and the time the water resides within that material.

The groundwater resource is a VEC because it provides potable water supply to approximately half of the population of Nova Scotia, including almost all unserviced rural residences.

Spatial boundaries for the assessment of groundwater resources are based on a combination of the locations of the aquifers relative to the Project, aquifer hydraulic properties, expected groundwater flow directions, and the distance between the proposed quarry extension and wells that may be affected by quarry activities. For example, the area of influence or capture area of a typical low yield domestic water well is usually less than about 100 m, and generally in a direction hydraulically up-gradient of the well. A quarry that is excavated below the local groundwater table could be considered to behave like a large well, and groundwater draining into the quarry would influence water levels immediately surrounding the excavation to a distance proportional to the size of the quarry.

Project-related contamination (*e.g.,* accidental petroleum hydrocarbon spills from machinery or blasting chemicals) (*i.e.,* fuel oil and nitrate) could theoretically impact the groundwater at the quarry and potentially affect well water quality down gradient of the Project. However, most potential hazards should be contained within the quarry dewatering system.

Vibration damage to a drilled or dug well is generally a function of the distance between the energy source and the receptor well, and the seismic properties of the intervening aquifer materials. With respect to rock type, risk of water well damage is greater for fractured crystalline bedrock than for overburden wells or soft bedrock (*e.g.,* sandstone or shale) wells. Based on experience, the risk from blasting or major excavation is considered to be greatest within 50 m, moderate from 50 to 200 m, and minimal beyond about 200 m.

Vibration effects caused by blastings are conservatively considered for drilled wells within 800 m of the proposed quarry extension (*i.e.,* the minimum distance from structures allowed for blasting without owner permission specified by the NSE Pit and Quarry Guidelines). Potential effects of accidental spills are considered for all wells located hydraulically down gradient of the

proposed quarry extension. The extent of the area potentially affected is dependent on the size and type of release, surface drainage patterns and surficial geology, and can generally extend 200 m in sand and gravel, and typically up to 50 m in less permeable glacial till.

The following discussion of the local groundwater resources and hydrogeology in the vicinity of the Project is based on a desktop study using available mapping and databases, and does not include any water well inspection, groundwater sampling and analysis, or groundwater depth measurements. Specific well types and locations were not confirmed in the field.

Physiography and Drainage

The estimated 65 ha Project area is somewhat rectangular in shape with its longest dimension extending NW to SE. It is approximately 900 m long (northwest/southeast direction) and 740 m wide (southwest to northeast) at its longest and widest points. Figure 1 shows the local topography and drainage, as well as the present and proposed extended quarry outline, with the 800 m assessment boundary).

The topography of the Project area generally slopes downward towards the southeast, towards the Beaverdam Meadows wetlands. Elevations in the Project area range from approximately 50 m to 150 m above sea level.

Located within the East Tusket River watershed, the site is drained by a series of wetlands identified across the site, generally toward the southeast. Drainage continues southeast and south from the site towards the Beaverdam Meadows, which drain sequentially into Clover Hill Brook, a wetland leading into a series of lakes (Harris Lake, Salmon Lake, Pleasant Lake), and eventually into the East Tusket River.

Surficial Geology

The surficial geology in the Project area (Figure 5) consists of three stratigraphic units from the last glaciation and post glaciation. According to Stea, Conley and Brown, 1992, the two units that cover a majority of the Project area include stony till plain (ground moraine) deposits and recent organic deposits. The available mapping also shows the organic deposits covering a majority of the existing quarry area, and the ground moraine covering a majority of the proposed quarry extension area.

As shown in Figure 5, in the organic surficial deposits in the eastern portion of the Project area and in the vicinity of the existing quarry operations, consist of sphagnum moss, peat, gyttja and clay. Gyttja can be described as a fine-grained, nutrient-rich organic mud, or peat, deposited in lakes and ponds. Stony till plain or ground moraine deposits can be described as stony, sandy matrix material derived from local bedrock sources. Local glacial till thickness is unknown; however, based on the closest water wells between 375 m and 590 m from the Project, the overburden thickness appears to average 4 m (Table 5.4).

Project Features

- Project Properties
- Existing Quarry Footprint
- Project Extension Boundary
- 800m Buffer

Map Features

- Building/Structure
- Watercourse
- Waterbody
- Wetlands (NSGC & NSDNR)

Surficial Geology

Post Last Glaciation (Holocene)

- Alluvial Deposits - Gravel, sand, mud; bedded, coarse at base, finer at top, stream channels generally gravelly sand, floodplains sand
- Organic Deposits - Sphagnum moss, peat, gyttja, clay

Last Glaciation (Wisconsinan)

- Stony Drumlin (Drumlin Facies) - Siltier till due to erosion and incorporation of older till units by glaciers
- Stony Till Plain (Ground Moraine) - Stony, sandy matrix, material derived from local bedrock sources

Bedrock Geology

ORDOVICIAN - SILURIAN

- OSwv - White Rock Formation, bimodal tholeiitic-alkalic lavas and volcaniclastic rocks, 4500(?) m, at Yarmouth and Cape St. Mary Conformable-disconformable on Halifax Formation

MIDDLE ORDOVICIAN

- MOg - Middle Ordovician granite, granite (interpreted to be coeval with White Rock Formation volcanic rocks)

CAMBRIAN - ORDOVICIAN (MEGUMA GROUP)

- COMg - Goldenville Formation, sandstone turbidites and slate: continental rise prism (in places metamorphosed to schist and gneiss), >5600 m (U-Pb concordant zircon and detrital titanite ages near base and top of unit of 566+/-8 and 552+/-5 Ma(39) respectively
- COMh - Halifax Formation, slope-outer shelf slate, siltstone, minor sandstone and Fe-Mn nodules (in places metamorphosed to schist), 500->4400 m (Tremadocian graptolites and acritarchs)

Project No. - 1054351.

Scale - 1 : 15,000

0 250 500

Meters

Data Source:
- Base Data from NSGC 1997
- Bedrock Geology & Faults from DP ME 43, Version 2, 2006, Digital Version of Nova Scotia Department of Natural Resources Map ME 2000-1, Geological Map of the Province of Nova Scotia, scale 1:500 000, Compiled by J. D. Keppie, 2000
- Wetlands from NSGC (1997) & NSDNR 2007

DATE: February 04, 2010

PREPARED BY: G.MESHEAU

AP LTD.

Hardscratch Quarry Extension Project

Surficial/Bedrock Geology

FIGURE NO.: **Figure 5**

Stantec

Bedrock Geology

The Project area is underlain by the Middle-Ordovician aged granite unit, as shown on Figure 5 (Keppie, 2000). The Middle Ordovician granite is interpreted to be the same age as the younger White Rock Formation volcanic rocks, which are located directly west of the Project area. According to Keppie (2000), older Cambrian-Ordovician aged fractured crystalline rocks found to the east of the Project area, trending in the same northeast-southwest direction include the Halifax Formation and Goldenville Formation of the Meguma Group. The bedrock contact between the Middle-Ordovician granite unit and the older Halifax Formation is shown to be located within the 800 m project extension boundary to the east and south east of the existing quarry site.

According to Porter (1982), the granitic bedrock consists of granite, granodiorite, quartz and diorite, and are known to exhibit considerable variations in texture and composition, but are generally grey with biotite and smaller amounts of muscovite. Porter (1982) describes the Halifax formation in the Southwestern Nova Scotia area as predominantly thinly laminated, dark to light grey slate. The Goldenville formation consists mainly of greywacke, with small amounts of conglomerate, slate and argillite. The White Rock Formation overlies the Meguma Group and is typified by siltstones, conglomerates, silty shales and dark shales (Porter, 1982).

Hydrogeology/Groundwater

The regional groundwater flow patterns are expected to be southeast towards the wetlands and a series of lakes and rivers to the southeast and east. Due to its topographical location within this regional context, the Project is expected to lie within a local groundwater recharge area. Inference of the regional groundwater flow direction has been made based on topography.

Review of available mapping information was conducted to determine the probable locations of water wells within 800 m of the Project area. Figure 1 shows the locations of buildings in the vicinity of the Project area. In rural areas, each residence, farm or commercial property is assumed to have a dug or drilled water supply well.

A review of the NSE Pumping Test Database for Yarmouth County revealed pumping test information for five wells drilled between 1977 and 1978 completed in the granite aquifer. The average yields for these wells ranged from 5 to 100 igpm, mean 26 igpm, with pumping well transmissivities ranging 1 to 24 cubic m^3/day/metre drawdown, mean 6 m^3/day/m and 20 year safe yields ranging 3.5 to 78 igpm, mean 21 igpm.

A search of the Service Nova Scotia and Municipal Relations' Property Online database was conducted to determine address and property ownership information for these areas. The results of this search were used to match well logs from the Nova Scotia Environment (NSE) Well Drillers Database for wells constructed between 1967 and 2009, and to determine well construction information for groundwater wells within the Project Area. Water well records were retrieved for a total of five potable supply wells within a 2 km radius to the north, northwest and south of the Project Area along Pitman Road, Highway No. 340 and Hardscratch Road and in

the community of South Ohio. Two of the five wells identified were within 800 m of the Proposed Project Extension area.

Table 5.4, presents a summary of the available well log information for the five drilled wells identified within the vicinity of the Project area. The approximate locations of two wells identified within 800 m of the Project area (1389 Highway No. 340 and 2138 Hardscratch Rd) are shown on Figure 3.

Table 5.4 Summary of Domestic Water Well Records for the South Ohio, NS Area

	Well Depth (m)	Casing Length (m)	Estimated Yield (igpm)	Hydro-stratigraphic Unit	Overburden Thickness (m)	Estimated Distance from Project Area
NSE 000931 – 1389 Highway No. 340, RR2 Yarmouth, NS. Drilled 17-Oct-00	92.9	6.1	0.4	Granite	3.6	590 m northwest
NSE 971550 –2138 Hardscratch Road, Drilled 22-Nov-97	56.4	6.1	5.0	Conglomerate	4.3	375 m northwest
NSE 060998 – 1932 Hardscratch Road, South Ohio. Drilled 22-Nov-06	38.1	6.1	4.3	Granite	3.7	1100 m south
NSE 941804 – 1069 Highway No. 340, South Ohio. Drilled 19-Dec-94	38.1	10.7	7.5	Slate	4.9	1500 m east
NSE 921674 – 451 Pitman Road, South Ohio. Drilled 7-Jul-92	92.9	23.2	0.2	Shale	19.8	2000 m northwest
Minimum	38.1	6.1	0.2	-	3.6	-
Maximum	92.9	23.2	7.5	-	19.8	-
Geomean	58.9	8.9	1.7	-	5.6	-
Median	56.4	6.1	4.3	-	4.3	-
STD	27.7	7.4	3.1	-	7.0	-
Number	5	5	5	-	5	-

Note: Information was obtained from the Well Log Database including wells constructed between 1967 and 2009. STD = standard deviation; igpm = imperial gallons per minute; m = metres; NSE = Nova Scotia Environment Well Log Reference No.

The wells located at 1389 Highway No. 340 and 2138 Hardscratch Rd is situated within 800 m of the existing quarry and the proposed quarry extension. These wells are located northwest of the existing quarry and proposed extension area and are inferred by topography to be hydraulically upgradient of the Project. The well located at 1389 Highway No.340 is located approximately 590 m northwest of the project extension boundary and is reportedly 93 m deep, having 6.1 m of 158 mm diameter steel casing and an estimated air-lift yield of 0.44 igpm. According to the well driller's log, this well has approximately 3.6 m of overburden consisting of clay and boulders and is completed in granite bedrock. The well located at 2138 Hardscratch Rd. approximately 375 m northwest of the project extension boundary and is reportedly 56 m deep, having 6.1 m of 152 mm steel casing and an estimated air-lift yield of 5 igpm. According to the well driller's log, this well has approximately 4.3 m of overburden consisting of clay and is

completed in conglomerate. Average domestic well yields are expected to be low (<9 L/min) in this area.

The closest seasonal public water supply, Ellenwood Lake Provincial Park, located 2 km to the east of the Project has three water supply wells completed into the Goldenville aquifer. Constructed in 1965 and 1990, these 152 mm diameter wells range in depth from 59.4 m to 76.2 m, have 10.7 to 22.8 m of casing, and yield 0.5 to 15 igpm. The newer wells are situated in thick till deposits ranging in depth from 10.7 m to 19.8 m. Due to distance (2.1 km), intervening wetlands and drainage considerations, interaction between the Project and these wells is considered to be unlikely.

Water Quality

The water quality potential is determined from known water quality characteristics for each hydrostratigraphic unit, including naturally occurring water quality concerns such as hardness, arsenic, uranium, salinity, iron and manganese.

Porter (1982) completed a regional water resources study in 1979 which included collection and analysis of 24 groundwater samples from wells distributed across southwestern Nova Scotia to gain an understanding of the groundwater quality from the major hydrostratigraphic units. The following characterizes the expected water quality for the granite and Goldenville formations; however, too few samples were collected from the adjacent Halifax and White Rock formations to allow meaningful interpretation (Porter, 1982). Considering the Project area and extension area is underlain by the Middle Ordovician granite unit, the following provides a summary of the expected groundwater quality for the formation, along with Goldenville formation.

Wells completed in the Goldenville Formation can be expected to produce a calcium bicarbonate to calcium sulphate type groundwater of generally good chemical quality. Iron ranges from 0.03 to 1.1 mg/L (mean, 0.34 mg/L) and manganese ranges from 0.01 to 0.44 mg/L (mean, 0.19 mg/L). Hardness is low to moderate and ranges from 35 to 275 mg/L (mean, 84 mg/L). Total dissolved solids (TDS) range from 103 to 491 mg/L (mean, 191 mg/L). Alkalinity ranges from 40 to 132 mg/L (mean, 66 mg/L). The pH ranges from 5.2 to 8.2 (mean, 7.4).

Wells completed in granite appears to be calcium and sodium chloride to calcium and sodium bicarbonate type groundwater. Iron ranges from 0.03 to 3.1 mg/L (mean, 0.62 mg/L), manganese ranges 0.04 mg/L to 1.4 mg/L (mean, 0.1 mg/L), hardness ranges from 3.5 mg/L to 330 mg/L (mean, 36 mg/L). Alkalinity ranges from 19 mg/L to 146 mg/L (mean, 60 mg/L), TDS ranges 60 mg/L to 803 mg/L (mean, 147 mg/L) and pH ranges 6.1 to 8.4 (mean, 7.1).

Based on general knowledge of groundwater chemistry for these units throughout Nova Scotia, the Goldenville bedrock can locally exceed drinking water guidelines for arsenic, iron and manganese. The granite can exceed guidelines for iron, manganese, uranium, arsenic and fluoride, and naturally low pH.

5.6.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

The potential environmental effects on surrounding groundwater resources from a quarry operation include: groundwater table lowering close to the quarry's high wall, depressurization of downgradient springs, temporary siltation of nearby wells due to intermittent blasting or heavy equipment operation, decrease in well yield due to groundwater level lowering or interception of recharging bedrock fractures, and possible water quality deterioration at down-gradient wells from accidental releases of deleterious substances such as petroleum hydrocarbons or acidic drainage production if a mineralized zone is encountered within the quarry area. Potential impacts to domestic water wells are a function of distance, relative location of a well and the quarry with respect to groundwater flow directions, depth of excavation below the water table, intensity and frequency of blasting, and individual well construction methods.

Water Quantity Effects

In most hard rock quarry operations, overland flow into the open pit is controlled by perimeter drainage measures. Groundwater inflow from perched sources in overburden and shallow bedrock, and from deeper bedrock fractures typically forms only a very small percentage of the total water "make" of the open pit. In low permeability bedrock environments, the majority of water discharge from an open pit mine originates from direct rainfall on the open pit foot print. If the quarry encounters increased groundwater seepage as it extends, this groundwater will collect with the rainfall within its lowest point (*e.g.,* a settling pond or sump). Depending on the floor elevation and the resulting amount of rainfall and groundwater encountered, and time of year, dewatering of the proposed quarry extension may be required.

Based on a review of available well driller's logs and property information in the vicinity of the project area, it is expected that properties to the west and northwest, along Hardscratch Road, Highway No. 340 are on drilled wells for potable water supply. Although no well driller's logs were retrieved for properties along Mood Road, which is located east of the existing quarry and runs parallel to Hardscratch Road, for the purpose of this groundwater assessment, it has been assumed that dwellings along Mood Road use groundwater.

Drilled wells located west and northwest of the existing quarry and proposed extension area are inferred to be hydraulically upgradient of the Project. Groundwater quantity effects are not anticipated at these locations. However, due to the close proximity of the wells located at 1389 Highway No.640 and 2138 Hardscratch Rd. to the extension area and the low reported well yield (0.4 igpm), it is recommended that the proponent conduct groundwater sampling and confirm water levels in this well, in advance of the extension.

Groundwater quantity effects are not anticipated at drilled wells located east and southeast of the quarry (along Mood Road) or at Ellenwood Provincial park, due to a combination of the distance from the quarry operations and the presence of the Beaverdam Meadows wetland as an intervening water boundary located between the quarry area and Mood Road. Stantec also

understands there are no plans to excavate rock below the water table, which should further mitigate the potential for groundwater quantity effects.

Water Quality Effects

Changes in groundwater quality at wells adjacent to and hydraulically down gradient of the quarry may theoretically occur as a result of excavations in the recharge area. Potential impacts include: temporary siltation, oil and nitrate from blasting operations, lubricant compounds, and other chemical releases within the quarry area that could exfiltrate outwards through fractured bedrock (if no watertable dewatering is occurring to control local gradients). A further possible long term impact on well water quality is decreased pH or increased dissolved solids and metals from the attenuation of acidic drainage from exposed sulfide-rich bedrock.

Acid rock drainage is the result of exposure to sulphide rich rocks to oxidizing environments such as rainwater. Earthwork activities around these sulphide rich rocks can increase the rock's exposure and thus the acid generation potential. Not all sulphide-containing rocks end up producing acid drainage. In many cases, rocks contain enough carbonate minerals to buffer the sulphide effect, and in these instances acid rock drainage is not produced.

In Nova Scotia, acid rock drainage is most commonly associated with slate from the Halifax Formation of the Meguma Group and coal bearing shales. Bedrock underlying the Hardscratch Quarry and Extension area consists of Middle Ordovician granite. In general, massive granite is not known to be a significant acid drainage risk.

Mitigation of Effects

Based on the separation distance between the quarry and the nearest water wells (375 m) to Highway 340 and 1400 m to Mood Road, and the presence of intervening surface water barriers (*e.g.,* Beaverdam Meadows wetland), the likelihood of a water quality or quantity effect on receptor domestic water supply wells from this quarry operation is considered to be very low.

The closest drilled wells located west and northwest of the existing quarry and proposed extension area are inferred to be hydraulically upgradient of the Project. Groundwater quantity or quality effects are not anticipated at these locations. However, due to the close proximity of the well at 2138 Hardscratch Road to the extension area and the low reported well yield (0.4 igpm) for this well, it is recommended that the proponent conduct groundwater sampling and confirm water levels in this well, in advance of the extension to establish baseline conditions.

In the unlikely event of adverse water level lowering, mitigation would involve deepening the well or provision of additional in-house storage capacity to provide more well yield and/or peak water storage.

Significant water quality impacts on bedrock groundwater supplies down gradient and east of the Project are not anticipated due to distance (>1400 m), very low bedrock hydraulic

conductivity, the presence of intervening hydraulic barriers, and anticipated natural attenuation processes primarily by dilution and dispersion along the groundwater pathways.

Mitigation of short-term turbidity impacts caused by blasting vibration, though highly unlikely given the distance to off-site wells, would likely involve temporary provision of bottled water to affected residents, or provision of an in-line dirt filter. In the unlikely event of persisting long-term degraded water quality, or a well yield loss event (*e.g.,* well collapse), the proponent should replace or repair any water supply well found to be adversely affected by their quarry operation to the satisfaction of the owner.

Monitoring

It is recommended that groundwater monitoring wells be installed northwest and west of the quarry extension area to determine depth to water table prior to the extension, and to monitor groundwater levels adjacent to the quarry extension as the operation proceeds. Monitor wells should be situated between the extension area and the identified domestic wells along Hardscratch Road. These wells should resemble a typical residential water supply well, and should be incorporated into the existing Aberdeen Paving environmental monitoring system. The wells should be periodically measured for water level, pH and other water quality parameters.

It is recommended that the proponent conducts groundwater sampling and confirm the depth to groundwater in the drilled wells at 1389 Highway No.640 and 2138 Hardscratch Road to confirm baseline conditions in advance of the extension.

It is recommended that a groundwater monitoring well be installed on the proponent's property in an area southeast of the existing quarrying operations to confirm the groundwater level at this location and to confirm groundwater flow direction for the property.

5.7 ARCHAEOLOGICAL AND HERITAGE RESOURCES

5.7.1 Description of the Existing Environment

For the purposes of this assessment, archaeological and heritage resources are defined as physical remains that inform us of the human use of and interaction with the physical environment. These resources may be above or below the surface of the ground and cover the earliest Pre-Contact times to the relatively recent past.

Heritage resources are generally considered to include historic period sites such as cemeteries, heritage buildings and sites, monuments, and areas of significance to First Nations or other groups. Pre-Contact refers to the time before the arrival of non-Aboriginal peoples.

The assessment of heritage resource potential within the proposed extension area incorporated sources that included archaeological site records at the Nova Scotia Museum and archival resources.

Background research was conducted using the records at the Public Archives of Nova Scotia, the Nova Scotia Museum, as well as those available on the Internet.

Background Research

The background research found very little information on the study area. The Mi'kmaq were a major presence along the coast and river systems of the Yarmouth area, particularly the Tusket River system. There were no documents found that referred to a Mi'kmaq presence within the study area. The first European settlements in the Yarmouth area were the Acadians who arrived after 1685 (Campbell 1876). The Acadians settled around the marshes of the coast and rivers and prospered in several areas such as Chebogue and Chegoggin until the Deportation in 1755 there was no evidence found that suggested the Acadians settled within or near the Project area, however. The expulsion of the Acadians created a great deal of ungranted land and, in 1761; these were filled by new, English-speaking settlers, the majority of whom were from New England (Campbell 1876). However, no evidence was found of early English settlement within or near the Project area, and there is no evidence of roads in the general area until well into the nineteenth century. Settlement continued to be centered around the coast or along other waterways, which were the principal means of transportation. The arrival of the Loyalists in 1784 had a profound effect on Nova Scotia and Yarmouth was no exception. The major Loyalist settlement in the province was Shelburne, but this new settlement declined extremely rapidly and many of those who abandoned it made their way to Yarmouth in 1785, many settling in Tusket (Campbell 1876). The Loyalists were also able to prosper on the former Acadian lands and the Town of Yarmouth grew rapidly into the nineteenth century. By 1855 there was a road built that travelled just south of Lake George, approximately 4.5 kilometres north of the Project area, east to the Kemptville area. The most significant event to occur close to the Project area was the building of the Western Counties Railway, which ran from Yarmouth to Digby, beginning in 1879 (Significant Dates in NS's Railway History 1998). The railway passed just north of the Project area and there was a station in Ohio, approximately 2.5 km to the north. While the railway would have stimulated settlement in the area at the end of the nineteenth century, no evidence was found for any settlement within the Project area.

Recorded Archeological sites

First Nations

There are no recorded archaeological sites within the study area. The closest recorded First Nation's archaeological site is AlDm-08, located on Harris Lake, approximately 4.5 km southeast of the Project area. The site was from Woodland-period and consisted of artifacts collected by amateurs along the shores of the lake. There are also sites recorded on the Tusket River, in North Chegoggin, and on Butler Lake.

Historic

There are no recorded historic archaeological sites within the study area.

Archeological Potential

First Nations

In general, the potential for an area to contain First Nation's archaeological resources is tied to proximity to water. Lake and river systems not only provided food and water to the Mi'kmaq but were used for traveling between the coast and the interior. As mentioned above, there are no watercourses within the study area, and no other resources that would have attracted settlement, so the potential for First Nation's archaeological resources should be considered low.

Historic

There was no evidence of historic settlement within the Project area and the potential for historic archaeological resources should be considered low.

Summary

The background research found no evidence of First Nation's or historic settlement within the study area and it contained no resources that would have elevated the archaeological potential of the area. The archaeological potential for the study area is considered to be low.

5.7.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

Certain activities associated with the Project (*i.e.,* blasting, road construction), could affect archaeological or heritage sites if they were present within the zone of surficial and subsurface disturbance. These disturbances, if unmitigated, could result in the loss of resources and the potential knowledge to be gained from its interpretation.

The Project area has low potential for identifiable human use in the pre-Contact and low potential for identifiable human use in the historic periods. It is assumed that no areas beyond the Project area will be disturbed during the development and operation of the proposed quarry extension. The development and operation of the proposed quarry is unlikely to have adverse environmental effects on unknown heritage resources and it is recommended that no further archaeology is required.

If archaeological or heritage resources are discovered during development and operation of the Project, the find will be immediately reported to the Curator of Archaeology at the Nova Scotia Museum and the Manager Special Places, Heritage Division. If the resources are thought to belong to First Nations, the Chief of the nearest Mi'kmaq band will also be contacted. The appropriate authorities will determine further actions to be undertaken which could include avoidance and further assessment.

In summary, it is recommended that no further archaeological work is necessary to ensure that significant Project-related effects on unknown resources are not likely to occur.

5.8 ATMOSPHERIC ENVIRONMENT

The Atmospheric Environment examines issues related to potential Project effects on air quality and sound quality.

5.8.1 Description of Existing Conditions

Air Quality

The Project area and Nova Scotia in general, has good air quality due to the combination of maritime climate and relatively small population and industrial bases (NSDOE 1998). Climatic conditions provide good dispersion of air contaminants. The ambient air quality also benefits from the infusion of relatively clean polar and arctic air masses. Occasionally, however, long-range transport of air masses from central Canada or the eastern seaboard may transfer contaminants into the area, causing occasions of poorer air quality.

Ambient air quality is monitored in Nova Scotia with a network of 13 sites, operated by NSE and Environment Canada. Motor vehicles, electrical power generation, pulp and paper processing and oil refining are the major local sources of air pollutants in the province Common air pollutants monitored regularly are SO_2, total particulate matter (TPM), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), particulate matter less than 10 microns in diameter (PM_{10}), carbon monoxide (CO), ground-level ozone (O_3), nitrogen dioxide (NO_2), hydrogen sulphide (H_2S) and total reduced sulphur (TRS). The closest NSE monitoring site to the Project site is located in Yarmouth at the Yarmouth Weather Office. In 2005 and 2006 ozone (O_3) was the only contaminant measured. The annual average for 2005 and 2006 was 27 ppb (Environment Canada 2008).

In June of 2009 the Government of Nova Scotia, in calabration with Environment Canada and other non-government organizations, introduced a new air quality health tool, the Air Quality Health Index (AQHI), in four communities in Nova Scotia, Halifax, Greenwood, Kentville and Sydney. It is intended that the AQHI will also be available in Port Hawkesbury and Pictou at a later date. The AQHI measures the current levels of outdoor air pollution and related human health risks using a scale of 1 to 10 representing low to very high risk levels. Three air pollutants are measured in order to calculate the AQHI and include ground-level ozone (O_3), particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2) (Government of Nova Scotia 2009). The closest community to the Project that has this program implemented is Greenwood and the current air quality levels can be viewed online at Environment Canada.

The quarry is located in a rural setting with little industrial development nearby. It is not anticipated that the common air pollutants are exceeded at the quarry location due to the separation distance from any large urban centre. Limited residential development can be found within 1 km of the site.

Ambient air quality in Nova Scotia is regulated by the provincial government. The federal government has set objectives for air quality, which are taken into account by federal agencies

in a project review. These objectives form the basis for the air quality regulations of several provinces, including Nova Scotia. The Nova Scotia regulated limits correspond to the upper limit of the Maximum Acceptable category for air quality, which are set under the Canadian Environmental Protection Act (CEPA). Air quality guidelines of tolerable, acceptable, and desirable are defined under CEPA. The maximum tolerable level denotes a concentration beyond which appropriate action is required to protect the health of the general population. The maximum acceptable level is intended to provide protection against effects on soil, water, vegetation, visibility, and human wellbeing. The maximum desirable level is the long-term goal for air quality. Additional guidelines are under development by the Canadian Council of Ministers of the Environment (CCME), and ultimately this body will develop Canada-Wide Standards that harmonize the regulations in all jurisdictions.

Sound Quality

The sound quality surrounding the Project is of a concern due to the potential for Project related noise emissions to have an effect on sensitive receptors. Noise is defined as unwanted sound and is measured as a sound pressure level (SPL) in decibels. To reflect the sensitivity of the human ear across the audio spectrum, SPL readings are sometimes given in what is termed as the “A” weighted scale and denoted as dBA.

Humans are exposed to a broad range of sound pressure levels. A level of 0 dBA is the least perceptible sound by a human. A change in 3 dBA represents a physical doubling of the SPL but is barely perceptible as a change, whereas most people clearly notice a change of 5 dBA and perceive a change of 10 dBA as a doubling of the sound level. Typically, conversation occurs in the range of 50 to 60 dBA. Loud equipment and trucks passing on a busy road are responsible for noise levels above 85 dBA. Very quiet environments, such as a still night, typically fall below 40 dBA.

The sound quality in an area can be degraded by the presence of unwanted sound (*i.e.,* noise). For the most part noise is a nuisance that detracts from the enjoyment of a quiet acoustic environment. In severe cases noise can cause sleep disturbance, anxiety and consequent health effects. It can also disturb wildlife and wildlife habitat.

The existing ambient sound levels in and surrounding the Project area would be characteristic of the existing quarry activities and natural background sounds (*e.g.,* wind).

5.8.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

Air Quality

Quarrying activities can generate dust (*i.e.,* particulate emissions) which has the potential to be transported offsite. There are a variety of activities that can lead to the generation of particulate matter on the construction site. The primary potential sources of airborne particulates include:

- Exhaust gas emissions due to incomplete combustion from diesel compression engine;

- Road dust;
- Wind erosion on storage piles;
- Removal of overburden;
- Blasting activities;
- Crushing operations;
- Material handling;
- Material transport; and
- Truck loading / truck unloading.

Some of the more pertinent contributor's airborne particulates are discussed in the following:

- Blasting can result in a concentrated plume of particulate matter, but the volume and time duration of such plumes are constrained. Even when blasts result in a visible plume, the contribution to 24-hour averages, as in the Air Quality Regulations, will be negligible. Much of the material in the initial plume is larger than the aerodynamic diameter of particles that can remain suspended in the air, and deposit within a relatively short distance (*e.g.,* 100 m) of the blast site;
- Crushing is a mineral extracting operation that involves the generation of particulate emissions. Uncontrolled processing operations like these can produce nuisances and/or exceedances of particulate standards;
- Material handling activities can result in the generation of particulate matter primarily through the vertical drop of material movement. As the fine material passes through the air, the finest material may become windblown and travel downwind;
- Storage piles and exposed areas are often left uncovered due to the need for frequent material transfer, which can lead to considerable dust generation. Dust emissions can take place during several points in the storage cycle, including material loading onto the pile, disturbances by strong wind currents, and removing loads from the pile;
- Particulate emissions can occur whenever vehicles travel over both paved and unpaved surfaces; and
- Although there are also emissions of combustion gases and products of incomplete combustion from the exhaust of the on-site vehicles and equipment, these are considered nominal.

Efforts to minimize the generation of dust at the site include covering work and laydown areas with blasted materials, and covering stockpiled topsoil with seed and hay. Fugitive dust emissions will be controlled as necessary with the application of water obtained from the quarry floor with the use of a water truck.

Dust generated by truck movement will be minimized by speed control, proper truck loading, application of water for dust suppression, proper construction of on-site roads, and/or other means as required by NSE. Details of any required monitoring will be included in the Industrial Approval amendment application.

Monitoring of airborne particulate emissions (dust) will be conducted at the request of NSE and in accordance with the Pit and Quarry Guidelines, the Nova Scotia Air Quality Regulations and the facilities Approval permit and shall not exceed the following limits at the property boundaries:

- Annual Geometric Mean 70 µg/m3; and
- Daily Average (24 hrs) 120 µg/m3.

Exhausts emissions from equipment and vehicles will be mitigated by ensuring vehicles are maintained in good working order to ensure efficient operation and minimization of emissions. Consideration will be given to methods to reduce idling, as feasible.

Sound Quality

Quarrying activities will produce noise from equipment operation and blasting. Approximately 15 buildings are located within 800 m of the Project property.

Blasting operations associated with the proposed extension will be conducted in accordance with current operations at the quarry as permitted by NSE (Approval No. 2009-067070), in accordance with the Pit and Quarry Guidelines (NSE 1999),with a frequency similar to past operations at the site and during daytime hours only. Blasting will be conducted in accordance with the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). It is understood that additional blast monitoring activities and/or reporting may be required by NSE.

Efforts to minimize sound emissions related to the operation of equipment include the use of mufflers on all engines and vehicles and adhering to strict maintenance policies. The scheduling of any potential noisy activities as well should be done so during daytime hours.

As per the requirements of the current operating Industrial Approval and standard provincial guidelines, sound levels from the operation in the extension area will be maintained at a level not to exceed by the provincial guidelines as stated in Section 2.5. Sound monitoring will be conducted at the request of NSE. Details of any required monitoring will be included in the Industrial Approval application.

Summary

The air and sound quality impacts related to the quarry extension can be controlled with standard mitigation practices and therefore the Project is not likely to have a significant adverse effect on the Atmospheric Environment. Dust and noise monitoring will be conducted as required at the request of NSEL with additional mitigative measures taken as necessary.

5.9 SOCIO-ECONOMIC ENVIRONMENT

5.9.1 Description of the Existing Environment

Population and Employment

The existing Hardscratch Quarry and the proposed Project area are located at 2128 Hardscratch Rd., South Ohio, Yarmouth County, Nova Scotia, which is situated in the Municipality of the District of Yarmouth (Figure 1). The municipal district has a population of 10,304 (Statistics Canada 2006). The population in this area decreased by 1.5% between 2001 and 2006. The employment rate in the district is 57.3% and the unemployment rate is 10.9% (Statistics Canada 2006). Over half of the experienced labour force consists of sales and service occupations (26%); trades, transport and equipment operators and related occupations (15%); and occupations unique to the primary industry (13%) (Statistics Canada 2006).

The existing quarry currently employs a minimum of eight people year-round. The number of employees increases to 12 during aggregate production. Drilling and blasting activities require additional resources; these activities are sub-contracted to a professional blasting company. Transporting materials from the quarry also involves additional resources and is typically arranged through the customer. Hauling activity can vary according to market demand, but an average of up to 25 truck-loads of aggregates is transported from the quarry per day. The existing quarry currently supplies granite to local gravel and concrete markets for use in local construction projects (*e.g.,* road building and municipal, residential, and commercial developments), as well as aggregate for asphalt production.

Land Use

The quarry and proposed extension area are situated in a rural setting. Only one building/structure is located within 800 m of the existing quarry site. This building is also located within 800 m of the proposed Project, as are approximately 13 additional structures (Figure 1).

Urban/residential areas are the only current land uses identified within 800 m of the Project site. Other current land uses that occur within 2 km of the Project site include waste management facilities (*i.e*., a landfill, compost facility, and metal scrap yard), agricultural areas (see Figure 1). As well, Ellenwood Lake Provincial Park is located 2 km to the east of the Project (Figure 3). These land uses are not expected to interfere with, or be subject to inference from, the proposed quarry extension.

The nearest First Nations reserve (Acadia First Nation's Yarmouth Reserve) is located approximately 10 km south of the Project site. Archaeological and heritage resources, including First Nations resources are considered in a separate VEC in Section 5.6 of this document.

The Proponent currently owns the parcels of land (PIDs 90138728, 90138777, and 90138710) on which the proposed quarry extension will be situated. The quarry is located on land that is zoned for "Rural Development".

Mining

A review of the NSDNR Abandoned Mine Openings Database indicates that there is a gold mine shaft (Ryerson Shaft) located approximately 10.7 km from the boundaries of the Project property, in Pembroke Cove (NSDNR 2006b). The status of the shaft is not known. As well, according to NSDNR, the Abandoned Mine Openings Database indicates a shaft located approximately 3 km south of the proposed quarry boundary was sunk by E.S. Matheson & Associates. Mica within pegmatite dykes was the commodity sought. These sites are of sufficient distance from the Hardscratch Quarry and extension property that they are not anticipated to interact in any way with the Project.

Agriculture

Agricultural areas are located within the general vicinity of the proposed quarry extension; however, no tracts of agricultural land are located within 800 m of the Project site. Several mink farms are located in the vicinity of Highway 340, with mink production activity particularly concentrated south of and parallel to Highway 1 from Weymouth to Hebron, near Yarmouth (Clean Annapolis River Project 2008). Quarry blasting can result in adverse effects at mink farms, especially during the whelping season. The noise and vibration associated with blasting has potential to cause psychological stress among the mink crop. This type of stressful disturbance has been documented to result in specific cases of maternal infanticide on mink farms. However, consultation with Nova Scotia Agriculture has confirmed that the Project is not likely to interact with mink production since no mink ranches are located in close proximity to (*i.e.*, within a one kilometer radius of) the Hardscratch Quarry (Moerman, pers. comm, 2010). Furthermore, there have been no recorded complaints from mink ranchers regarding current blasting activities at the existing quarry. Therefore, the Project is not located in a region where conflict with current and future agricultural practices is anticipated.

Forestry

Intensive forestry or silviculture operations have been identified in the region within and surrounding the Project area.

Areas of clear cut and partially depleted forest cover occur within 800 m of the proposed Project. All of the clear cut tracts of land occur within the boundaries of Aberdeen's property.

Transportation

The Project area is located approximately 1 km southeast of the intersection of Hardscratch Road and Highway 340 at East Canaan. The existing quarry is currently accessed via a private road that branches off of Hardscratch Road (Figure 1). This private road will continue to provide access to and from the extended operation.

Quarried material will continue to be transported from the site to local markets via tandem trucks or tractor trailing trucks. The average number of trucks hauling aggregates from the extended

quarry could be up to 40 per day, depending on market demand. This is consistent with current truck volume at the existing quarry. Truck traffic could increase, for a short period, if a large aggregate supply contract were awarded.

A transportation assessment was not conducted in support of this environmental registration. Such a study was not deemed necessary given that the roads surrounding the Project property are in good repair and the Project is not anticipated to result in any significant increase in the volume of truck traffic on public roads compared to current levels.

Recreation and Tourism

Recreational fishing and hunting are permitted in the region surrounding the Project area. The existing quarry and proposed expansion site are located in Recreational Fishing Area 4 (Nova Scotia Fisheries and Aquaculture 2009). The nearest lakes to the Project that are included in the Provincial recreational fish stocking program are Butlers (Chegoggin) Lake (located approximately 7.5 km west of the Project property), Bird Lake (located approximately 8 km northeast of the Project property), and Sloans Lake (9.5 km northeast), and Allens Lake (located approximately 10 km west of the Project property). These lakes are stocked with speckled trout (Nova Scotia Fisheries and Aquaculture 2009).

The quarry is situated in Deer Management Zone 1. Antlerless deer hunting is permitted in the region surrounding the Project area. One thousand antlerless deer hunting stamps were issued for Deer Management Zone 1 in 2008 (NSDNR 2008). The same numbers of stamps are available for 2009 (NSDNR 2009a). The seasons for hunting deer during 2009 are as follows: the special youth season runs from October 16 to October 24; the general open season runs from October 30 to December 5; and the bowhunting season runs from September 26 to October 29 and December 7 to December 12. All of these deer hunting seasons exclude Sundays (NSDNR 2009b).

Ellenwood Lake Provincial Park is located approximately 2 km from the Project property boundary, which offers an 87 site campground (open from May to September 7), two picnic areas, a boat launch, a supervised beach, and a walking/hiking trail. The Park occupies 114 hectares and includes forested land consisting of maple, birch, hemlock, spruce, fir and pine trees. The rocky lakeshore provides habitat for rare species of coastal plain flora that are not found anywhere in Canada outside of southwestern Nova Scotia, including pink coreopsis, Plymouth gentian, and water pennywort. These species are protected by provincial and federal governments (Nova Scotia Provincial Parks 2009). The Project is of sufficient distance from the Park that no interactions are expected.

Human Health

Human health related aspects and potential effects on environmental health include potential impacts on air quality and noise; these issues are addressed in Section 5.7.

5.9.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

Population and Employment

The quarry produces valuable products that support development and infrastructure, and the growth of the region's economy. Continued direct and indirect employment associated with operation of Hardscratch Quarry is beneficial to the regional economy although employment levels at the quarry are not anticipated to change as a result of the Project.

Expansion of Hardscratch Quarry to allow for continued operation will result in an overall positive effect on the regional economy. The availability of additional local supply to the market place should encourage a more stable price for aggregate. In some cases (*i.e.,* markets in close proximity to quarries) the overall price for aggregates will be lower since cost of aggregate largely reflects the distance it has to be hauled. This, in turn, can significantly reduce costs of construction, which should result in financial benefits in the public infrastructure sector affecting highway development, communities, public works agencies, and taxpayers (NSDNR 2006b).

Land Use

Due to the existing industrial activity in the vicinity of the Project area (*i.e.,* the existing Hardscratch Quarry and nearby landfill, as indicated on Figure 1), and the distance of the proposed extension area from residences, impacts on existing and future adjacent land uses are not expected. All activities at the existing quarry and the proposed Project site will be conducted in accordance with the Pit and Quarry Guidelines, and all setback distances specified in the Guidelines will be maintained.

Quarrying activities will produce noise from equipment operation and blasting. Approximately 15 buildings/structures are located within 800 m of the Project property. The owners of these buildings must provide consent in order for blasting to take place within the quarry extension area. The potential for noise from the quarry site to have a significant effect on residents is minimal.

Blasting operations associated with the proposed extension will be conducted in accordance with current operations at the quarry as permitted by NSE (Approval No. 2008-065008), in accordance with the Pit and Quarry Guidelines (NSE 1999) and with a frequency similar to past operations at the site. Blasting will be conducted in accordance with the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). It is understood that additional blast monitoring activities and/or reporting may be required by NSE.

As per the requirements of the current operating Industrial Approval and standard provincial guidelines, sound levels from the operation in the extension area will be maintained at a level not to exceed the following sound levels (L_{eq}) from the property boundaries:

- L_{eq} 65dBA 0700-1900 hours (Days);
  60dBA 1900-2300 hours (Evenings); and

55dBA 2300-0700 hours (Nights).

Sound monitoring will be conducted at the request of NSE. Details of any required monitoring will be included in the Industrial Approval application.

Transportation

The Project is not anticipated to result in a significant increase in truck traffic on public roads above that associated with the existing Hardscratch Quarry operation. Future hauling practices will remain consistent with current practices.

Recreation and Tourism

The existing quarry and proposed extension of the operation are not likely to have an impact on hunting and recreational fishing in the general area. Because an active quarry is already operational on-site, animals have likely been deterred from adjacent habitat. The quarry is situated in a hunting management zone, but the Project is not located on Crown land and thus hunters will require permission from Aberdeen to pursue their activities in the area.

Human Health

Project activities may result in a slight increase in air emissions; however, these impacts will be temporary and localized and are not expected to result in any significant effects on human health. Human health related issues pertaining to air quality are discussed in more detail in Section 5.7. The Project will not result in any impacts on the safety of travelers, as it will not entail any significant effects on traffic on public roads. The health and safety of nearby residences is not expected to be affected by the Project.

Summary

In summary, assuming effective application of mitigative measures (*e.g.,* Pit and Quarry Guidelines, dust suppression) significant adverse Project-related effects on the socio-economic environment is not likely to occur. Continued operation of the quarry will result in economic benefits, including ongoing employment and business opportunities.

5.10 OTHER UNDERTAKINGS IN THE AREA

The Proponent is not aware of any active pit or quarry operations licensed to operate within a 10 km radius of the Project other than the existing Hardscratch Quarry. The existing quarry operation is currently functioning without any issues in terms of noise, dust, emissions, traffic, *etc.* Since the proposed extension does not include an increase in production, and assuming the effective application of mitigative measures, significant adverse Project-related effects regarding other undertakings in the area are not likely to occur.

6.0 EFFECTS OF THE PROJECT ON THE ENVIRONMENT

Activities associated with the proposed quarry extension Project, and operation of the extended quarry, will be conducted in accordance with terms and conditions of the current Industrial Approval for the existing quarry operation, as well as future amendments to the Approval, and the Pit and Quarry Guidelines.

Environmental effects of the quarry extension will include the loss of terrestrial habitat within the proposed revised quarry extension area. The results of flora and fauna habitat modeling show that there is potential for habitats in the Project area to support rare or sensitive species. More detailed assessment and mitigative measures pertaining to rare and sensitive flora and wildlife are provided in Sections 5.3 and 5.4 respectively.

One watercourse drainage system, being feed by another watercourse and drainage channel and 15 wetlands has been identified within the extension area. The Proponent is committed to wetland compensation for the loss of any wetland habitat as a result of quarrying operations.

The results of the groundwater study indicate that based on the separation distance between the quarry and the nearest water wells and the presence of intervening surface water barriers, the likelihood of a water quality or quantity effect on receptor domestic water supply wells from this quarry operation is considered to be very low.

The potential for acid drainage production in this area is presently unknown; however, generally massive granite is not known to be a significant acid drainage risk.

Minor, localized impacts on air quality can be expected through the formation of airborne particulate matter. These impacts are readily controlled through standard mitigative measures (*e.g.,* dust suppression) and follow-up monitoring as necessary (see Section 5.7).

A stormwater management plan will be submitted as part of the quarry development plan during the Industrial Approval application process.

Assuming the mitigative measures specified in this report are implemented, and the quarry is operated according to existing provincial guidelines and approvals, no significant adverse residual environmental effects are likely.

7.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The definition of an environmental effect often includes any change to the project that may be caused by the environment. In the case of a quarry operation, potential effects of the environment on the Project are limited to climate and meteorological conditions, specifically precipitation. Precipitation and runoff may cause temporary delays in quarry construction, operation, and rehabilitation activities. Wet weather or snow may also affect hauling of material from the site.

On a national basis, Canada shows a warming and cooling pattern with a higher overall warming trend of approximately 1.1 ºC since 1895. The Atlantic Region, however, shows a warming trend from 1895 which peaked in the mid 1950s followed by a cooling trend in the 1990s. The overall warming trend of 0.4 ºC in Atlantic Canada since 1895 is not statistically significant. With respect to precipitation, the Atlantic Region shows an overall increasing trend in precipitation since 1948, with an increasing trend in the number of daily precipitation events above 20 mm and a very slightly increasing trend in the number of daily snowfall events above 15 cm (Lewis 1997).

There is a number of planning, designs, and construction strategies intended to minimize the potential effects of the environment on the Project so that the risk of damage to the Project or interruption of service can be reduced to acceptable levels. Mitigation measures include, but are not limited to, designing and installing erosion and sediment control structures to accommodate appropriate levels of precipitation, and considering weather conditions when scheduling activities, including scheduling of activities to accommodate weather interruptions. All Project activities will be taking place out-of-doors and thus weather has been and will be factored into all Project phases and activities. The Proponent proposes that the quarry remain operational 48 weeks per year or more, weather permitting, and will consider severe winter weather conditions when planning activities. Heavy snowfalls and significant snow accumulation will have an impact on the quarry's ability to remain open.

In summary, climate and meteorological conditions, including climate change, are not anticipated to significantly affect the operation of the quarry over its proposed lifetime.

8.0 OTHER APPROVALS REQUIRED

As stated in Section 2.0, the Proponent is required to register this Project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. Other relevant provincial regulations include the Activities Designation Regulations, which requires an amendment to the existing Industrial Approval from NSE for operation of the Project; and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). Provincial guidelines to be adhered to include the *Pit and Quarry Guidelines* (NSDOE 1999).

9.0 FUNDING

The proposed extension will be 100 percent privately funded.

10.0 ADDITIONAL INFORMATION

No additional information is provided in support of this document.

11.0 REFERENCES

Anderson, P.G., B.R. Taylor and G.C. Balch. 1996. Quantifying the effects of sediment release on fish and their habitats. Canadian Manuscript Report on Fisheries and Aquatic Sciences.

Atlantic Canada Conservation data Center (ACCDC). 2009. Species Ranks. Available at: http://www.accdc.com/products/ranking.html. Last updated April 2009 (accessed June, 2009).

Campbell, John Roy. History of the County of Yarmouth. J & A. McMillan: Saint John, 1876.

Canadian Council of Ministers of the Environment. 2007. Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME-FAL), 2007 update.

Clean Annapolis River Association. 2008. The Environmental Gremlin: A Ticking Economic and Ecological Disaster. Available online at http://www.annapolisriver.ca/gremlin.php?id=62 (Accessed May 7, 2010).

COSEWIC. 2006. COSEWIC assessment and status report on the Rusty Blackbird (Euphagus carolinus) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Available at: www.sararegistry.gc.ca/status/status_e.cfm.

COSEWIC. 2009. Canadian Wildlife Species at Risk. Committee on the Status of Endangered Wildlife in Canada. Web site: www.cosewic.gc.ca/eng/sct0/rpt/rpt_csar_e.cfm [accessed September 2009].

Department of Justice Canada. 1994. Migratory Birds Convention Act. Available at: http://laws.justice.gc.ca/en/M-7.01/. Last updated September 2009 [accessed September 2009].

Environment Canada. 2008. National Air Pollution Surveillance Network, Annual Data Summary for 2005 and 2006.

Erskine, A. J. 1992. Atlas of Breeding Birds of the Maritime Provinces. Nimbus Publishing and the Nova Scotia Museum, Halifax

Fisheries and Oceans Canada (DFO). 1986. Policy for the Management of Fish Habitat. Ottawa, ON: DFO Fish Habitat Management Branch.

Gilhen, J. 1984. Amphibians and Reptiles of Nova Scotia. Nova Scotia Museum. Halifax, Nova Scotia.

Goodwin, T.A. 2004. Bedrock, Glacial, Economic and Environmental Geology of the Halifax Regional Municipality. Open File Report ME2004-3, Mineral Resources Branch. Nova Scotia Natural Resources. Halifax.

Government of Nova Scotia (GNS). 2009. Air Quality Health Index (AQHI). Available online: http://www.gov.ns.ca/nse/aqhi/

Hinds, H.R. 2000. Flora of New Brunswick. Biology Department, University of New Brunswick, Fredericton, N.B.

Hooper, W. C., McCabe, L. and Robertson T. 1995. A Standardized Fisheries Stream Survey Approach of Atlantic Canada, DRAFT. Presented to 21st Annual AIC Meeting, American Fisheries Society Shelburne, New Hampshire. September 1995.

Jones, C., K.M. Somers, B. Craig, and T.B. Reynoldson. 2005. Ontario Benthos Biomonitoring Network Protocol Manual. Version Version 1.0. 48 pp.

Keppie, J. D. (2000). Geological Map of the Province of Nova Scotia. N.S. Department of Natural Resources. Minerals and Energy Branch. Map ME2000-1. Scale 1: 500,000.

Lewis, P. J. 1997. Trends. In: Shaw, R.W. (ed.). Climate Variability and Climate Change in Atlantic Canada. Proceedings of a Workshop Halifax, Nova Scotia, 3-6 December 1996. Prepared for Environment Canada. Halifax, NS.

MacGregor, M., and Elderkin, M. 2003. Protecting and Conserving Wood Turtles: A Stewardship Plan for Nova Scotia. Wildlife Division, Nova Scotia department of Natural Resources. Kentville, Nova Scotia. Available at: www.gov.ns.ca/natr/Wildlife/BIODIV/species_recovery/recoveryplans/finalwoodturtleplan.pdf

Maritimes Breeding Bird Atlas (MBBA). 2009. Available online at: http://www.mba-aom.ca/english/index.html (Accessed: August 2009).

Moerman, Dennis. Regional Coordinator for Annapolis, Digby, Yarmouth, and Shelburne Counties, Nova Scotia Agriculture. Personal Communication, May 6, 2010.

Nova Scotia American Marten Recovery Team. 2006. Recovery Strategy for American Marten (Martes americana) on Cape Breton Island, Nova Scotia in Canada. Nova Scotia, Canada. Available at: www.gov.ns.ca/natr/Wildlife/BIODIV/species_recovery/recoveryplans/martenstrategy07.pdf

Nova Scotia Department of Environment (NSDOE). 1988. Erosion and Sedimentation Control Handbook for Construction Sites. Nova Scotia: NSE Environmental Assessment Division.

Nova Scotia Department of Environment (NSDOE). 1998. “The State of the Nova Scotia Environment, 1998”. Halifax, Nova Scotia.

Nova Scotia Environment (NSE). 2008. Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia. Nova Scotia: NSE (Revised September 2008).

Nova Scotia Department of Environment and Labour (NSEL). 1999. Pit and Quarry Guidelines. Revised May 1999. Nova Scotia: NSEL

Nova Scotia Department of Environment and Labour (NSEL). 2005. Guidelines for Environmental Noise Measurement and Assessment. Nova Scotia: NSEL (Originally published April 1990 by the former Nova Scotia Department of the Environment; Revised May 18, 2005).

Nova Scotia Department of Natural Resources (NSDNR). 1995. Nova Scotia Department of Environment Wetlands Directive.

Nova Scotia Department of Natural Resources (NSDNR). 2006a. Mineral resources Land-Use Map. Available at: http://gis4.natr.gov.ns.ca/website/mrlu83/viewer.htm. Last updated February 2006 [accessed November 2009].

Nova Scotia Department of Natural Resources (NSDNR). 2006b. Nova Scotia Abandoned Mine Openings Database: Mine Openings from DP ME 10, Version 3, 2006. Nova Scotia: Minerals and Energy Branch, NSDNR.

Nova Scotia Department of Natural Resources (NSDNR). 2007a. General Status Ranks of Wild Species in Nova Scotia. Available at: http://www.gov.ns.ca/natr/wildlife/genstatus/ranks.asp. Last updated November 2007 (accessed August, 2009).

Nova Scotia Department of Natural Resources (NSDNR). 2007b. Significant habitat mapping database. Available at: http://www.gov.ns.ca/natr/wildlife/Thp/disclaim.htm. Last updated November 2007 (accessed August, 2009).

Nova Scotia Department of Natural Resources (NSDNR). 2007c. Species at Risk in Nova Scotia. Wildlife Species Protected Under the Endangered Species Act in Nova Scotia. Available at://www.gov.ns.ca/natr/wildlife/biodiv/specieslist.htm. Accessed August, 2009.

Nova Scotia Department of Natural Resources (NSDNR). 2008. 2008 Nova Scotia Hunting and Furharvesting Licence & Summary of Regulations. Kentville, NS: NSDNR Wildlife Division. Kentville, NS: NSDNR Wildlife Division.

Nova Scotia Department of Natural Resources (NSDNR). 2009a. Deer Management Zones. Available online at http://www.gov.ns.ca/natr/draws/deerdraw/ddzones.asp (Modified: September 29, 2009; Accessed: November 6, 2009).

Nova Scotia Department of Natural Resources (NSDNR). 2009b. 2009 Nova Scotia Hunting and Furharvesting Licence & Summary of Regulations. Kentville, NS: NSDNR Wildlife Division.

Nova Scotia Environment and Labour (NSEL). 2008. NS Pumping Test Database, Microsoft Access Format (2008).

Nova Scotia Environment and Labour (NSEL). 2008. The Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia.

Nova Scotia Environment (NSE). 2009. NS Well Logs Database, Microsoft Access Format (2009).

Nova Scotia Fisheries and Aquaculture. 2009. Sportfishing: Spring Stocking List – 2009. Available online at http://www.gov.ns.ca/fish/sportfishing/stocked/list.shtml (Modified: April 7, 2009; Accessed: November 6, 2009).

Nova Scotia Provincial Parks. 2009. Ellenwood Lake Provincial Park (Brochure). Published by Nova Scotia Department of Natural Resources and Nova Scotia Tourism, Culture and Heritage. Available online at http://www.novascotiaparks.ca/brochures/Ellenwood.pdf (Accessed February 10, 2010).N.S. Reg. 196/2006, 2006. Lake George Watershed Protected Water Area Designation made under Section 106 of the Environment Act S.N.S. 1994-95, C.1. (http://www.gov.ns.ca/just/regulations/regs/envpwlgd.htm). Accessed on February 5, 2010.

Parker, G. 2001. Status report on the Canada Lynx in Nova Scotia, Loup-Cervier (Lynx canadensis (Kerr 1792)). Nova Scotia Species at Risk Working Group. Available at: http://www.gov.ns.ca/natr/Wildlife/BIODIV/species_recovery/statusreports/sr_lynx.pdf.

Parker, G. 2003. Status report on the Eastern Moose (Alces alces americana Clinton) in mainland Nova Scotia. Committee on the Status of Endangered Wildlife in Canada.

Available at: www.gov.ns.ca/natr/Wildlife/BIODIV/species_recovery/statusreports/StatusReportMooseNSComplete.pdf.

Porter, R. J. (1992) Regional Water Resources of Southwestern Nova Scotia, Nova Scotia Department of the Environment, 1982.

Province of Nova Scotia. 1989. Wildlife Act - an act to provide for the protection, management and conservation of wildlife and wildlife habitats. Available at: http://www.gov.ns.ca/legislature/legc/statutes/wildlife.htm. Last updated February 2002 [accessed September 2009].

Province of Nova Scotia. 1994. Environment Act - an act to reform the environmental laws of the Province and to encourage and promote the protection, enhancement and prudent use of the environment. Available at: ttp://www.gov.ns.ca/legislature/legc/statutes/envromnt.htm [accessed September 2009].

Reynoldson, T.B., C. Logan, T. Pascoe, and S.P. Thompson (accessed via the web-site: http://cabin.cciw.ca/Main/cabin_online_resources.asp?Lang=en-ca, June 2007). CABIN (Canadaian Aquatic Biomonitoring Network) Invertebrate Biomonitoring Field and Laboratory Manual. Environment Canada. 47 pp.

Service Nova Scotia, 2006. The Nova Scotia Atlas. 6th ed.. Formac Publishing Company Limited. Halifax, NS.

Significant Dates in Nova Scotia's Railway History. 1998. Available at: http://www.trainweb.org/canadianrailways/articles/SignificantDatesInNSRailwayHistoryPart2.html.

Smith, K. 2002. COSEWIC Status report on the Eastern Ribbonsnake (Thamnophis sauritus) in Canada, Committee on the Status of Endangered Wildlife in Canada. Ottawa. Available at: http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_eastern_ribbonsnake_e.pdf.

Species at Risk Act. 2002, c. 29 S-15.3 (Assented to December 12, 2002; Current version in force since February 26, 2009).

Statistics Canada. 2006. 2006 Population Census: Community Profiles. Available online at http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E (Modified: July 24, 2009; Accessed: November 2009).

Stea, R., H. Conley and Y. Brown (1992). Surficial Geology of the Province of Nova Scotia. Nova Scotia Dept. of Natural Resources, Map 92-3.

The Blanding's Turtle Recovery Team. 2003. National Recovery Plan for the Blanding's Turtle (Emydoidea blandingii),Nova Scotia Population. Nova Scotia, Canada. Available at: http://www.gov.ns.ca/natr/Wildlife/BIODIV/species_recovery/recoveryplans/Blandings_Turtle_Recovery_Plan_Jan2003.pdf.

Trow Consulting Engineers Ltd. 1996. Instream Sediment Control Techniques Field Implementation Manual. Ontario Ministry of Natural Resources.

Warner, B. and C. Rubec. 1997. The Canadian Wetland Classification System. Second Edition. Wetlands Research Centre. University of Waterloo.

Wright, D.G. and G.E. Hopky. 1998. Guidelines for the use of Explosives In or Near Canadian Fisheries Waters. Canadian Technical Report of Fisheries and Aquatic Sciences 2107. Science Directorate, Central and Arctic Region and Habitat Management and Environmental Science, Directorate, DFO.

Zinck, M. 1998. Roland's flora of Nova Scotia. Nimbus Publishing & The Nova Scotia Museum. Halifax, NS. 1297 pp.

V:\1215\active\1-JW Projects\105xxxx\1054351 - Aberdeen Paving Quarry Extension EA\Final EA Document\fin_121510237_20100621.doc

12.0 Appendices

APPENDIX A	Registry of Joint Stocks and Industrial Approval
APPENDIX B	Proposed Quarry Development Plan
APPENDIX C	Aberdeen Quarry Extension Hydrology Study
APPENDIX D	Project Information Bulletin and Letters
APPENDIX E	Fish Habitat Survey
APPENDIX F	Rare and Sensitve Plants Identified during Modelling Exercise as being Potentially Present in Project Area
APPENDIX G	Population Status of Vascular Plants Recorded in Project Area
APPENDIX H	Breeding and Population Status of Birds Recorded in the Project Area and the Breeding Bird Atlas Squares
APPENDIX I	Plants and Wildlife Species Recorded within Wetlands
APPENDIX J	Disposition Table

APPENDIX A
Registry of Joint Stocks and Industrial Approval

NOVA SCOTIA
Environment
Environmental Monitoring and Compliance

13 First Street
Yarmouth, Nova Scotia
Canada B5A 1S8

902 742-8985 T
902 742-7790 F
www.gov.ns.ca

Our File Number: 92100-30

July 31, 2009

Mr. Wayne LeBlanc
Aberdeen Paving Ltd.
PO Box 579
Yarmouth, NS
B5A 4B4

Dear Mr. LeBlanc:

RE: Approval to Construct and Operate - Quarry
Approval No. 2009-067070
PID # 90138728

Enclosed please find Approval # 2009-067070 issued to Aberdeen Paving Ltd to construct and operate the Quarry at 2128 Hardscratch Rd. South Ohio, Yarmouth County, Nova Scotia. Please ensure that you forward the original Approval to Aberdeen Paving Ltd.

This approval replaces prior approval number 98-IAW-030 which is now null and void.

Strict adherence to the attached terms and conditions is imperative in order to validate this approval. Please note that requirements for a revised survey and rehabilitation plan from (section 2j of) the prior approval have been carried forward to this approval. The due date for a revised rehabilitation plan is October 30, 2009. Refer to section 11a of this approval.

Despite the issuance of this Approval, the Approval Holder is still responsible for obtaining any other authorization which may be required to carry out the activity, including those which may be necessary under provincial, federal or municipal law.

Should you have any questions, please contact Denis Tufts, Western Region, Yarmouth Office at (902) 742-8985.

Yours Truly

D. Bruce Arthur
District Manager

cc Denis Tufts, NSE
Heather Macpherson, NSE

Eimas #: 2009-067070

NOVA SCOTIA
Service Nova Scotia and Municipal Relations
Registry of Joint Stock Companies

Print Close Window

PROFILE - ABERDEEN PAVING LIMITED - as of: 2009-11-03 02:05 PM

Company/Society Name:	ABERDEEN PAVING LIMITED
Registry ID:	3087066
Type:	N.S. Limited Company
Nature Of Business:	
Status:	Active
Jurisdiction:	Nova Scotia
Registered Office:	900-1959 UPPER WATER ST. HALIFAX NS Canada B3J 3N2
Mailing Address:	PO BOX 997 HALIFAX NS Canada B3J 2X2

PEOPLE

Name	Position	Civic Address	Mailing Address
WILLIAM W. ROSS	Director	42 KIMARA DRIVE HAMMONDS PLAINS NS B3Z 1H9	
WILLIAM W. ROSS	PRESIDENT & SECRETARY	42 KIMARA DRIVE HAMMONDS PLAINS NS B3Z 1H9	
LAWRENCE J. STORDY	Recognized Agent	800-1959 UPPER WATER ST.	PO BOX 997 HALIFAX NS

		HALIFAX NS B3J 3N2	B3J 2X2

ACTIVITIES

Activity	Date
Annual Renewal	2009-03-27
Annual Renewal	2008-03-31
Annual Statement Filed	2008-03-27
Annual Renewal	2007-03-30
Annual Statement Filed	2007-03-30
Annual Statement Filed	2007-03-30
Annual Statement Filed	2007-03-30
Special Resolution	2006-05-26
Annual Renewal	2006-03-31
Annual Statement Filed	2006-03-31
Annual Statement Filed	2005-04-26
Annual Renewal	2005-04-01
Filed Document	2004-03-01
Effective Date of Amalgamation	2004-03-01
Change of Directors	2004-03-01
Date of Filing Amalgamation	2004-03-01
Appoint an Agent	2004-03-01

RELATED REGISTRATIONS

This Company ...	
ABERDEEN PAVING LIMITED	Amalgamated From

PEERLESS ASPHALT LIMITED	Amalgamated From
ATLANTIC PAVING	Registered
A.P.L. HOLDINGS LIMITED	Amalgamated From
BEDFORD EQUIPMENT COMPANY	Registered
PROSPECT FARM HOLDINGS LIMITED	Amalgamated From

NOVA SCOTIA
Environment

APPROVAL

Province of Nova Scotia
Environment Act, S.N.S. 1994-95, c.1

APPROVAL HOLDER:	Aberdeen Paving Ltd
SITE PID:	90138728
APPROVAL NO:	2009-067070
EXPIRY DATE:	July 31, 2019

Pursuant to Part V of the *Environment Act*, S.N.S. 1994-95, c.1 as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following activity:

Construction and operation of a Quarry, and associated works, at or near 2128 Hardscratch Rd, South Ohio, Yarmouth County in the Province of Nova Scotia.

Administrator _____

Effective Date July 31, 2009

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Environment

Approval Holder:	Aberdeen Paving Ltd
Project:	Quarry
Site:	2128 Hardscratch Rd, South Ohio, Yarmouth County PID # 90138728
Approval No:	2009-067070
File No:	92100-30
Grid Reference:	19T E738750 N4867500

Reference Documents:

- Application dated May 25, 2009 and attachments.
- Prior NS Department of Environment Approval #98-IAW-030, file number 11-98-0088.
- Quarry Site dimensions drawing by Wayne LeBlanc, P. Eng. dated June 3, 2002. Stamped received by Dept. of Environment & Labour, Sept. 25, 2007.
- Letter of Guarantee from The Bank of Nova Scotia, No. G70003/115867 for renewable bond in the amount of $19,500 dated Oct. 30, 1998.

1. **Definitions**

a) "Abandonment" means cessation of production of aggregate for a period of twelve (12) months.

b) "Act" means the *Environment Act* S.N.S. 1994-1995, c.1 and includes all regulations made pursuant to the Act.

c) "Active Area" means the area required to operate a quarry and includes the working face and associated works.

d) "Associated works" means any building, structure, processing facility, pollution abatement system or stockpiles of aggregate.

e) "Department" means the Western Region, Yarmouth Office, of Nova Scotia Environment located at the following address:

Nova Scotia Environment
Environmental Monitoring and Compliance Division
Western Region, Yarmouth Office
13 First St.
Yarmouth, NS B5A 1S9

Phone: (902) 742-8985
Fax: (902) 742-7796

f) "Disturbed Area" means any area on a quarry site that has been stripped of vegetation and is susceptible to erosion.

g) "Facility" means the Quarry and associated works.

h) "Minister" means the Minister of Nova Scotia Environment.

i) "Rehabilitation" means restorative work performed or to be performed in accordance with the rehabilitation plan.

j) "Structure" includes but is not limited to a private home, a cottage, an apartment building, a school, a church, a commercial building or a treatment facility associated with the treatment of municipal sewage, industrial or landfill effluent, an industrial building, infrastructure or construction, a hospital, and a nursing home, etc.

2. Scope of Approval

a) This Approval (the "Approval") relates to the Approval Holder and their application and supporting documentation, as listed in the reference documents above, to construct and operate the Facility, situated at or near 2128 Hardscratch Rd, South Ohio, Yarmouth County (the "Site").

b) The Facility shall be constructed and operated as outlined in the application for industrial approval dated May 25, 2009 and supporting documentation.

c) The Site shall not exceed the area as outlined in the application and supporting documentation.

d) Should the work authorized by this Approval not be commenced within a year, this Approval shall automatically be null and void, unless extended in writing by an Administrator.

3. **General Terms and Conditions**

a) The Approval Holder shall construct, operate and reclaim its Facility in accordance with provisions of the:

i) *Environment Act* S.N.S. 1994-1995, c.1, as amended from time to time;
ii) Regulations, as amended from time to time, pursuant to the above Act;

b) The Approval Holder is responsible for ensuring that they operate the Facility on lands which they own or have a lease or written agreement with the landowner or occupier. The Approval Holder shall be responsible for ensuring that the Department has, at all times, a copy of the most recent lease or written agreement with the landowner or occupier. Breach of this condition may result in cancellation or suspension of the Approval.

c) If there is a discrepancy between the reference documents and the terms and conditions of this Approval, the terms and conditions of this Approval shall apply.

d) The Minister or Administrator may modify, amend or add conditions to this Approval at anytime pursuant to Section 58 of the Act.

e) This Approval is not transferable without the consent of the Minister or Administrator.

f) (i) If the Minister or Administrator determines that there has been non-compliance with any or all of the terms and conditions contained in this Approval, the Minister or Administrator may cancel or suspend the Approval pursuant to subsections 58(2)(b) and 58(4) of the Act, until such time as the Minister or Administrator is satisfied that all terms and conditions have been met.

(ii) Despite a cancellation or suspension of this Approval, the Approval Holder remains subject to the penalty provisions of the Act and regulations.

g) The Approval Holder shall notify the Department prior to any proposed extensions or modifications of the Facility, including the active area, process changes or waste disposal practices which are not granted under this Approval. An amendment to this Approval will be required before implementing any change. Extensions or modifications to the Facility may be subject to the Environmental Assessment Regulations.

h) Pursuant to Section 60 of the *Act*, the Approval Holder shall submit to the Administrator any new and relevant information respecting any adverse effect that actually results, or may potentially result, from any activity to which the Approval relates and that comes to the attention of the Approval Holder after the issuance of the Approval.

i) The Approval Holder shall immediately notify the Department of any incidents of non-compliance with this Approval.

j) The Approval Holder shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.

k) Unless specified otherwise in this Approval, all samples required to be collected by this Approval shall be collected, preserved and analysed, by qualified personnel, in accordance with recognized industry standards and procedures.

l) Unless written approval is received otherwise from the Administrator, all samples required by this Approval shall be analysed by a laboratory that meets the requirements of the Department's "Policy on Acceptable Certification of Laboratories" as amended from time to time.

m) The Approval Holder shall submit any monitoring results or reports required by this Approval to the Department. Unless specified otherwise in this Approval, All monitoring results shall be submitted within 30 days following the month of monitoring.

n) The Approval Holder shall ensure that this Approval, or a copy, is kept on Site at all times and that personnel directly involved in the Facility operation are made fully aware of the terms and conditions which pertain to this Approval.

o) The Approval Holder will be required to register their project under Part IV of the *Environment Act* should the Facility and associated works including access roads exceed an area of four (4) hectares.

4. Construction of Facility

a) Erosion and sedimentation controls are to be in place prior to construction at this facility. Additional controls shall be implemented if Site runoff exceeds the discharge limits contained herein.

b) Erosion and sedimentation controls are to be maintained and remain in place until the disturbed areas are stabilized.

c) The Approval Holder shall ensure that the following discharge limits are met for any water which is discharged from the Site to a watercourse or wetland:

Clear Flows (Normal Background Conditions):

i) Maximum increase of 25 mg/l from background levels for any short term exposure (24 hours of less)
ii) Maximum average increase of 5 mg/l from background levels for longer term exposure (inputs lasting between 24 and 30 days)

High Flow (Spring Freshets and Storm Events)

i) Maximum increase of 25 mg/l from background levels at any time when background levels are between 25 mg/l and 250 mg/l
ii) Shall not increase more than 10% over background levels when background is > 250 mg/l

d) Signage including emergency telephone numbers and contacts are to be posted at the entrance to the Facility.

e) The use of used oil as a dust suppressant is strictly prohibited. The generation of dust from the Site shall be suppressed as required.

5. **Particulate Emissions (Dust)**

a) Particulate emissions shall not exceed the following limits at or beyond the Site property boundaries:

Annual Geometric Mean 70 $\mu g/m^3$

Daily Average (24 hr.) 120 $\mu g/m^3$

b) The use of used oil as a dust suppressant is strictly prohibited. The generation of dust from the Site shall be suppressed as required.

c) Monitoring of particulate emissions shall be conducted at the request of the Department. The location of the monitoring station(s) for particulate will be established by a qualified person retained by the Approval Holder and submitted to the Department for approval, this may include point(s) beyond the property boundary of the Site.

d) When requested, suspended particulate matter shall be measured by the EPA standard; EPA/625/R-96/010a; Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM_{10}. Using High Volume (HV) Sampler.

6. **Sound Levels**

a) Sound levels measured at the Site property boundaries shall not exceed the following equivalent sound levels (Leq):

Leq 65 dBA 0700-1900 hours (Days)
60 dBA 1900-2300 hours (Evenings)
55 dBA 2300-0700 hours (Nights)

b) Monitoring of sound levels shall be conducted at the request of the Department. The location of the monitoring station(s) for sound will be established by a qualified person retained by the Approval Holder and submitted to the Department for approval, this may include point(s) beyond the property boundary of the Site.

7. **Surface Water**

a) The site shall be developed and maintained to prevent siltation of the surface water which is discharged from the property boundaries into the nearest watercourse or beyond the property boundary. Additional controls shall be implemented if site runoff exceeds the discharge limits contained herein.

b) No authority is granted by this Approval to enable the Approval Holder to discharge surface water beyond the property boundary and onto adjoining lands without the authorization of the affected landowner(s). It is the responsibility of the Approval Holder to ensure that the authorization of said landowner(s) is current and valid. Failure to maintain said authorization will result in this Approval being null and void. The Approval Holder shall provide, to the Department, proof of the continued authorization of the adjoining landowner(s) when the current agreement has expired.

c) Erosion and sedimentation control devices shall be installed prior to any excavation of material.

d) The Approval Holder shall ensure the following liquid effluent levels are met and that the effluent is monitoring at the frequency and locations indicated.

i) <u>Total Suspended Solids</u>

Clear Flows (Normal Background Conditions):

1) Maximum increase of 25 mg/l from background levels for any short term exposure (24 hour or less)
2) Maximum average increase of 5 mg/l from background levels for longer term exposure (inputs lasting between 24 hours and 30 days)

High Flow (Spring Freshets and Storm Events):

1) Maximum increase of 25 mg/l from background levels at any time when background levels are between 25 mg/l and 250 mg/l
2) Shall not increase more than 10% over background levels when background is > 250 mg/l

ii) **pH**

1) Maximum 5 to 9 in grab sample
2) Maximum 6 to 9 as a Monthly Arithmetic Mean

iii) **Monitoring Locations**

1) The Approval Holder shall sample at the following locations: Drainage discharge from active quarry area.

iv) **Sampling Frequency**

1) The Approval Holder shall sample at the following frequency: At NSE Request

e) If it becomes necessary to drain the Site, the wastewater shall be treated to meet the suspended solids limits outlined in this Approval.

f) All wash water systems shall be arranged in closed circuit.

g) Additional monitoring stations for liquid effluent may be specified as required by the Department.

h) A monthly summary of results of monitoring shall be submitted to the Department.

8. **Groundwater**

a) The Approval Holder shall replace at their expense any water supply which has been lost or damaged as a result of extracting aggregate.

b) The Approval Holder shall secure from the Administrator an approval amendment prior to excavating below the watertable.

9. **Separation Distances**

a) The Approval Holder shall not locate the Active Area of the quarry within:

i) 30 m of the boundary of a public or common highway.

ii) 30 m of the bank of any watercourse or ordinary high water mark.

iii) 30 m of the boundary of the quarry property.

b) The Approval Holder shall not blast within:

i) 30 m of the boundary of a public or common highway.

ii) 30 m of the bank of any watercourse or ordinary high water mark.

iii) 800 m of the foundation or base of a structure located off site.

iv) 15 m of the property boundary when a structure on the abutting property is not involved.

10. **Blasting**

a) The Approval Holder shall have a technical blast design prepared by a qualified person which ensures the ground vibration and air concussion limits in this Approval can be achieved.

b) The Approval Holder shall conduct a pre-blast survey including a water quality analysis of all structures within 800 metres of the Facility. The survey shall be conducted in accordance with the Department's 'Procedure For Conducting a Pre-Blast Survey" and the results of this survey sent to the Department prior to any blasting on the Site. Water quality parameters will be determined by NSE staff.

c) The Approval Holder shall call the nearest weather office, to assess the climatic conditions prior to conducting any blasting. No blasting will be permitted if a thermal inversion is anticipated at the time of the proposed blast.

d) No blasting shall occur on Sunday, on a statutory holiday prescribed by the Province, or on any day between 1800 and 0800 hours.

e) The Approval Holder shall ensure that all blasts are monitored for concussion and ground vibration to ensure that the limits in Table 2 are not exceeded:

Table 2

Blasting Limits

Parameters	Maximum	Monitoring Frequency	Monitoring Station
Concussion (Air Blast)	128 dBL	Every Blast	Within 7 m of the nearest structure not located on the Site
Ground Vibration	0.5 in/sec (12.5 mm/s)	Every Blast	Below grade or less than 1 m above grade in any part of the nearest structure not located on the Site

f) The monitoring station for blasting shall be as indicated in Table 2. Additional monitoring stations for blasting may be specified as required by the Department.

g) A monthly summary of results of monitoring shall be submitted to the Department.

11. Rehabilitation

a) The Approval Holder shall submit a rehabilitation plan to the Department for review by October 30, 2009. The rehabilitation plan shall be revised and updated every three years thereafter and submitted for review. The rehabilitation plan shall include the estimated total cost for labour, equipment, supplies and services of a third party contractor to undertake the following activities:

i) surface contouring
ii) establishing proper drainage
iii) revegetation work
iv) any work necessary to reclaim the quarry

b) The Approval Holder shall revise the existing final security as calculated using the rehabilitation plan and factors in item c) above. The final security shall be revised every three years in accordance with the revised rehabilitation plan.

c) The Approval Holder shall rehabilitate the Site within twelve (12) months of abandonment and in accordance with the rehabilitation plan submitted by the Approval Holder in 11 (c) or other terms as specified by the Department,

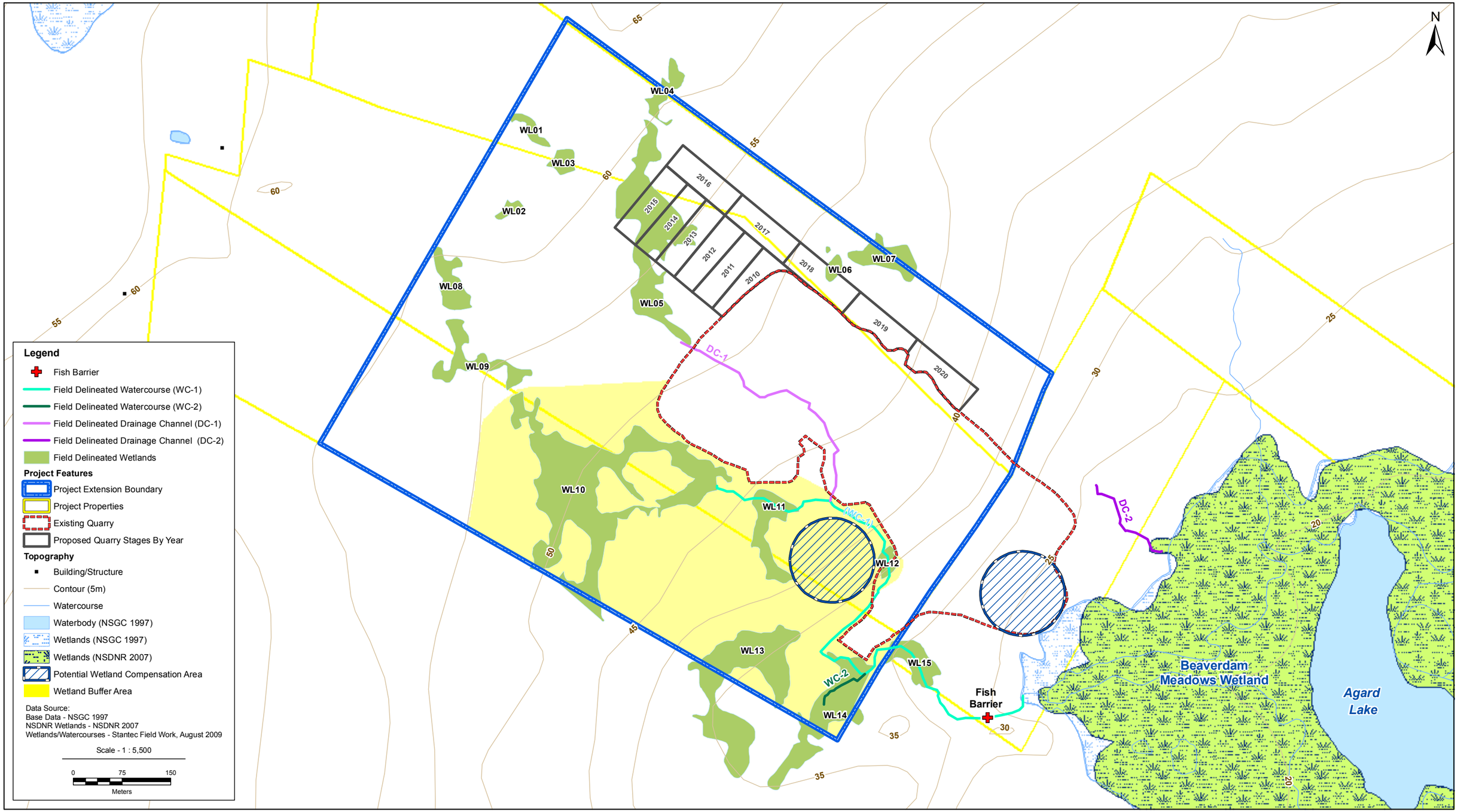
d) Nova Scotia Environment shall release the security to the Approval Holder after final rehabilitation of the Site has been completed to the satisfaction of the Minister or Administrator. The Approval Holder shall notify the Department when rehabilitation has been completed.

e) The Approval Holder shall ensure that any security posted for rehabilitation be kept valid for the term of the Approval.

12. **Site Specific Conditions**

a) The boundaries of the Site will be cut out and kept reasonably clear of new growth and the corner boundaries shall be clearly marked with permanent markers no less than four feet high.

APPENDIX B
Proposed Quarry Development Plan



DATE: May 26, 2010

PREPARED BY: G. Mesheau

Hardscratch Quarry Extension Project

Proposed Quarry Development Plan & Wetland Buffers

FIGURE NO.: **Figure B1**

Stantec

APPENDIX C
Aberdeen Quarry Extension Hydrology Study

Stantec Consulting Ltd.
3 Spectacle Lake Drive
Dartmouth NS B3B 1W8
Tel: (902) 468-7777
Fax: (902) 468-9009

Aberdeen Paving Quarry Extension Hydrology Study

Report Prepared for:
Aberdeen Paving Ltd.
Hammonds Plains Rd
Halifax, NS B4B 1B1

File: 121510237

December 2009

Table of Contents

LIST OF TABLES

LIST OF FIGURES

1.0 Introduction

1.1 GENERAL

As part of the requirements of the Environmental Assessment Registration, a hydrologic study was conducted for the area that covers the existing Hardscratch Quarry and the proposed quarry extension area. The main objectives of this hydrologic study were to determine changes on the local hydrologic regime due to the proposed quarry extension, to identify adverse effects on downstream hydrologic elements, and to offer measures to mitigate these effects.

1.2 OBJECTIVES

The main objectives of this hydrologic study are as follows:

1. Estimate the total change in surface water runoff amounts for the pre and post-development conditions.

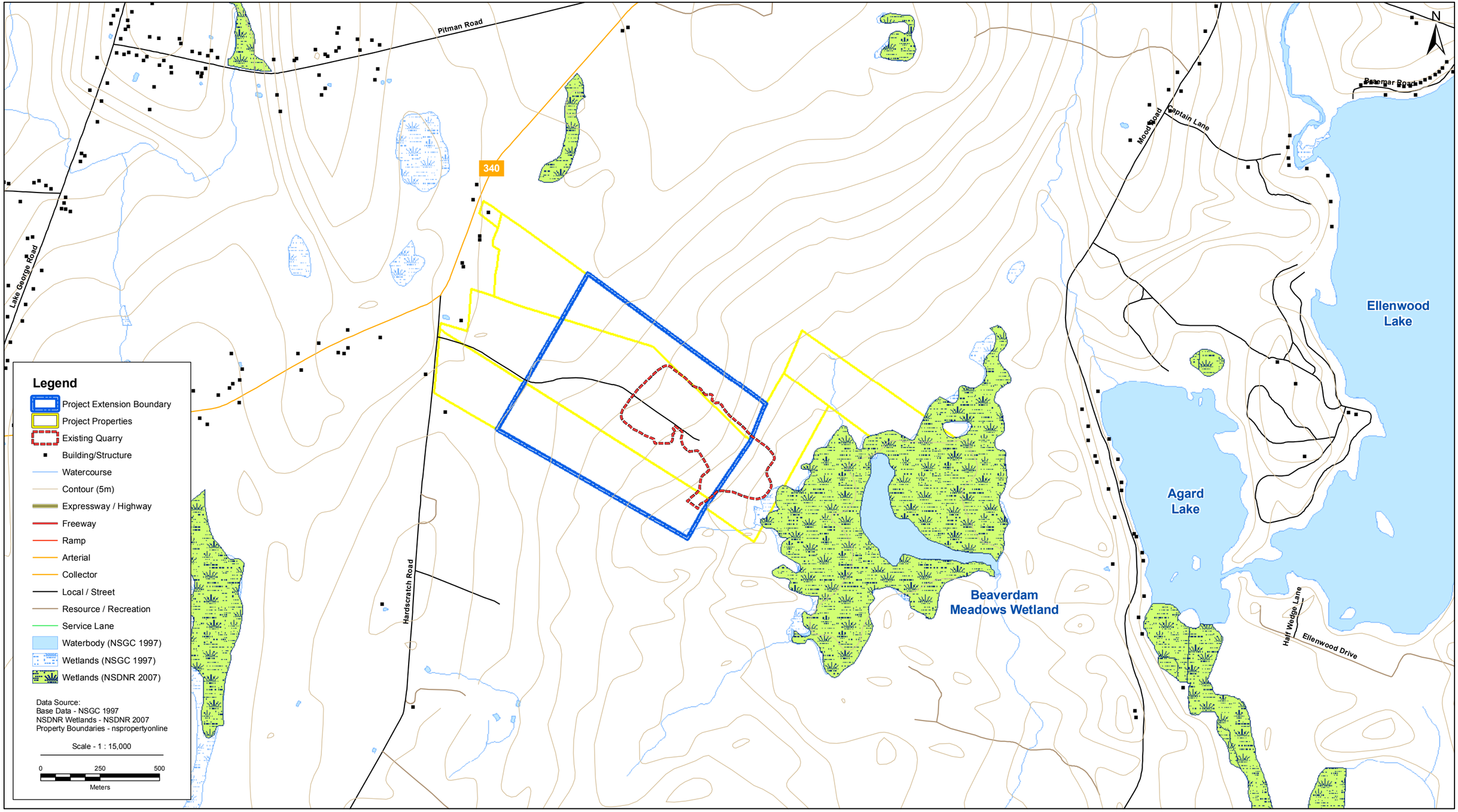
2. Estimate the total capacity of the required flow retention/siltation facilities (i.e. retention pond) for the ultimate level of quarry extension.

3. Assess any potential impacts of the proposed quarry extension on downstream hydrologic elements with respect to water quantity and quality and provide recommendations to mitigate these potential impacts.

1.3 SITE DESCRIPTION AND BACKGROUND

The proposed quarry extension land (referred thereafter as the “site”) is located approximately 12 km north of the town of Yarmouth, in South Ohio, Yarmouth County, Nova Scotia. The proposed extension is situated around the area of the existing Hardscratch Quarry which covers three separate properties (PIDs 90138728, 90138777, and 90138710). The total area of the Site is approximately 94.4 Ha (including all three properties).

The Project site is somewhat rectangular in shape with its longest dimension extending from NW to SE. The existing quarry encompasses an area of 14.0 Ha and has been operating since 1997. As the operation progresses, the organic layer at the site is removed and stockpiled for future reinstatement. The aggregates from the quarry are extracted by blasting, crushing and stockpiling of material on site (overburden and bedrock) and are used to supply granite to local gravel and concrete markets. It is expected that the operation of the proposed quarry extension will be the same as the existing quarry. The existing quarry boundary, the proposed extension area and other main features of the area are shown in Figure 1.1.

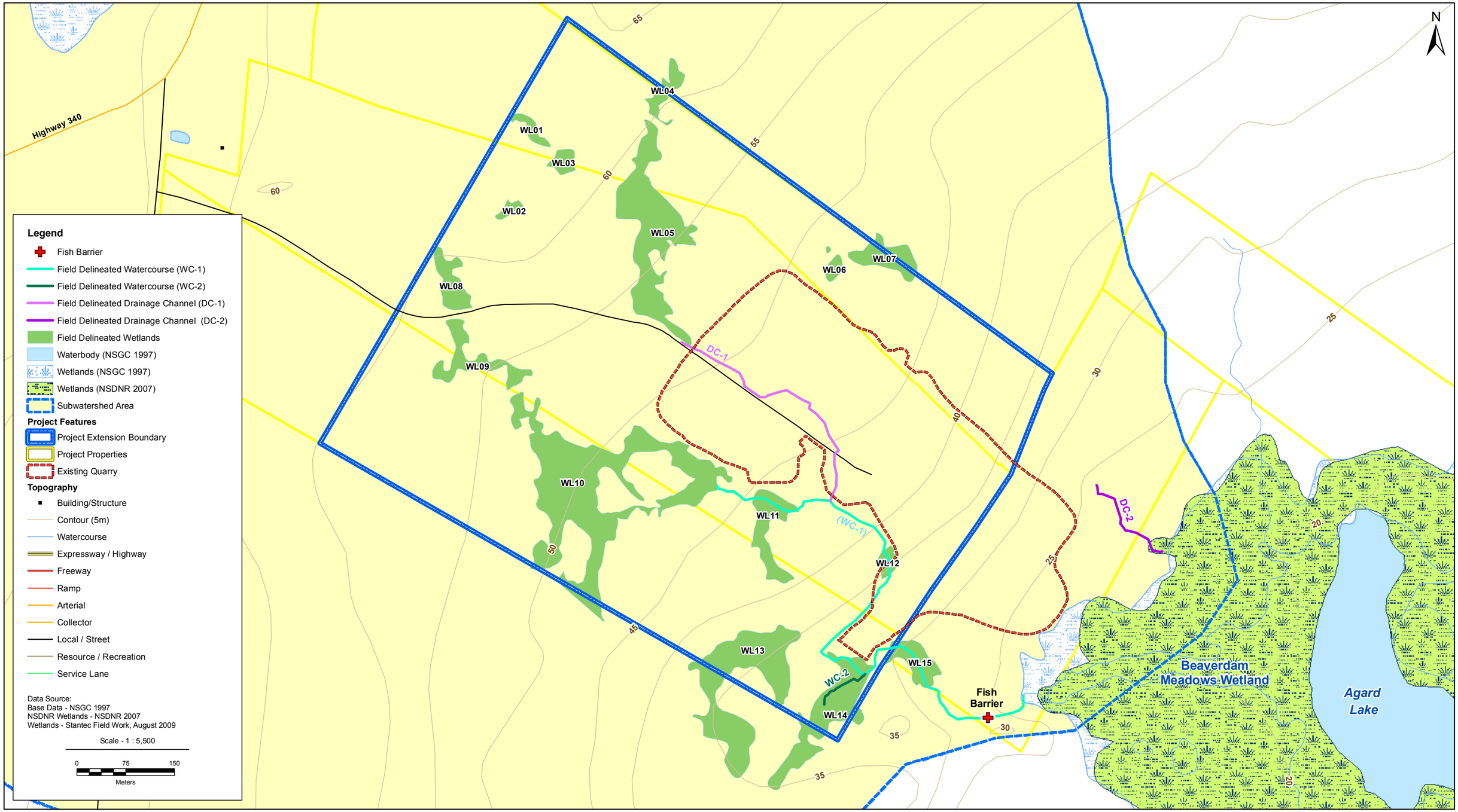


DATE: February 04, 2010	Hardscratch Quarry Extension Project	FIGURE NO.: **Figure 1.1**
PREPARED BY: G. MESHEAU	**Project Location and Proposed Extension Area**	Stantec

The existing topography for the entire site slopes to the southeast. Surface runoff is conveyed by two drainage channels located within the site. These convey the water to two settling ponds; the water then flows out to a naturally vegetated area where it is infiltrated. During a site visit conducted by Stantec representatives on October 29, 2009, the presence of two watercourses was also confirmed within the site. Both watercourses exhibited clear flowing water, however, a barrier to fish passage was found in the downstream area of the main watercourse and outside the proposed project extension boundary. It was also found during the site visit that both watercourses and one of the two existing drainage channels have a direct connection with Agard Lake.

The site is intended to be developed over a number of years until the complete extension is achieved. It is our understanding that the site will be extended gradually to the northwest and to the southwest until the entire proposed development boundary is reached. A 30 m buffer area around the entire perimeter of the property is also required, however, in this case the 30 m buffer applies only to properties that are not own by Aberdeen Paving located on the north and south boundaries, making the total development area in the order of 60.6 Ha.

Based on available stream and contour mapping (5 m resolution) the site is located within one sub-watershed that drains to the southeast, towards Agard Lake. A series of wetlands were also identified during the site visit. These along with other hydrologic features of the site are shown on Figure 1.2.



DATE: February 04, 2010 PREPARED BY: L. Kendell	Hardscratch Quarry Extension Project **Hydrological Features**	FIGURE NO.: **Figure 1.2**

2.0 METHODOLOGY

2.1 MEAN ANNUAL SITE RUNOFF ESTIMATION

The mean annual site runoff for the entire proposed extension was calculated by comparing the mean annual water balance of both the existing and the proposed conditions. The entire development condition assumes that all the vegetative cover and topsoil layer will be removed from the site which will cause an increase in site runoff due to a decrease in evapotranspiration and infiltration amounts.

2.2 FLOW RETENTION AND SILTATION TREATMENT SIZING

The discharge capacity and dimensions of the required flow retention and siltation treatment structures for the total proposed extension were calculated with the hydrologic model HEC-HMS version 3.3. HEC-HMS was developed by the U.S. Army Corp of Engineers and is widely accepted as a tool to conduct hydrologic modeling by engineers and scientists around the world.

The parameters required for calculations were obtained from different sources. Annual precipitation data was obtained from climate normals from Station 8206100 (Tusket) operated by Environment Canada. Station 8206100 is located approximately 5.5 km to the southeast of the site. The surface slope, area and other physical parameters were approximated using GIS tools and available mapping. The concentration time was estimated with the Upland Method included in the National Engineering Handbook, Section 4, Natural Resources Conservation Service (NRCS, formerly the USDA Soil Conservation Service).

The required volume capacity for the flow retention and siltation structures was estimated based on a 6 hour duration rainfall with an associated Annual Exceedance Probability (AEP) of 0.04, which is a rainfall event with an associated return period of 25 years. The maximum discharge capacities for the hydraulic discharge structures were based on the 6 hour 0.01 AEP storm (1:100 year return period rainfall event). Rainfall Intensity-Duration-Frequency (IDF) curves were obtained from Station 8206500 (Yarmouth Airport), operated by Environment Canada. Station 8206500 is the nearest station with available data and is located approximately 12 km to the south of the site.

2.3 RESULTS

2.3.1 Mean Annual Site Runoff Estimation

Based on climate normals (1971-2000) from station 8206100 (Tusket), the average total annual precipitation at the site is in the order of 1368 mm.

Total annual evapotranspiration in the area has been estimated using the Thornthwaite Equation and average monthly temperature data from Station 8206500 (Yarmouth Airport).

Based on the Thornthwaite Equation, the estimated local annual evapotranspiration is in the order of 559 mm, or 40.8% of the average annual precipitation. Infiltration is assumed to be in the order of 15% of the average annual precipitation based on the hydrologic soil group, vegetation cover and average surface topography at the site combined with previous experience with similar sites in Nova Scotia (David MacFarlane, personal communication, June 22nd 2009). The annual infiltration is therefore in the order of 205.2 mm.

The remaining 44.2% of the average annual precipitation can contribute to surface runoff to the site which corresponds to 604.6 mm per year. It has been estimated that surface runoff from the site will increase by approximately 20% as a result of the quarry extension; this takes into account an equivalent decrease in evapotranspiration and infiltration.

Although it is difficult to accurately determine the effects of climate change within the next century, there is a general agreement that the magnitude of precipitation events will likely increase. Since the site will be developed over a long period of time it is advisable to account for climate change effects, and therefore an extra 10% increase in mean annual precipitation was assumed (Jacques Whitford, 2008). Therefore, the annual effective precipitation at the site is assumed to be 798.0 mm.

The existing and post-development surface runoff volumes were estimated by multiplying the estimated annual precipitation by its corresponding catchment area. The results are presented on Table 2.1.

Table 2.1 Pre and Post Development Site Runoff Volumes

Scenario	Area (Ha)	Effective annual Precipitation (mm)	Runoff Volume (m^3)
Existing condition	14.0	604.6	84,644.0
Proposed Extension	60.6	798.0	483,588.0

Therefore, the expected increase in the average annual site runoff due to the proposed quarry extension is in the order of 398,944.0 m^3 or a 571% increase from the existing condition.

2.4 FLOW RETENTION AND SILTATION TREATMENT SIZING

A summary of the hydrologic model parameters is provided on Table 2.2. These were used as the main input in the hydrologic model HEC-HMS.

Table 2.2 Summary of Hydrologic Parameters Used in HEC-HMS

Parameter	Phase I
Initial and Constant Loss Method	Initial Loss: 2.5 mm Constant Rate: 7.6 mm/hr Imperviousness: 60%
Clark Unit Hydrograph Routing Method	Concentration Time (Tc): 0.48 hr
Included Storms	6 hour 1:25 year return period 6 hour 1:100 year return period
Subcatchment Area	0.6 km^2

Table 2.2 Summary of Hydrologic Parameters Used in HEC-HMS

Parameter	Phase I
Baseflow	Not considered
Attenuation effects due to channel storage	Not considered
Modeling interval	5 min

The parameters used in the hydrologic model to calculate the concentration time for the proposed quarry extension are included on Table 2.3.

Table 2.3 Model Parameters Used for the Calculation of Tc

Scenario	Area (Ha)	Flow Path Length (m)	Slope (m/m)	Concentration Time (min)
Extension	60.6	1,000	0.03	28.8

For all calculations it was assumed that all surface runoff originating from the upstream regions of the catchment area located off-site are diverted around the proposed quarry extension, and therefore no off-site catchment area is contributing to on-site surface runoff. Flow hydrographs developed for the 6 hour 1:25 and 1:100 year storms are shown in Figures 2.1 and 2.2, below.

Figure 2.1 Flow Hydrograph for the 1:25 Year Rainfall Event for Full Quarry Extension

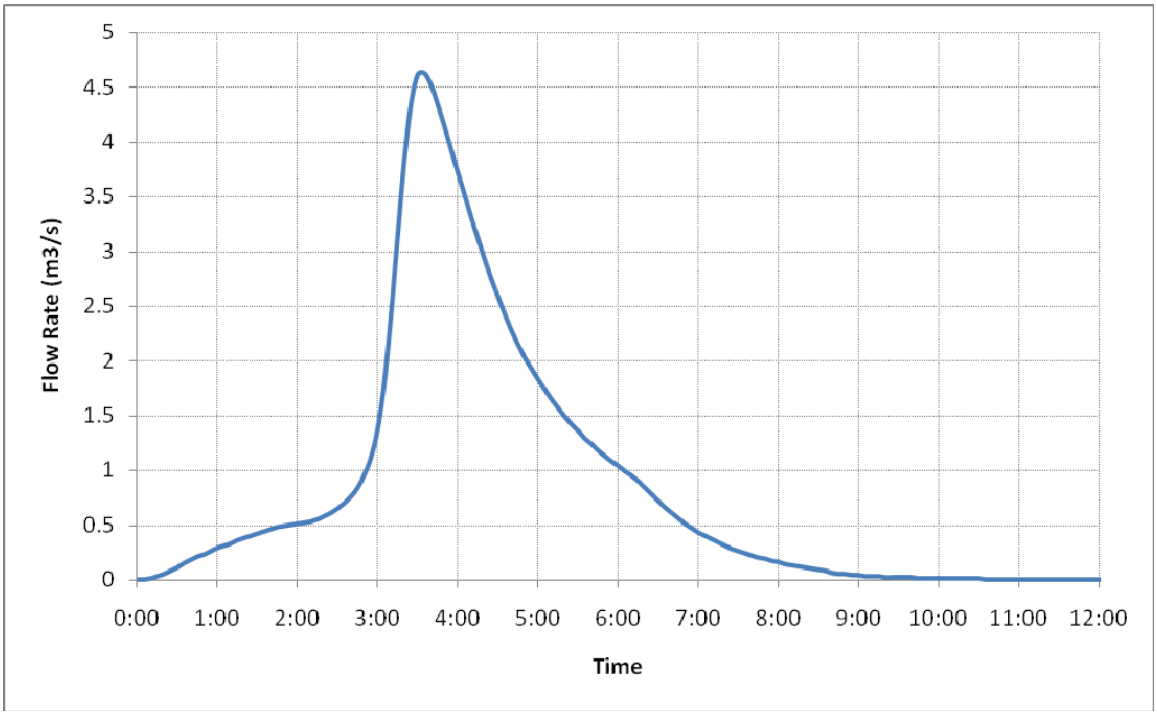
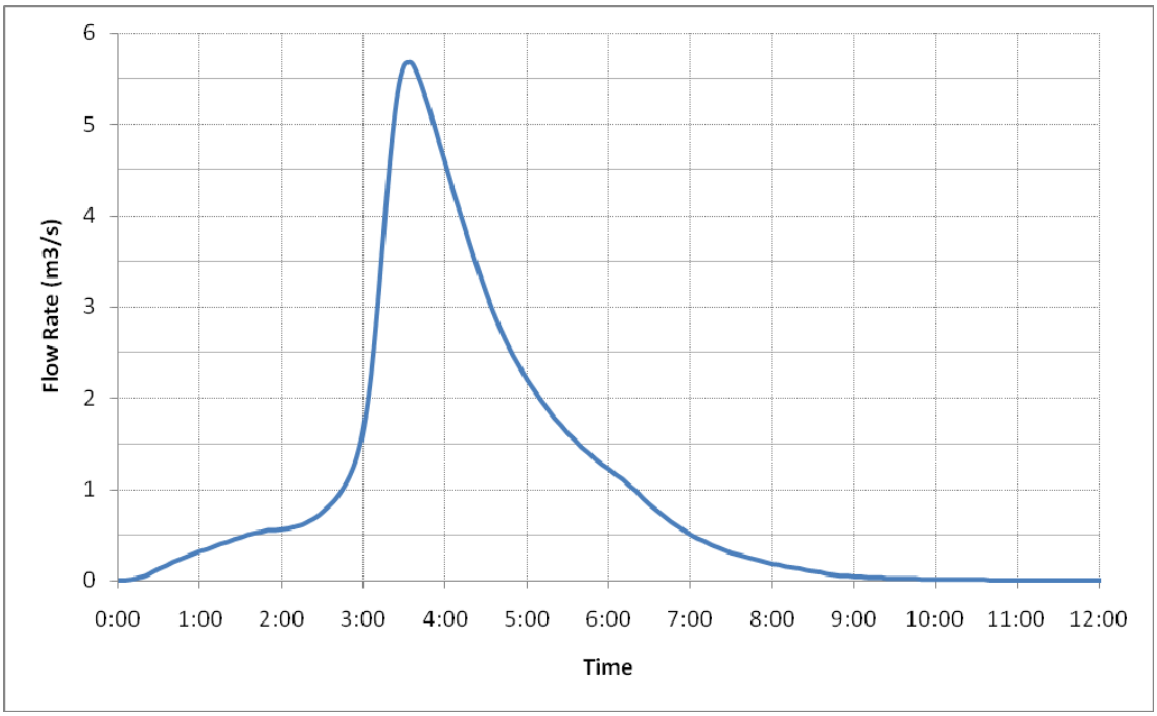


Figure 2.2 Flow Hydrograph for the 1:100 Year Rainfall Event for Full Quarry Extension



Based on model estimations for the 6 hour 1:25 year and 1:100 year rainfall events, the expected runoff peak flows and volumes as a result of the ultimate level of proposed quarry extension are shown in Table 2.4.

Table 2.4 Estimated runoff peak flows and volumes for different rainfall events

Extension stage	Return Period	Peak Flow (m^3/s)	Volume (m^3)
Full quarry extension (proposed)	1:25	4.63	36,390
	1:100	5.68	43,720

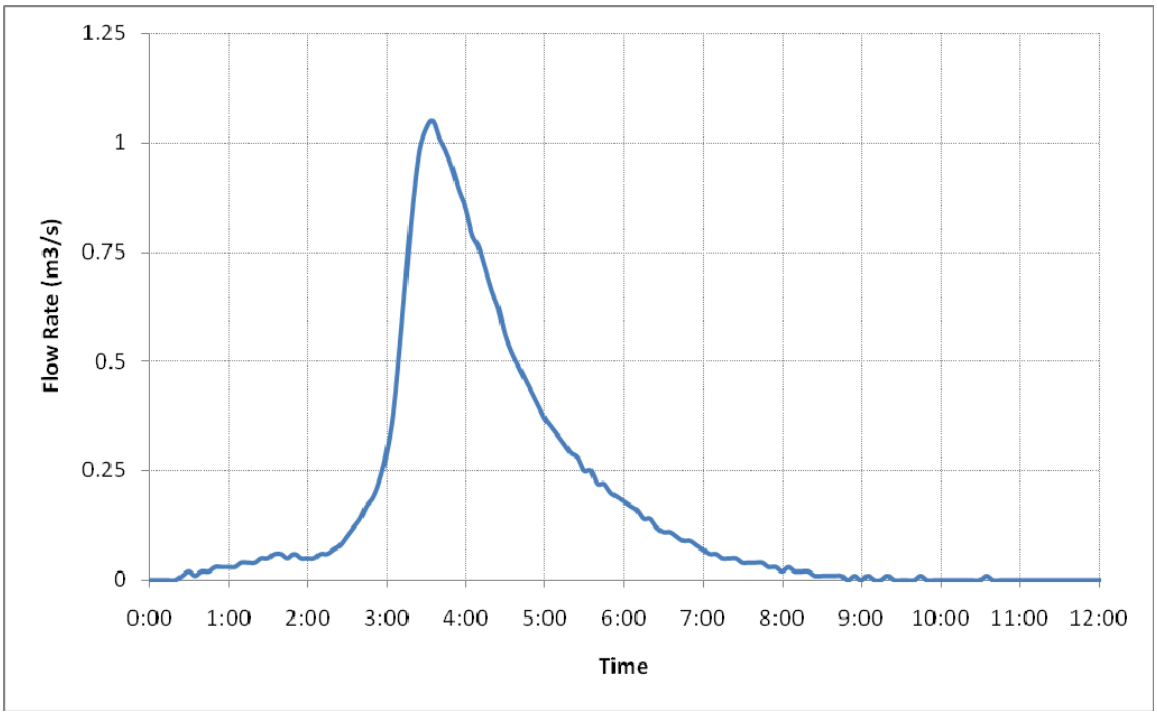
It is recommended to size the flow retention structures to retain the volume from the 1:25 year rainfall event. Therefore, the total volume of retention storage for the site for the ultimate level of quarry extension should be in the order of 36,390 m^3. This volume is only expected after the site has been developed fully, therefore it is feasible to maintain a smaller storage pond capacity which will require to be extended with the quarry operation.

Based on the simulations completed for the 1:100 year six hour duration rainfall event, the peak flow is estimated to be in the order of 5.68 m^3/s. The construction of stormwater retention structures will have an attenuation effect on the peak flow from the 1:100 year rainfall event, therefore, since the storage pond should be able to store the 1:25 year storm the discharge structure at the exit of the retention ponds should be designed to accommodate as a minimum the excess discharge between the 1:25 and the 1:100 year rainfall events.

Therefore, the difference in flow hydrographs between the 1:25 and 1:100 year rainfall events are shown on Figure 2.3. Based on Figure 2.3, the weir structure should be sized as a minimum to convey 1.05 m^3/s.

Drawdown of water levels from the 1:25 year rainfall event detention storage level to the permanent pool retention level should be estimated based on the detention time that will improve water quality. A recommended drawdown period of 24 hours is expected to decrease suspended sediment concentrations by as much as 80%. Based on the low flow threshold of 24 hour discharge for runoff events equal or smaller than the 1:25 year rainfall event, the mean discharge capacity should be 0.421 m^3/s. As a result, an appropriately designed weir is recommended as the most suitable discharge structure which is expected to control peak discharge volumes reducing the threat of downstream erosion and extending the discharge time to downstream hydrologic features.

Figure 2.3 Excess flow rate from the 1:100 year rainfall event with storage attenuation



2.4.1 Effects on Downstream Flows and Water Quality

The full quarry development is anticipated to increase the total mean annual runoff at the site by 398,944.0 m^3. As mentioned previously, there are a number of identified wetlands on the site that are not indicated on provincial mapping, it is assumed that the full development of the site as a quarry operation will result in the removal of the field identified wetlands from the site. Although it has not been quantified, the elimination of these wetlands may also increase peak flows by reducing storage capacity. However, this effect is considered negligible when compared to other factors that influence flow routing and peak flow generation.

It is important to mention that control measurements must be implemented to minimize the impact on any streams and wetlands located downstream of the site. All surface water runoff that is being discharge to downstream receptors must meet all applicable guidelines for the protection of aquatic life and the aquatic environment.

It is anticipated that the largest potential for water quality impacts due to the quarry extension and operation would be erosion and an associated increased in sediment loads. There are certain measures that can be adopted to reduce these impacts, including check dams along collection ditches and the placement of free draining cover materials over disturbed areas. The proper design of the retention ponds should include the capacity to remove sediment as needed to maintain the required volume and extend the life of the structures, or the addition of extra volume to accommodate sediment loads. Even with this measure, maintenance would likely be required from time to time to empty the retention ponds.

Aquatic life was not observed in any of the unnamed tributaries within the site, and therefore it is assumed that the minimum 30 m buffer zone is not required between the quarry operation and the streams. Surface runoff from the site should not be sent to downstream receptors before being routed in the retention ponds and the surface water runoff should comply with existing guidelines to protect the aquatic environment. The streams are not likely to experience major changes in the flow regime as there are upstream areas of the subwatersheds that can contribute to flow. However, a monitoring program for water quality and/or quantity may be warranted if major modifications to the aquatic regime are observed and corrective measures may be necessary to ensure that a good aquatic environment is maintained near the site.

3.0 CONCLUSIONS

The following conclusions are offered based on the desktop hydrology study for the proposed Hardscratch quarry extension.

The existing site runoff for the site is estimated to be in the order of 84,644.0 m^3. The expected total increase in the mean annual runoff for the site resulting from the proposed extension is in the order of 398,944.0 m^3 or a 571% increase from the existing condition.

The flow retention structures for the proposed quarry extension should be able to accommodate a volume of 36,390 m^3 during the 6 hour 1:25 year storm as the largest event. The dimensions of the proposed retention pond(s) will depend on site characteristics, as an example, a retention pond able to accommodate 36,390 m^3 can have approximate dimensions of 98 m x 98 m x 4 m.

The outlet structures for the retention pond should be able to accommodate a discharge of 1.05 m^3/s, which corresponds to the difference in peak flows between the 1:25 year and the 1:100 year rainfall events.

Based on a recommended retention time of 24 hours for any precipitation event equal or smaller than the 1:25 year rainfall event, the discharge structure should be designed to conform to a mean discharge capacity of 421.2 L/s. This will facilitate the recommended 24 hour drawdown period. The maximum discharge capacity should be maintained as indicated previously.

Flow retention structures should be placed immediately downstream of the quarry facilities to capture all surface runoff before it is conveyed towards hydrologic features downstream of the site. This will also help to attenuate peak flows, reduce the slope of the recession limb and to some extent maintain pre-development conditions.

Drainage features should be constructed with appropriate erosion and sediment control measures to direct and convey site surface runoff to their corresponding flow retention and sediment control structures.

The surface water runoff from the site should comply with the applicable guidelines for the protection of the aquatic environment.

4.0 CLOSURE

This report has been prepared on behalf of and for the exclusive use of Aberdeen Paving. This report represents the conditions of the property at the time of the assessment. The conclusions presented in this report represent the best judgment of the assessor based on current environmental standards. Stantec Consulting Ltd attests that to the best of our knowledge the information presented in this report is accurate.

5.0 REFERENCES

Canadian Climate Normals or Averages 1971-2000. Environment Canada. Data accessed online at http://www.climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html

National Engineering Handbook, Part 630, Chapter 4. Natural Resources Conservation Service. Washington, USA, 1993.

Jacques Whitford. 2008. Environmental Assessment Registration, Panuke Quarry Extension Project.

5.1 PERSONAL COMMUNICATION

Stantec Consulting Ltd., Dave MacFarlane, personal communication June 22, 2009.

APPENDIX D
Project Information Bulletin and Letters

Stantec Consulting Ltd.
3 Spectacle Lake Drive
Dartmouth NS B3B 1W8
Tel: (902) 468-7777
Fax: (902) 468-9009

November 3, 2009
File: 1054351

Mi'kmaq Rights Initiative
Kwikmug Maw-Klusuag
851 Willow Street
Truro, NS B2N 6N8

Attention: Ms. Janice Maloney

Dear Ms. Maloney:

Reference: Aberdeen Paving Limited Quarry Extension Project

This letter is to inform you of a proposed Project near the town of Yarmouth, Nova Scotia.

The Project consists of an extension of quarry activities at an existing facility along Hardscratch Road, Yarmouth, NS. The developer, Aberdeen Paving Limited, is proposing to extend the area of the existing Hardscratch Quarry while maintaining approximately the same level of production. Aberdeen Paving is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

Please find enclosed the Project Information Sheet and the corresponding Figure, which provide more details regarding the Project and the site location.

Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

STANTEC CONSULTING LTD.

ORIGINAL SIGNED BY

Robert Federico
Senior Project Manager
(902) 468-7777
robert.federico@stantec.com

Cc. Gillian Asche, SCL

Attachment

Stantec Consulting Ltd.
3 Spectacle Lake Drive
Dartmouth NS B3B 1W8
Tel: (902) 468-7777
Fax: (902) 468-9009

November 3, 2009
File: 1054351

Confederacy of Mainland Mi'kmaq
57 Martin Crescent
P.O. Box 1590
Truro, NS, B2N 5V3

Attention: Mr. Donald M. Julien

Dear Mr. Julien:

Reference: Aberdeen Paving Limited Quarry Extension Project

This letter is to inform you of a proposed Project near the town of Yarmouth, Nova Scotia.

The Project consists of an extension of quarry activities at an existing facility along Hardscratch Road, Yarmouth, NS. The developer, Aberdeen Paving Limited, is proposing to extend the area of the existing Hardscratch Quarry while maintaining approximately the same level of production. Aberdeen Paving is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

Please find enclosed the Project Information Sheet and the corresponding Figure, which provide more details regarding the Project and the site location.

Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

STANTEC CONSULTING LTD.

ORIGINAL SIGNED BY

Robert Federico
Senior Project Manager
(902) 468-7777
robert.federico@stantec.com

Cc. Gillian Asche, SCL

Attachment

Stantec Consulting Ltd.
3 Spectacle Lake Drive
Dartmouth NS B3B 1W8
Tel: (902) 468-7777
Fax: (902) 468-9009

November 3, 2009
File: 1054351

Union of Nova Scotia Indians
47 Maillard Street
Membertou, NS B1S 2P5

Attention: Mr. Joe B. Marshall

Dear Mr. Marshall:

Reference: Aberdeen Paving Limited Quarry Extension Project

This letter is to inform you of a proposed Project near the town of Yarmouth, Nova Scotia.

The Project consists of an extension of quarry activities at an existing facility along Hardscratch Road, Yarmouth, NS. The developer, Aberdeen Paving Limited, is proposing to extend the area of the existing Hardscratch Quarry while maintaining approximately the same level of production. Aberdeen Paving is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

Please find enclosed the Project Information Sheet and the corresponding Figure, which provide more details regarding the Project and the site location.

Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

STANTEC CONSULTING LTD.

ORIGINAL SIGNED BY

Robert Federico
Senior Project Manager
(902) 468-7777
robert.federico@stantec.com

Cc. Gillian Asche, SCL

Attachment

Stantec Consulting Ltd.
3 Spectacle Lake Drive
Dartmouth NS B3B 1W8
Tel: (902) 468-7777
Fax: (902) 468-9009

November 3, 2009
File: 1054351

Native Council
324 Abenaki Road
PO Box 1320
Truro, NS B2N 5N2

Attention: Mrs. Grace Conrad

Dear Mrs. Conrad:

Reference: Aberdeen Paving Limited Quarry Extension Project

This letter is to inform you of a proposed Project near the town of Yarmouth, Nova Scotia.

The Project consists of an extension of quarry activities at an existing facility along Hardscratch Road, Yarmouth, NS. The developer, Aberdeen Paving Limited, is proposing to extend the area of the existing Hardscratch Quarry while maintaining approximately the same level of production. Aberdeen Paving is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

Please find enclosed the Project Information Sheet and the corresponding Figure, which provide more details regarding the Project and the site location.

Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

STANTEC CONSULTING LTD.

ORIGINAL SIGNED BY

Robert Federico
Senior Project Manager
(902) 468-7777
robert.federico@stantec.com

Cc. Gillian Asche, SCL

Attachment

Aberdeen Paving Limited
Hardscratch Quarry Extension Project
Project Information Sheet

Project Overview

Aberdeen Paving Limited proposes to extend its quarry activities at the existing facility in Yarmouth, Nova Scotia (refer to Figure 1 on reverse). The current operation is approximately 3.9 hectares in area. The proposed extension will incorporate land north west of the existing quarry to increase the total size of the operation to approximately 66 hectares. Blasting, crushing and stockpiling of aggregate is proposed to take place at the extension site. The quarried material is primarily used for local construction and aggregate for asphalt plants. Depending on market demand, the proposed activities will take place over an extended period of time until the material is exhausted. Based on current estimates, there are over 6-8 million tonnes of rock reserves within the proposed extension area. The extended site could therefore sustain aggregate production for approximately 40 years.

Proposed project activities will be consistent with current quarry operations. These activities were approved by Nova Scotia Environment (NSE) and in accordance with the *Nova Scotia Pit and Quarry Guidelines* (NSE 1999). Aggregate production begins with drilling and blasting, which will be conducted by a licensed blasting contractor. Blasting will take place approximately three to five times per year. After blasting, portable crushing equipment will be brought to the site to process the blasted rock. Various products (*i.e.*, various aggregate sizes) will be stockpiled at the quarry site until they are transported to local markets via tandem trucks or tractor trailer trucks via the existing truck route. The average number of trucks hauling aggregates from the quarry could be up to 25 per day, depending on market demand. This is consistent with current truck volume at the existing quarry and could increase, for a short period, if a large aggregate supply contract were awarded.

The anticipated average production rate is approximately 200,000 tonnes per year, with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule may be 12 hrs/day, 5 days/week, 48 weeks/year or more, depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

Environmental Assessment Process

Aberdeen Paving Limited is required to register this project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and *Environmental Assessment Regulations*. The environmental assessment registration is currently being prepared by environmental consultants Stantec, on behalf of Aberdeen Paving Limited, to fulfill these regulatory requirements. Other relevant provincial regulations include *the Activities Designation Regulations*, which requires an Industrial Approval from Nova Scotia Environment for the quarry operation, and the *General Blasting Regulations* made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). Provincial guidelines to be adhered to include the Nova Scotia *Pit and Quarry Guidelines* (NSE 1999).

The environmental assessment registration will evaluate potential environmental effects of the project and identify appropriate mitigation and monitoring to minimize these effects. The environmental assessment registration document will be available for public review and comment once it is filed with NSE.

Environmental Document Components

The environmental registration document focuses on those aspects of the environment that are considered to be of most concern. Components to be evaluated include:

- rare and sensitive flora;
- wildlife;
- surface water resources
- groundwater resources;
- wetlands;
- archaeological and heritage resources;
- atmospheric environment (includes dust and noise); and
- socio-economic environment.

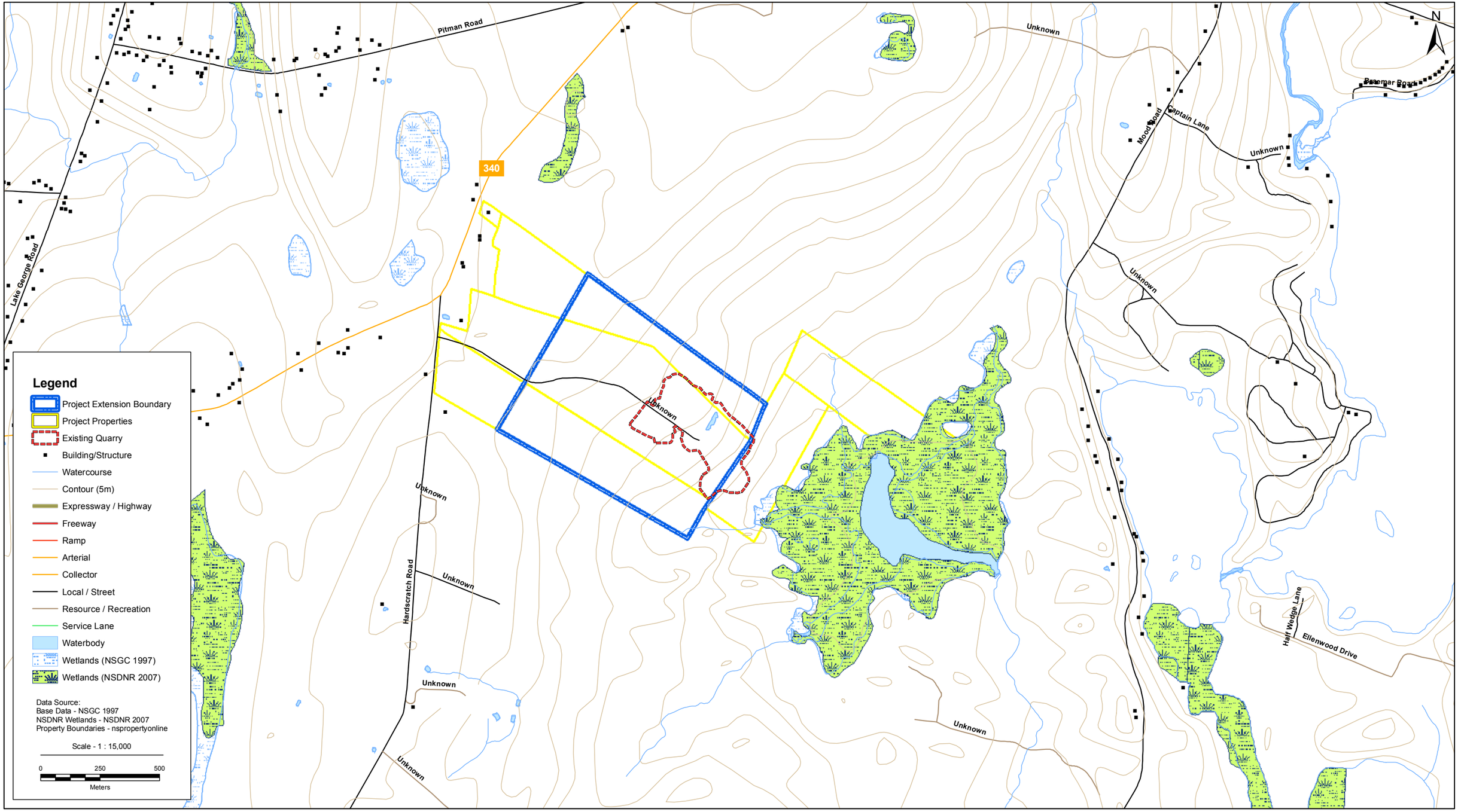
Potential effects of quarry activities on these components will be addressed in the registration document. Preliminary results of an environmental evaluation identified a number of wetlands and a potential stream on the property. To date, no other sensitive features have been identified onsite; however, field investigations are ongoing. Assuming the implementation of standard mitigative measures and government guidelines and approvals, no significant adverse environmental or socio-economic effects are considered likely.

Contacts

If you have any questions or concerns about this project please contact:

Mr. Wayne LeBlanc
Aberdeen Paving Limited
P.O. Box 579, Yarmouth, NS B5A 4B4
Tel: (902) 663-2276

Gillian Asche, Project Scientist
Stantec
3 Spectacle Lake Drive, Dartmouth, NS B3B 1W8
Tel: (902) 468-7777
E-mail: gillian.asche@Stantec.com



DATE: October 01, 2009	Aberdeen Paving - Quarry Expansion - Yarmouth, NS	FIGURE NO.: **Figure 1**
PREPARED BY: G. MESHEAU	**Project Base Map**	Stantec

APPENDIX E
Fish Habitat Survey

Watercourse 1 (WC-1) Upstream Area Between Wetlands WL7/6/8-R and WL5-M

Looking downstream (DS)

Looking upstream (US)

Substrate example

Watercourse 1 (WC-1) Downstream of Wetland WL5-M

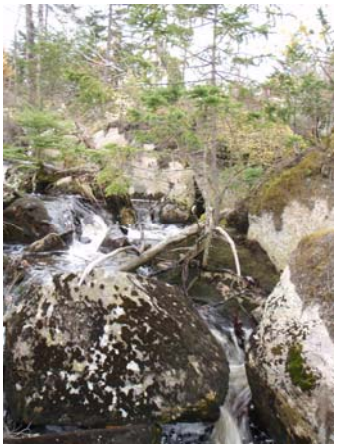
Looking DS

Looking US

Cascade

Watercourse 1 (WC-1) Channelized Area

Watercourse 1 (WC-1) Downstream Area, Wetland WL1-R and downstream to Agard Lake



Cascade in WL1-R

Cascade US of Agard Lake
(outside extension boundary)

Looking DS to Agard Lake
(outside extension boundary)

Watercourse 2 (WC-2)

Looking DS (existing quarry in background)

Looking US

Watercourse width

Drainage Channel 1 (DC-1)

Roadside drainage ditch with culverts under existing quarry access road.

Drainage Channel 2 (DC-2) – Outside Proposed Extension Boundaries

Existing Quarry Ponding Area

Ponding Area narrows down gradient

Channel draining ponding area
(looking US toward ponding)

Channel draining ponding area
(looking DS toward Agard Lake wetland area)

Table 1. Stream Survey form Project #: 1054351 - Aberdeen Quarry Date: October 29, 20

Watercourse	Reach No	Stream Type	Channel Type	Avg Width (m)		Depth				Substrate (%)							%	% Site		Comments
						1/4	1/2	1/4												
				Wet	Bank Channel	Wet (cm)	Wet (cm)	Wet (cm)	Avg. Depth Wet Width (cm)	Bedrock	Boulder	Rock	Rubble	Gravel	Sand	Fines	Embeddedness	Riffle / Run	Pools	
DC-1	1	8	1	0.5	1.00	7	8	5	7	0	5	10	15	20	20	30 clay	2	98	2.0	US of existing access road
	2	8	1	0.5	0.75	4	9	4.5	5-10	0	0	0	0	0	5	95 clay	N/A	100	0.0	DS of existing road to confluence with WC-1
WC-1	1	8	1	1.5	2.00	20	24	19.5	20	20	30	0	0	0	0	50	3	90	10	Input from WL-5-M & WL-7/6/8-R to R2.
	2	8/4	1	1.5	2.00	10	9	18	15	0	20	10	0	0	0	70	1	85	15	DS of WC-1 start, DS of WL2-M to manmade channel
	3	manmade channel	1	1.5	2.00	15.5	27	15	20	0	0	60	30	0	0	10	1	100	0	manmade channel to WL-3M
	4	8/4	1	1.5	2.00	13.5	18	14.5	15	0	35	15	10	5	10	25	1	95	5	DS of WL-3M toward lake
WC-2	7	8	1	1	1.50	25	60	45	50	0	20	0	0	0	0	80	2	100	0	Feeding from/through WL3-M
DC-2	1	8	1	1	1.50	7	5.5	3	5	0	10	25	40	0	0	25	1	100	0	Draining from quarry site.

Stream Type:					
1	Fall	10	Midchannel	18	Eddy
2	Cascade	11	Convergence	19	Gabion
3	Riffle (GR/RB)	12	Lateral	20	Log Structures
4	Riffle (R/B)	13	Beaver	21	Road Crossing
5	Riffle (Sand)	14	Trench	22	Wood Debris
6	Sheet (ledge)	15	Plunge	23	Man-made Dam
7	Chute	17	Bogan	24	Natural Deadwater
8	Run				
9	Rapid				

Substrate (mm)	
Bedrock	
Boulder	>461
Rock	180-460
Rubble	54-179
Gravel	2.6-53
Sand	0.06-2.5
Fines	0.0005-0.05

Embeddedness	
1	<20%
2	20-35%
3	35-50%
4	>50%

Stream Banks																																
Bank Erosion Left Bank 0-50%			Bank Erosion Right Bank 0-50%			% Undercut Bank		Vegetation %				% Overhanging Bank Vegetation		% Shade (Canopy + Riparian Veg.)	Riparian Vegetation Left Bank (0-30/30-100m)	Rip. Vegetation Right Bank (0-30/30-100m)	Large Woody Debris	Macrophytes	Algae	Pool rating Criteria		Pool Tail Embeddedness	River Characteristics	Temperature (° C)	Specific Conductivity (uS/cm)	TDS (g/L)	Salinity (ppm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH	Flow State (water quality sample)
Stable	Bare Stable	Eroding	Stable	Bare Stable	Eroding	L	R	Bare Ground	Grasses	Shrubs	Trees	L	R							No.	Letter											
20	30	0	20	30	0	0	0	85	5	8	2	2	2	15	cl/cl	cl/cl	0	S-1 e-1	S-1	<0.5 m		-	per-st	8.61	6	0.004	0.00	88.8	10.37	4.96	Run
50	0	0	50	0	0	2	2	0	65	30	5	30	30	75	E-F / parking	E-F / E-F	0	S-1 e-1	S-1	N/A		-	per-st	7.89	6	0.004	0.00	86.5	10.28	4.97	Run
48	0	2	48	0	2	10	15	0	70	0	30	5	5	70	E / clearing	E / E	5	S-1	S-1	4	b	3	per-st	7.53	6	0.004	0.00	69.2	8.28	5.42	Run (~60 m US of confluence)
45	0	5	48	0	2	10	10	0	70	0	30	2	2	60	E / clearing	E / E	5	S-1	S-1	4	b	1	per-st	7.55	6	0.004	0.00	82.3	9.87	5.48	DS of riffle
2	48	0	2	48	0	0	0	98	2	0	0	0	0	0	cl/cl	cl / E-F	0	0	S-1	N/A		-	per-st	8	6	0.004	0.00	89.1	10.55	5.47	DS of riffle
45	5	0	50	0	0	5	5	10	50	5	35	5	5	60	E / clearing	E / E	10	S-1	S-1	4	b	1	per-mean	7.97	6	0.004	0.00	77.2	9.14	5.13	Run DS of riffle
50	0	0	50	0	0	0	0	0	90	0	10	15	15	30	WL / WL	WL / WL	4	S-1	F-1 A-1	N/A		-	per-mean	8.23	7	0.004	0.00	62.9	7.40	5.02	Run
20	10	20	30	10	10	0	0	10	50	38	2	15	15	40	E/E	E/E	2	E-1 S-1	A-2 F-1 S-1	N/A		-	per-st	8.78	19	0.012	0.01	83.3	9.69	6.73	Run

Riparian Vegetative Community [Right and Left Banks: Facing DOWNSTREAM]

Use: A (None), B (cultivated), C (meadow), D (scrubland), E (forest, mainly coniferous), F (forest, mainly deciduous)
Cl (Clearing), WL (wetland)

Aquatic Macrophytes and Algae (Use: 2 (Abundant), 1 (Present), 0 (Absent)

Macrophytes	Algae
E - Emergent	FA - Floating Algae
RF - Rooted Floating	F - Filaments
S - Submergent	A - Attached Algae
FF - Free Floating	S - Slimes or Crusts

Pool Rating			
Number			Letter (% pools in Site)
	Pool Depth >1.5m		a- >30%
1	Instream Cover	>30%	b- 10-30%
2	Instream Cover	<30%	c- <10%
	Pool Depth 0.5-1.5 m		
3	Instream Cover	>30%	a->50%
4	Instream Cover	<30%	b-<50%
* Denotes Pool Depth < 0.50 m			

Common River Characteristics	
per-st	perennial, straight
per-mean	perennial, meandering
eph-st	ephemeral, straight
eph-mean	ephemeral, meandering
ing-st	intermittant, straight
int-mean	intermittant, meandering

Legend

- Lake George Watershed Protected Water Supply Area
- Existing Quarry

Access

- Expressway
- Principal Highway
- Secondary Highway
- Primary Road
- Secondary/Local Road
- Project Extension Boundary
- Project Properties
- Wetlands (NSDNR 2007/NSGC 1997)

STANTEC PROJECT NO.: 121510237

0 0.5 1 1.5 2

Distance in Kilometres

N

Lake Annis

Lake Jesse

Two Island Lake

Lake George

Killams Lake

Lake George

LAKE GEORGE WATERSHED

Brazil Lake

Brazil Lake

Brenton Lake

Brenton Lake

340

Sunday Lake

Hoopers Lake

Ellenwood Lake

101

Bunkers Lake

South Ohio

Agard Lake

Beaverdam Meadows Wetland

DATE: April 30th, 2010 PREPARED BY: C.Shupe	Aberdeen Paving - Quarry Expansion - Yarmouth, NS **Lake George Watershed Protected Area**	FIGURE NO: **Figure E1**

APPENDIX F
Rare and Sensitive Plants Identified during Modelling Exercise as being Potentially Present in Project Area

Table F-1 ACCDC Rare and Sensitive Plants Potentially Present in Project Area

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank	Target for Spring Survey?
Nantucket Shadbush	*Amelanchier nantucketensis*	Pine barrens, pond margins, fields, edges, and thickets. Old fields /roadsides.	May	S1	Red	Yes
Maidenhair Spleenwort	*Asplenium trichomanes*	Damp shaded cliffs, and talus slopes. Acidic rock such as granite, basalt and sandstone.	Can be identified without sprangia.	S2	Yellow	No
Groundseltree	*Baccharis halimifolia*	By woodland streams or in calcareous woods.	Not given for NS.	S1	Red	No
Purple-Stem Swamp Beggar-Ticks	*Bidens connata*	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores.	August and September, can be identified when not in flower.	S3?	Yellow	No
Crowded Sedge	*Carex adusta*	Dry, open places. Rocky coastal, nonforested, upland.	June to September	S2S3	Yellow	No
Slender Wood Sedge	*Carex digitalis*	Dry, sandy woodlands.	Not given for NS	S1	Red	Yes
a Sedge	*Carex houghtoniana*	Sandy soils and roadside banks.	Not given for NS	S2?	Yellow	No
Loose-Flowered Sedge	*Carex laxiflora*	Damp clearings and open rocky woods.	Not given for NS	S1	Red	Yes
Swan Sedge	*Carex swanii*	Boggy pastures, dry peaty barrens, forests, clearings, and the edges of woods.	Early summer	S2?	Yellow	Yes
Wiegand's Sedge	*Carex wiegandii*	Boggy and peaty soils, conifer and alder swamps.	Matures in summer	S1	Red	No
Coast Pepper-Bush	*Clethra alnifolia*	The shores of lake headwaters, swamps, damp thickets, and sandy woods.	Late September to October	S1S2	Yellow	No
Hemlock Parsley	*Conioselinum chinense*	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast.	August to October	S2S3	Yellow	No
Capitate Spikerush	*Eleocharis olivacea*	Peaty muck of bogs, wet sandy shores, and swales.	June to October. Mature achenes required for identification.	S2	Yellow	No
Ovate Spikerush	*Eleocharis ovata*	Muddy shores and ditches.	Flowers/Fruit May to October	S2?	Yellow	No
Purple-Leaf Willow-Herb	*Epilobium coloratum*	Low-lying ground, springy slopes and similar locations.	July and October. Seeds required for identification.	S2?	Yellow	No

Table F-1 ACCDC Rare and Sensitive Plants Potentially Present in Project Area

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank	Target for Spring Survey?
Downy Willow-Herb	*Epilobium strictum*	Wet meadows, boggy swales and marshes.	July to September	S3	Yellow	No
Slender Cotton-Grass	*Eriophorum gracile*	Wet peat and inundated shores.	Flowers and fruits early summer	S2	Yellow	Yes
Joe-Pye Thoroughwort	*Eupatorium dubium*	Rocky shores, swamps and damp thickets.	August and September, can be identified when not in flower.	S2	Red	No
Grass-Leaved Goldenrod	*Euthamia caroliniana*	Dry sandy soils, and beaches.	August and September	S3	Yellow	No
Black Ash	*Fraxinus nigra*	Low ground, damp woods and swamps.	May and June. Can be identified without flowers.	S3	Yellow	No
Green Ash	*Fraxinus pennsylvanica*	Near lakes or ponds, or in other low-lying areas.	Flowers in May	S1	Red	No
Northern Bedstraw	*Galium boreale*	The edges of woods and in grassy places, such as pastures.	Flowers June to August	S2	Red	No
Blunt-Leaf Bedstraw	*Galium obtusum*	Boggy swales and wet thickets.	May to July	S1	Red	Yes
Downy Rattlesnake-Plantain	*Goodyera pubescens*	Woodland and thickets. Usually found in dry or moist coniferous or mixed woods, often in a sandy substrate with oak or white pine.	July and August	S1	Red	No
Dwarf Rattlesnake-Plantain	*Goodyera repens*	Under conifers, growing with very few other plants.	Flowers July and August	S2S3	Yellow	No
American Pennyroyal	*Hedeoma pulegioides*	Stony till and upland pastures, throughout northern part of NS. Near seashores occasionally.	August	S2S3	Yellow	No
Robinson's Hawkweed	*Hieracium robinsonii*	Rock crevices and cliffs, cobble shores, and along streams.	Flowers July and August	S2	Yellow	No
Golden-Heather	*Hudsonia ericoides*	Dry, rocky, and sandy barrens. Recently disturbed areas or on open sandy soils.	Late May to early July	S2	Yellow	No
Disguised St. John's-Wort	*Hypericum dissimulatum*	On shores and damp open areas.	Not provided	S2S3	Yellow	Yes
Larger Canadian St. John's Wort	*Hypericum majus*	Wet or dry open soil.	July to September	S1	Red	No

Table F-1 ACCDC Rare and Sensitive Plants Potentially Present in Project Area

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank	Target for Spring Survey?
Southern Twayblade	*Listera australis*	Among the shaded sphagnum moss of bogs or damp woods.	June. Quickly senesces after flowering.	S1	Red	Yes
Golden Crest	*Lophiola aurea*	Lakeshores, wet savannas, sphagnous swales.	August through early September	S2	Red	No
Beck Water-Marigold	*Megalodonta beckii*	Shallow, quiet waters, slow-moving streams, and ponds.	August and September	S3	Yellow	No
Farwell's Water-Milfoil	*Myriophyllum farwellii*	Ponds and slow-moving streams.	Flowers June to September	S2	Yellow	Yes
Philadelphia Panic Grass	*Panicum philadelphicum*	Floodplains and cranberry bogs.	June to October	S2S3SE	Yellow	Yes
Canada Mountain-Ricegrass	*Piptatherum canadense*	Dry sandy soils.	Not provided	S2	Yellow	Yes
Southern Rein-Orchid	*Platanthera flava*	Sandy or gravelly beaches, wet peat, and lake or river margins. Bogs, swamps, and Meadows.	May to August	S2	Yellow	Yes
Cursed Crowfoot	*Ranunculus sceleratus*	Marshes, ditches, swampy meadows.	May to August	S1S2	Red	No
Silky Willow	*Salix sericea*	Low thickets and stream banks.	Late March to early May	S2	Yellow	Yes
Ledge Spike-Moss	*Selaginella rupestris*	Dry, exposed rocks and sandy soils.	July to October	S1	Red	No
Hairy Goldenrod	*Solidago hispida*	Woods and forest edges.	Summer and fall	S1?	Red	No
Yellow Nodding Ladies'-Tresses	*Spiranthes ochroleuca*	Characteristic of the driest sand barrens in southwestern counties. Also near rivers and in dry habitats such as roadsides and fields.	September to October	S2	Yellow	No
Boreal American-Aster	*Symphyotrichum boreale*	Gravelly soil of lake beaches, along streams and the edges of bogs.	August and September	S2?	Yellow	No
Wavy-leaf American-Aster	*Symphyotrichum undulatum*	Old fields and the edges of thickets.	August and September	S2	Yellow	No
Northern White Cedar	*Thuja occidentalis*	Lakesides and swamps or old pastures.	Can be identified throughout the year	S1S2	Red	No
Poison Sumac	*Toxicodendron vernix*	Swampy lakeshores, marsy areas.	May to July	S1	Red	No

Table F-1 ACCDC Rare and Sensitive Plants Potentially Present in Project Area

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank	Target for Spring Survey?
Humped Bladderwort	*Utricularia gibba*	Shallow lake margins, small pools and small ponds in quagmires or peaty situations.	Late June to September. Can be identified without flowers, but is very cryptic.	S2	Yellow	No
Oval-Leaf Huckleberry	*Vaccinium ovalifolium*	Moist or mesic coniferous woods. An arctic/alpine species.	Late July to early September, can be identified when not in flower.	S1	Red	No
Northern Bog Violet	*Viola nephrophylla*	Cool mossy bogs, the borders of streams, and damp woods.	May to July.	S2	Yellow	Yes
Netted Chainfern	*Woodwardia areolata*	Swamps, bog margins and along streams.	July to October.	S2	Yellow	No

Table F-2 Rankings and locations (NAD 83 Zone 20) of species with S-ranks of S1 - S3/4

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	X	Y
Fragrant Cudweed	*Gnaphalium obtusifolium*	S3S4	GREEN	257065.96	4867556.30
Sharp-Fruit Rush	*Juncus acuminatus*	S3S4	UNDETERMINED	256912.42	4867508.92
Sharp-Fruit Rush	*Juncus acuminatus*	S3S4	UNDETERMINED	256566.61	4867845.91
Sharp-Fruit Rush	*Juncus acuminatus*	S3S4	UNDETERMINED	256820.77	4867629.43
Woods-Rush	*Juncus subcaudatus*	S3	UNDETERMINED	256566.61	4867845.91
Yellow Nodding Ladies'-Tresses	*Spiranthes ochroleuca*	S2	YELLOW	257110.68	4867434.73
Boreal American-Aster	*Symphyotrichum boreale*	S2?	YELLOW	256930.81	4867352.90
Boreal American-Aster	*Symphyotrichum boreale*	S2?	YELLOW	256925.18	4867356.44
Boreal American-Aster	*Symphyotrichum boreale*	S2?	YELLOW	256864.41	4867237.81
Boreal American-Aster	*Symphyotrichum boreale*	S2?	YELLOW	256882.45	4867163.19
Boreal American-Aster	*Symphyotrichum boreale*	S2?	YELLOW	256566.61	4867845.91
Highbush Blueberry	*Vaccinium corymbosum*	S3	GREEN	256905.40	4867409.07
Highbush Blueberry	*Vaccinium corymbosum*	S3	GREEN	256610.88	4867470.68
Highbush Blueberry	*Vaccinium corymbosum*	S3	GREEN	257055.68	4867294.19
Highbush Blueberry	*Vaccinium corymbosum*	S3	GREEN	256604.43	4867444.78
Highbush Blueberry	*Vaccinium corymbosum*	S3	GREEN	256641.52	4867502.36

APPENDIX G
Population Status of Vascular Plants Recorded in Project Area

Table G-1 Population Status of Vascular Plants Recorded in Project Area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Balsam Fir	*Abies balsamea*	S5	Green
Red Maple	*Acer rubrum*	S5	Green
Common Yarrow	*Achillea millefolium*	S5	Green
Nova Scotia False-Foxglove	*Agalinis neoscotica*	S4	Green
Colonial Bentgrass	*Agrostis capillaris*	SE	Exotic
Perennial Bentgrass	*Agrostis perennans*	S4S5	Green
Rough Bentgrass	*Agrostis scabra*	S5	Green
Spreading Bentgrass	*Agrostis stolonifera*	S5SE	Green
Speckled Alder	*Alnus incana*	S5	Green
Green Alder	*Alnus viridis*	S5	Green
Running Serviceberry	*Amelanchier x intermedia*	HYB	?
Pearly Everlasting	*Anaphalis margaritacea*	S5	Green
Bristly Sarsaparilla	*Aralia hispida*	S5	Green
Wild Sarsaparilla	*Aralia nudicaulis*	S5	Green
Twining Bartonia	*Bartonia paniculata*	S4S5	Green
Yellow Birch	*Betula alleghaniensis*	S5	Green
Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	?
Paper Birch	*Betula papyrifera var. papyrifera*	S5	Green
Gray Birch	*Betula populifolia*	S5	Green
Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Green
Brome-Like Sedge	*Carex bromoides*	S3	Green
Brownish Sedge	*Carex brunnescens*	S5	Green
Brownish Sedge	*Carex brunnescens ssp. sphaerostachya*	S5	?
Button Sedge	*Carex bullata*	S4	Green
Hoary Sedge	*Carex canescens*	S5	Green
Fibrous-Root Sedge	*Carex communis*	S5	Green
Fringed Sedge	*Carex crinita*	S4S5	Green
Clustered Sedge	*Carex cumulata*	S4S5	Green
Little Prickly Sedge	*Carex echinata*	S5	Green
Long Sedge	*Carex folliculata*	S5	Green
a Sedge	*Carex gynandra*	S5	Green
Bladder Sedge	*Carex intumescens*	S5	Green
Shallow Sedge	*Carex lurida*	S5	Green
Pointed Broom Sedge	*Carex scoparia*	S5	Green
a Sedge	*Carex sp.*	n/a	n/a
Three-Seed Sedge	*Carex trisperma*	S5	Green
Black Starthistle	*Centaurea nigra*	SE	Exotic
Common Centaury	*Centaurium erythraea*	SE	Exotic
Common Mouse-Ear Chickweed	*Cerastium fontanum*	SE	Exotic
Leatherleaf	*Chamaedaphne calyculata*	S5	Green
Fireweed	*Chamerion angustifolium*	S5	Green
White Turtlehead	*Chelone glabra*	S5	Green
Bull Thistle	*Cirsium vulgare*	SE	Exotic
Sweet Fern	*Comptonia peregrina*	S5	Green
Canada Horseweed	*Conyza canadensis*	S5	Green
Goldthread	*Coptis trifolia*	S5	Green
Dwarf Dogwood	*Cornus canadensis*	S5	Green
Pink Lady's-Slipper	*Cypripedium acaule*	S5	Green
Orchard Grass	*Dactylis glomerata*	SE	Exotic
Poverty Oat-Grass	*Danthonia spicata*	S5	Green
Wild Carrot	*Daucus carota*	SE	Exotic
Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Green
Crinkled Hairgrass	*Deschampsia flexuosa*	S5	Green

Table G-1 Population Status of Vascular Plants Recorded in Project Area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Panic Grass	*Dichanthelium acuminatum*	S5	Green
Northern Witchgrass	*Dichanthelium boreale*	S5	Green
Starved Witchgrass	*Dichanthelium depauperatum*	S4S5	Green
Northern Bush-Honeysuckle	*Diervilla lonicera*	S5	Green
Parasol White-Top	*Doellingeria umbellata*	S5	Green
Roundleaf Sundew	*Drosera rotundifolia*	S5	Green
Mountain Wood-Fern	*Dryopteris campyloptera*	S5	Green
Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Green
Crested Shield-Fern	*Dryopteris cristata*	S5	Green
Evergreen Woodfern	*Dryopteris intermedia*	S5	Green
a Hybrid Wood-fern	*Dryopteris x boottii*	HYB	?
Least Spike-Rush	*Eleocharis acicularis*	S5	Green
Creeping Spike-Rush	*Eleocharis palustris*	S5	Green
Trailing Arbutus	*Epigaea repens*	S5	Green
Hairy Willow-Herb	*Epilobium ciliatum*	S5	Green
Linear-Leaved Willow-Herb	*Epilobium leptophyllum*	S5	Green
Marsh Willow-Herb	*Epilobium palustre*	S5	Green
Field Horsetail	*Equisetum arvense*	S5	Green
Fireweed	*Erechtites hieraciifolia*	S5	Green
Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Green
Common Boneset	*Eupatorium perfoliatum*	S5	Green
Rough-Leaved Aster	*Eurybia radula*	S5	Green
Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Green
Hair Fescue	*Festuca filiformis*	SE	Exotic
Small Bedstraw	*Galium trifidum*	S5	Green
Creeping Snowberry	*Gaultheria hispidula*	S5	Green
Teaberry	*Gaultheria procumbens*	S5	Green
Black Huckleberry	*Gaylussacia baccata*	S5	Green
Canada Manna-Grass	*Glyceria canadensis*	S5	Green
American Mannagrass	*Glyceria grandis*	S4S5	Green
Northern Mannagrass	*Glyceria laxa*	S4?	Green
Blunt Manna-Grass	*Glyceria obtusa*	S4	Green
Fowl Manna-Grass	*Glyceria striata*	S5	Green
Meadow Hawkweed	*Hieracium caespitosum*	SE	Exotic
Canada Hawkweed	*Hieracium canadense*	S4S5	Green
Mouseear	*Hieracium pilosella*	SE	Exotic
Smoothish Hawkweed	*Hieracium x floribundum*	SE	Exotic
Common Velvet Grass	*Holcus lanatus*	SE	Exotic
Northern St. John's-Wort	*Hypericum boreale*	S5	Green
Canadian St. John's-Wort	*Hypericum canadense*	S5	Green
Orange-Grass St. John's-Wort	*Hypericum gentianoides*	SE	Exotic
a St. John's-Wort	*Hypericum perforatum*	SE	Exotic
Spotted Cat's-Ear	*Hypochoeris radicata*	SE	Exotic
Black Holly	*Ilex verticillata*	S5	Green
Blueflag	*Iris versicolor*	S5	Green
Sharp-Fruit Rush	*Juncus acuminatus*	S3S4	Undetermined
Jointed Rush	*Juncus articulatus*	S5	Green
Narrow-Panicled Rush	*Juncus brevicaudatus*	S5	Green
Canada Rush	*Juncus canadensis*	S5	Green
Soft Rush	*Juncus effusus*	S5	Green
Soft Rush	*Juncus effusus var. pylaei*	S4?	?
a Rush	*Juncus effusus var. solutus*	S5	?
a Rush	*Juncus sp.*	n/a	n/a
Woods-Rush	*Juncus subcaudatus*	S3	Undetermined

Table G-1 Population Status of Vascular Plants Recorded in Project Area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Slender Rush	*Juncus tenuis*	S5	Green
Sheep-Laurel	*Kalmia angustifolia*	S5	Green
Pale Laurel	*Kalmia polifolia*	S5	Green
American Larch	*Larix laricina*	S5	Green
Common Labrador Tea	*Ledum groenlandicum*	S5	Green
Autumn Hawkbit	*Leontodon autumnalis*	SE	Exotic
Oxeye Daisy	*Leucanthemum vulgare*	SE	Exotic
Butter-And-Eggs	*Linaria vulgaris*	SE	Exotic
Twinflower	*Linnaea borealis*	S5	Green
Indian-Tobacco	*Lobelia inflata*	S5	Green
Tall Rye Grass	*Lolium arundinaceum*	SE	Exotic
Large-Leaved Lupine	*Lupinus polyphyllus*	SE	Exotic
Bog Clubmoss	*Lycopodiella inundata*	S5	Green
Northern Bugleweed	*Lycopus uniflorus*	S5	Green
Swamp Loosestrife	*Lysimachia terrestris*	S5	Green
Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Green
Three-Leaf Solomon's-Plume	*Maianthemum trifolium*	S4S5	Green
Musk Cheeseweed	*Malva moschata*	SE	Exotic
Partridge-Berry	*Mitchella repens*	S5	Green
Indian-Pipe	*Monotropa uniflora*	S5	Green
Northern Bayberry	*Morella pensylvanica*	S5	Green
Fall Dropseed Muhly	*Muhlenbergia uniflora*	S5	Green
Mountain Holly	*Nemopanthus mucronata*	S5	Green
Whorled Aster	*Oclemena acuminata*	S5	Green
Bog Aster	*Oclemena nemoralis*	S5	Green
a Hybrid White Panicled American-Aster	*Oclemena X blakei*	HYB	Green
Common Evening-Primrose	*Oenothera biennis*	S5	Green
Sensitive Fern	*Onoclea sensibilis*	S5	Green
Cinnamon Fern	*Osmunda cinnamomea*	S5	Green
Interrupted Fern	*Osmunda claytoniana*	S5	Green
Royal Fern	*Osmunda regalis*	S5	Green
White Wood-Sorrel	*Oxalis montana*	S5	Green
a Panic-grass	*Panicum sp.*	n/a	n/a
Old Switch Panic Grass	*Panicum virgatum*	S4	Green
Reed Canary Grass	*Phalaris arundinacea*	S5	Green
Northern Beech Fern	*Phegopteris connectilis*	S5	Green
Meadow Timothy	*Phleum pratense*	SE	Exotic
Black Chokeberry	*Photinia melanocarpa*	S5	Green
White Spruce	*Picea glauca*	S5	Green
Black Spruce	*Picea mariana*	S5	Green
Red Spruce	*Picea rubens*	S5	Green
Eastern White Pine	*Pinus strobus*	S5	Green
English Plantain	*Plantago lanceolata*	SE	Exotic
Canada Bluegrass	*Poa compressa*	SE	Exotic
Fringed Black Bindweed	*Polygonum cilinode*	S5	Green
Lady's Thumb	*Polygonum persicaria*	SE	Exotic
Large-Tooth Aspen	*Populus grandidentata*	S5	Green
Quaking Aspen	*Populus tremuloides*	S5	Green
Old-Field Cinquefoil	*Potentilla simplex*	S5	Green
Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Green
Fire Cherry	*Prunus pensylvanica*	S5	Green
Fragrant Cudweed	*Pseudognaphalium obtusifolium*	S3S4	Green
Bracken Fern	*Pteridium aquilinum*	S5	Green

Table G-1 Population Status of Vascular Plants Recorded in Project Area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Northern Red Oak	*Quercus rubra*	S5	Green
Rhodora	*Rhododendron canadense*	S5	Green
Allegheny Blackberry	*Rubus allegheniensis*	S5	Green
Smooth Blackberry	*Rubus canadensis*	S5	Green
Bristly Dewberry	*Rubus hispidus*	S5	Green
Red Raspberry	*Rubus idaeus*	S5	Green
a Bramble	*Rubus plicatifolius*	S?	Undetermined
Small Bristleberry	*Rubus setosus*	S4?	Green
a Bramble	*Rubus sp.*	n/a	n/a
a Bramble	*Rubus tardatus*	S?	Undetermined
Dewberry	*Rubus trifrons*	S?	Undetermined
Sheep Sorrel	*Rumex acetosella*	SE	Exotic
Bebb's Willow	*Salix bebbiana*	S5	Green
a Willow	*Salix sp.*	n/a	n/a
Red Elderberry	*Sambucus racemosa*	S5	Green
Cottongrass Bulrush	*Scirpus cyperinus*	S5	Green
Sticky Groundsel	*Senecio viscosus*	SE	Exotic
Old-Man-In-The-Spring	*Senecio vulgaris*	SE	Exotic
Downy Goldenrod	*Solidago puberula*	S5	Green
Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Green
Spiny-Leaf Sowthistle	*Sonchus asper*	SE	Exotic
American Mountain-Ash	*Sorbus americana*	S5	Green
American Bur-Reed	*Sparganium americanum*	S5	Green
Narrow-Leaf Burreed	*Sparganium erectum*	S5	Green
Cornspurry	*Spergula arvensis*	SE	Exotic
Purple Sandspurry	*Spergularia rubra*	SE	Exotic
Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Green
Hardhack Spiraea	*Spiraea tomentosa*	S5	Green
Nodding Ladies'-Tresses	*Spiranthes cernua*	S5	Green
Yellow Nodding Ladies'-Tresses	*Spiranthes ochroleuca*	S2	Yellow
Boreal American-Aster	*Symphyotrichum boreale*	S2?	Yellow
White Panicled American-Aster	*Symphyotrichum lanceolatum*	S4S5	Green
Farewell-Summer	*Symphyotrichum lateriflorum*	S5	Green
New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Green
New York Fern	*Thelypteris noveboracensis*	S5	Green
Bog Fern	*Thelypteris simulata*	S4S5	Green
Northern Poison Oak	*Toxicodendron rydbergii*	S5	Green
Marsh St. John's-Wort	*Triadenum fraseri*	S5	Green
Marsh St. John's Wort	*Triadenum virginicum*	S4S5	Green
Northern Starflower	*Trientalis borealis*	S5	Green
Rabbit-Foot Clover	*Trifolium arvense*	SE	Exotic
Low Hop Clover	*Trifolium campestre*	SE	Exotic
Red Clover	*Trifolium pratense*	SE	Exotic
Colt's Foot	*Tussilago farfara*	SE	Exotic
Broad-Leaf Cattail	*Typha latifolia*	S5	Green
Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Green
Highbush Blueberry	*Vaccinium corymbosum*	S3	Green
Large Cranberry	*Vaccinium macrocarpon*	S5	Green
Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Green
Small Cranberry	*Vaccinium oxycoccos*	S5	Green
Gypsy-Weed	*Veronica officinalis*	S5SE	Exotic
Possum-Haw Viburnum	*Viburnum nudum*	S5	Green
Marsh Blue Violet	*Viola cucullata*	S5	Green
Lance-Leaf Violet	*Viola lanceolata*	S5	Green

Table G-1 Population Status of Vascular Plants Recorded in Project Area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Smooth White Violet	*Viola macloskeyi*	S5	Green

APPENDIX H
Breeding and Population Status of Birds Recorded in the Project Area and the Breeding Bird Atlas Squares

Table H-1 Breeding Status and Population Status of Birds Recorded in the Project area and the Breeding Bird Atlas Squares

Common Name	Scientific Name	NSDNR Rank	ACCDC Rank	Breeding Status (MBBA)	Breeding Status (Field Observations)
Spotted Sandpiper	*Actitis macularius*	Green	S5B	Probable	Not observed
Red-winged Blackbird	*Agelaius phoeniceus*	Green	S5B	Confirmed	Not observed
Green-winged Teal	*Anas crecca*	Green	S5B	Observed	Not observed
Mallard	*Anas platyrhynchos*	Green	S5B	Possible	Not observed
American Black Duck	*Anas rubripes*	Green	S5B	Confirmed	Not observed
Ruby-throated Hummingbird	*Archilochus colubris*	Green	S5B	Not observed	Observed
Great Blue Heron	*Ardea herodias*	Green	S5B	Observed	Not observed
Cedar Waxwing	*Bombycilla cedrorum*	Green	S5B	Not observed	Possible
Ruffed Grouse	*Bonasa umbellus*	Green	S5	Confirmed	Not observed
Canada Goose	*Branta canadensis*	Green	S4B	Confirmed	Not observed
Broad-winged Hawk	*Buteo platypterus*	Green	S4B	Probable	Not observed
Northern Cardinal	*Cardinalis cardinalis*	Green	S2B	Possible	Not observed
American Goldfinch	*Carduelis tristis*	Green	S5	Possible	Not observed
Turkey Vulture	*Cathartes aura*	ACCIDENTAL	SNA	Not observed	Observed
Veery	*Catharus fuscescens*	Green	S5B	Possible	Not observed
Northern Flicker	*Colaptes auratus*	Green	S5B	Probable	Not observed
Rock Pigeon	*Columba livia*	Exotic	SEB	Observed	Not observed
Eastern Wood-Pewee	*Contopus virens*	Green	S4B	Possible	Observed
American Crow	*Corvus brachyrhynchos*	Green	S5	Possible	Not observed
Common Raven	*Corvus corax*	Green	S5	Possible	Observed
Blue Jay	*Cyanocitta cristata*	Green	S5	Probable	Observed
Black-throated Blue Warbler	*Dendroica caerulescens*	Green	S4B	Possible	Not observed
Yellow-rumped Warbler	*Dendroica coronata*	Green	S5B	Possible	Not observed
Magnolia Warbler	*Dendroica magnolia*	Green	S5B	Probable	Not observed
Yellow Warbler	*Dendroica petechia*	Green	S5B	Probable	Not observed
Black-throated Green Warbler	*Dendroica virens*	Green	S5B	Probable	Not observed
Common Loon	*Gavia immer*	Yellow	S4B,S4N	Possible	Not observed
Common Yellowthroat	*Geothlypis trichas*	Green	S5B	Probable	Observed
Barn Swallow	*Hirundo rustica*	Yellow	S4B	Possible	Not observed
Wood Thrush	*Hylocichla mustelina*	Green	S2B	Possible	Not observed
Dark-eyed Junco	*Junco hyemalis*	Green	S5	Probable	Not observed
Herring Gull	*Larus argentatus*	Green	S4	Possible	Not observed
Great Black-backed Gull	*Larus marinus*	Green	S5B	Observed	Not observed
Swamp Sparrow	*Melospiza georgiana*	Green	S5B	Possible	Observed
Song Sparrow	*Melospiza melodia*	Green	S5B	Possible	Not observed
Black-and-white Warbler	*Mniotilta varia*	Green	S5B	Possible	Not observed
Northern Parula	*Parula americana*	Green	S5B	Probable	Not observed
Gray Jay	*Perisoreus canadensis*	Yellow	S4	Possible	Not observed
Double-crested Cormorant	*Phalacrocorax auritus*	Green	S5B	Observed	Not observed
Black-backed Woodpecker	*Picoides arcticus*	Green	S4	Possible	Not observed
Downy Woodpecker	*Picoides pubescens*	Green	S5	Probable	Not observed
Hairy Woodpecker	*Picoides villosus*	Green	S5	Possible	Not observed
Black-capped Chickadee	*Poecile atricapillus*	Green	S5	Probable	Possible
Common Grackle	*Quiscalus quiscula*	Green	S5B	Probable	Not observed

Table H-1 Breeding Status and Population Status of Birds Recorded in the Project area and the Breeding Bird Atlas Squares

Common Name	Scientific Name	NSDNR Rank	ACCDC Rank	Breeding Status (MBBA)	Breeding Status (Field Observations)
Eastern Phoebe	*Sayornis phoebe*	Green	S2S3B	Possible	Not observed
Ovenbird	*Seiurus aurocapilla*	Green	S5B	Probable	Not observed
American Redstart	*Setophaga ruticilla*	Green	S5B	Possible	Not observed
European Starling	*Sturnus vulgaris*	Exotic	SE	Possible	Not observed
Tree Swallow	*Tachycineta bicolor*	Green	S5B	Probable	Not observed
Winter Wren	*Troglodytes troglodytes*	Green	S5B	Possible	Not observed
American Robin	*Turdus migratorius*	Green	S5B	Confirmed	Not observed
Red-eyed Vireo	*Vireo olivaceus*	Green	S5B	Possible	Not observed
Blue-headed Vireo	*Vireo solitarius*	Green	S5B	Possible	Not observed
Mourning Dove	*Zenaida macroura*	Green	S5B	Possible	Not observed
White-throated Sparrow	*Zonotrichia albicollis*	Green	S5B	Probable	Not observed

APPENDIX I
Plants and Wildlife Species Recorded within Wetlands

Table I-1 Plant Species Recorded within Wetlands of the Project Area

Common Name	Scientific Name	Wetland #														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15*
Balsam Fir	*Abies balsamea*	P	P	P	P	P	P	P	P	P	P		P	P	P	
Red Maple	*Acer rubrum*	P		P	P	P	P	P	P		P	P	P	P	P	P
Nova Scotia False-Foxglove	*Agalinis neoscotica*										P					
Colonial Bentgrass	*Agrostis capillaris*										P		P	P	P	
Perennial Bentgrass	*Agrostis perennans*			P		P			P	P	P					
Rough Bentgrass	*Agrostis scabra*	P		P		P	P		P	P	P	P		P		
Speckled Alder	*Alnus incana*						P							P	P	
Green Alder	*Alnus viridis*					P			P							
Wild Sarsaparilla	*Aralia nudicaulis*								P			P	P	P		
Twining Bartonia	*Bartonia paniculata*			P	P		P									
Yellow Birch	*Betula alleghaniensis*					P			P	P	P	P	P	P	P	
Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*					P										
Paper Birch	*Betula papyrifera var. papyrifera*				P		P			P	P	P	P	P	P	
Gray Birch	*Betula populifolia*					P										
Blue-Joint Reedgrass	*Calamagrostis canadensis*		P			P			P	P	P					
Brownish Sedge	*Carex brunnescens*								P					P		
Brownish Sedge	*Carex brunnescens ssp. sphaerostachya*										P					
Button Sedge	*Carex bullata*								P							
Fringed Sedge	*Carex crinita*					P					P		P	P		
Clustered Sedge	*Carex cumulata*						P									
Little Prickly Sedge	*Carex echinata*						P					P		P	P	
Long Sedge	*Carex folliculata*								P					P	P	
a Sedge	*Carex gynandra*									P						
Bladder Sedge	*Carex intumescens*					P						P		P	P	
Shallow Sedge	*Carex lurida*									P	P	P		P	P	P
Pointed Broom Sedge	*Carex scoparia*					P										
Three-Seed Sedge	*Carex trisperma*	P		P	P		P	P	P		P	P	P	P	P	
Leatherleaf	*Chamaedaphne calyculata*		P													
White Turtlehead	*Chelone glabra*											P		P		
Goldthread	*Coptis trifolia*				P			P	P				P		P	
Dwarf Dogwood	*Cornus canadensis*	P		P	P			P	P	P	P	P	P	P		
Poverty Oat-Grass	*Danthonia spicata*					P										
Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	P			P		P		P	P	P	P	P	P	P	

Table I-1 Plant Species Recorded within Wetlands of the Project Area

Common Name	Scientific Name	Wetland #														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15*
Crinkled Hairgrass	*Deschampsia flexuosa*								P							
Parasol White-Top	*Doellingeria umbellata*	P			P	P	P		P	P	P	P	P	P	P	
Roundleaf Sundew	*Drosera rotundifolia*			P		P									P	
Mountain Wood-Fern	*Dryopteris campyloptera*	P			P				P		P					
Spinulose Shield Fern	*Dryopteris carthusiana*	P												P		
Crested Shield-Fern	*Dryopteris cristata*										P			P	P	
Evergreen Woodfern	*Dryopteris intermedia*								P							
a Hybrid Wood-fern	*Dryopteris x boottii*														P	
Least Spike-Rush	*Eleocharis acicularis*			P	P											
Creeping Spike-Rush	*Eleocharis palustris*													P		
Hairy Willow-Herb	*Epilobium ciliatum*										P					
Linear-Leaved Willow-Herb	*Epilobium leptophyllum*						P								P	
Marsh Willow-Herb	*Epilobium palustre*					P					P			P	P	
Fireweed	*Erechtites hieraciifolia*													P	P	
Tawny Cotton-Grass	*Eriophorum virginicum*						P				P			P	P	
Common Boneset	*Eupatorium perfoliatum*					P					P	P		P		
Rough-Leaved Aster	*Eurybia radula*	P		P			P	P	P			P		P	P	
Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*					P	P					P		P	P	
Small Bedstraw	*Galium trifidum*											P			P	
Creeping Snowberry	*Gaultheria hispidula*							P	P		P	P		P		
Black Huckleberry	*Gaylussacia baccata*	P			P		P	P	P		P		P	P	P	
Canada Manna-Grass	*Glyceria canadensis*													P		
American Mannagrass	*Glyceria grandis*														P	
Northern Mannagrass	*Glyceria laxa*										P			P		
Blunt Manna-Grass	*Glyceria obtusa*			P						P	P					
Fowl Manna-Grass	*Glyceria striata*	P		P	P				P		P	P	P	P	P	
Northern St. John's-Wort	*Hypericum boreale*										P					
Canadian St. John's-Wort	*Hypericum canadense*			P		P	P			P	P	P		P	P	P
Black Holly	*Ilex verticillata*		P		P			P	P		P	P	P	P	P	
Blueflag	*Iris versicolor*			P											P	
Sharp-Fruit Rush	*Juncus acuminatus*										P	P				
Jointed Rush	*Juncus articulatus*					P										
Narrow-Panicled Rush	*Juncus brevicaudatus*			P		P					P	P			P	

Table I-1 Plant Species Recorded within Wetlands of the Project Area

Common Name	Scientific Name	Wetland #														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15*
Canada Rush	*Juncus canadensis*		P			P	P		P		P	P		P	P	
Soft Rush	*Juncus effusus*	P	P	P	P	P	P	P		P	P			P	P	
Soft Rush	*Juncus effusus var. pylaei*									P	P			P		
a Rush	*Juncus effusus var. solutus*											P				
Woods-Rush	*Juncus subcaudatus*						P				P					
Slender Rush	*Juncus tenuis*					P										
Sheep-Laurel	*Kalmia angustifolia*	P	P	P	P	P	P	P	P	P	P		P	P	P	
Pale Laurel	*Kalmia polifolia*					P										
American Larch	*Larix laricina*	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
Common Labrador Tea	*Ledum groenlandicum*	P	P	P		P	P	P	P		P					
Twinflower	*Linnaea borealis*	P			P	P			P	P		P	P	P		
Bog Clubmoss	*Lycopodiella inundata*					P										
Northern Bugleweed	*Lycopus uniflorus*	P				P						P	P	P	P	
Swamp Loosestrife	*Lysimachia terrestris*	P	P	P					P	P	5			P	P	
Wild Lily-of-The-Valley	*Maianthemum canadense*							P			P					
Three-Leaf Solomon's-Plume	*Maianthemum trifolium*														P	
Partridge-Berry	*Mitchella repens*	P						P								
Indian-Pipe	*Monotropa uniflora*								P					P		
Northern Bayberry	*Morella pensylvanica*		P	P	P	P		P	P		P			P	P	
Fall Dropseed Muhly	*Muhlenbergia uniflora*						P									
Mountain Holly	*Nemopanthus mucronata*	P		P	P		P	P	P		P	P		P		
Whorled Aster	*Oclemena acuminata*	P				P	P			P	P		P		P	
Bog Aster	*Oclemena nemoralis*				P											
a Hybrid White Panicled American-Aster	*Oclemena X blakei*					P	P					P	P	P	P	
Sensitive Fern	*Onoclea sensibilis*					P										
Cinnamon Fern	*Osmunda cinnamomea*	P	P	P	P		P	P	P	P	P	P	P	P	P	
White Wood-Sorrel	*Oxalis montana*								P					P		
Northern Beech Fern	*Phegopteris connectilis*											P				
Black Chokeberry	*Photinia melanocarpa*		P													
White Spruce	*Picea glauca*										P				P	
Black Spruce	*Picea mariana*	P		P	P	P	P	P		P	P			P	P	
Red Spruce	*Picea rubens*												P	P		

Table I-1 Plant Species Recorded within Wetlands of the Project Area

Common Name	Scientific Name	Wetland #														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15*
Eastern White Pine	*Pinus strobus*									P						
Lady's Thumb	*Polygonum persicaria*										P					
Old-Field Cinquefoil	*Potentilla simplex*											P				
Bracken Fern	*Pteridium aquilinum*	P							P				P			
Rhodora	*Rhododendron canadense*	P		P		P	P				P				P	
Allegheny Blackberry	*Rubus allegheniensis*										P					
Smooth Blackberry	*Rubus canadensis*								P							
Bristly Dewberry	*Rubus hispidus*	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
Red Raspberry	*Rubus idaeus*	P							P		P	P		P	P	P
a Bramble	*Rubus plicatifolius*										P					
Small Bristleberry	*Rubus setosus*									P						
a Bramble	*Rubus sp.*													P		
a Bramble	*Rubus tardatus*									P						
Bebb's Willow	*Salix bebbiana*										P					
a Willow	*Salix sp.*					P										
Red Elderberry	*Sambucus racemosa*										P					
Cottongrass Bulrush	*Scirpus cyperinus*		P		P	P	P			P	P	P		P	P	P
Downy Goldenrod	*Solidago puberula*					P										
Rough-Leaf Goldenrod	*Solidago rugosa*					P	P			P	P	P	P	P	P	
American Mountain-Ash	*Sorbus americana*											P				
American Bur-Reed	*Sparganium americanum*														P	
Narrow-Leaf Burreed	*Sparganium erectum*														P	
Narrow-Leaved Meadow-Sweet	*Spiraea alba*			P		P									P	
Hardhack Spiraea	*Spiraea tomentosa*					P	P			P	P	P		P	P	
Nodding Ladies'-Tresses	*Spiranthes cernua*					P										
Boreal American-Aster	*Symphyotrichum boreale*													P		
New Belgium American-Aster	*Symphyotrichum novi-belgii*					P	P			P	P			P	P	
New York Fern	*Thelypteris noveboracensis*				P	P	P		P		P	P	P	P	P	
Bog Fern	*Thelypteris simulata*														P	
Northern Poison Oak	*Toxicodendron rydbergii*										P					
Marsh St. John's-Wort	*Triadenum fraseri*	P	P	P					P	P	P					
Marsh St. John's Wort	*Triadenum virginicum*										P					
Northern Starflower	*Trientalis borealis*										P	P	P	P		

Table I-1 Plant Species Recorded within Wetlands of the Project Area

Common Name	Scientific Name	Wetland #														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15*
Late Lowbush Blueberry	*Vaccinium angustifolium*	P			P	P	P	P								
Highbush Blueberry	*Vaccinium corymbosum*		P	P	P	P			P	P	P				P	
Large Cranberry	*Vaccinium macrocarpon*	P	P	P					P		P					
Velvetleaf Blueberry	*Vaccinium myrtilloides*				P		P	P			P		P			
Small Cranberry	*Vaccinium oxycoccos*	P														
Possum-Haw Viburnum	*Viburnum nudum*	P		P			P		P	P				P	P	
Marsh Blue Violet	*Viola cucullata*											P		P		
Lance-Leaf Violet	*Viola lanceolata*		P	P			P									
Smooth White Violet	*Viola macloskeyi*									P	P	P		P	P	
Total species richness		33	19	32	29	49	40	22	44	34	72	43	29	64	59	>5

* A complete plant inventory of this wetland was not performed because it is primarily located outside of the Project Extension Boundary

Table I-2 Wildlife Species Recorded Within Wetlands of the Project Area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	Wetand #														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Birds																		
Ruby-throated Hummingbird	Archilochus colubris	S5B	Green													P		
Cedar Waxwing	Bombycilla cedrorum	S5B	Green	P														
Blue Jay	Cyanocitta cristata	S5	Green								P							
Common Yellowthroat	Geothlypis trichas	S5B	Green													P	P	
Swamp Sparrow	Melospiza georgiana	S5B	Green													P		
Black-capped Chickadee	Poecile atricapillus	S5	Green		P						P		P					
Mammals																		
American Porcupine	*Erithizon dorsatum*	S5	Green													P		
Meadow Vole	*Microtus pennsylvanicus*	S5	Green													P		
Red Squirrel	*Tamiasciursus hudsonicus*	S5	Green					P										
Herpetiles																		
Yellow-spotted Salamander	*Ambystoma maculatum*	S5	Green											P				
American Toad	*Bufo americanus*	S5	Green										P					
Spring Peeper	*Pseudacris crucifer*	S5	Green											P		P	P	
Green Frog	*Rana clamitans*	S5	Green		P			P				P	P	P	P	P	P	P
Pickerel Frog	*Rana palustris*	S5	Green														P	

APPENDIX J
Disposition Table

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
1	Ian McCrackren, Environmental Assessment and Marine Programs Environmental Protection Operations Directorate (Atlantic) – Environment Canada	Based on the project description, it is not likely that EC has a power, duty or function in relation to the proposed project that would trigger the *Canadian Environmental Assessment Act*. At this time, it is recommended that the Proponent review the report and ensure that it reflects applicable regulatory information and best management practices discussed in the attached document, Environment Canada Guidance Related to the Environmental Assessment of Aggregate Pit Mines and Quarries in the Atlantic Provinces, April 2008.	Comment acknowledged. The proponent is aware of the EC guidance document referenced and has prepared the registration document in consideration of those BMPs.
2	Angela Swaine, Environmental Analyst - Nova Scotia Transportation and Infrastructure Renewal	NSTIR has reviewed the Draft Registration report for the Hardscratch Quarry Extension and we have no comments on the proposed undertaking at this time.	Comment acknowledged.
3	Andrew D Cameron – Agriculture	The report on page 5.45 indicates "...agricultural areas are located within the general vicinity..." However it does not identify the type of agriculture. Highway 340 is known as a mink production area. Blasting is a concern for mink especially during the welping season. This may not be an issue if there are no mink ranches in the area. There is no good large scale map in the report to give an indication of where near Highway 340 the quarry is located.	Consultation with Nova Scotia Agriculture has confirmed that the Project is not likely to interact with mink production since no mink ranches are located in close proximity to (i.e., within a one kilometer radius of) the Hardscratch Quarry (Moerman, pers. comm, 2010). Furthermore, there have been no recorded complaints from mink ranchers regarding current blasting activities at the existing quarry. Section 5.45 of the EA has been updated with this information.
4	Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	From a tourism perspective, the main areas of interest regarding the proposed expansion to the existing quarry operation are truck traffic, visual aesthetics, noise, and a consideration of whether the expansion would negatively affect tourism in the region and / or in Nova Scotia.	Comment acknowledged.
5	Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	The project is not anticipated to result in a significant increase in truck traffic on public roads above that associated with the existing Hardscratch Quarry operation. Future hauling practices are expected to remain consistent with current practices.	Comment acknowledged.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
6	Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	The sound quality impacts related to the quarry extension are expected be controlled with standard mitigation practices. The project is not likely to have a significant adverse effect on the atmospheric environment.	Comment acknowledged.
7	Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	Due to the existing industrial activity in the vicinity of the project area and the distance of the proposed extension area from residences, impacts on existing and future adjacent land uses are not expected.	Comment acknowledged.
8	Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	Urban and residential areas are the only current land uses identified within 800 m of the project site. Other current land uses that occur within 2 km of the site include waste management facilities, agricultural areas and Ellenwood Lake Provincial Park.	Comment acknowledged.
9	Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	Ellenwood Lake Provincial Park is located approximately 2 km from the project property boundary. It offers an 87 site campground, two picnic areas, a boat launch, a supervised beach, and a walking/hiking trail. The project is of sufficient distance from the Park that no interactions are expected.	Comment acknowledged. Ellenwood Provincial park is discussed in Section 5.9.1 and shown on Figure 3.
10	Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	Given the above observations, from a tourism perspective, it appears that the proposed expansion to the existing quarry would not appear to significantly impact tourism or have a negative effect on the visitor experience.	Comment acknowledged.
11	Andrew Murphy Manager, Air Quality, Nova Scotia Environment	We do not believe that the quarry expansion will have a significant negative effect on local air quality.	Comment acknowledged.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
12	Andrew Murphy Manager, Air Quality, Nova Scotia Environment	However, we suggest that the proponent identify specific opportunities for dust suppression techniques for rock crushing operations.	Section 2.6 of the EA discusses dust control. As well, details of any monitoring programs required by NSE (e.g., surface water, noise, dust) will be developed in consultation with NSE and outlined in the Industrial Approval amendment application.
13	Lisa Paon, Fish Habitat Biologist – Fisheries and Oceans Canada	It is stated that there are multiple barriers to fish passage WC-1 and WC-2. Is there any potential that a resident population occurs in WC-1 or WC-2? What investigations have been carried out to verify this?	There is a small chance that resident populations of fish reside upstream of the fish passage barriers identified in WC-1 and WC-2. Investigation was not carried out to confirm the presence or absence of resident fish upstream of barriers given that there is no intention to alter the watercourse within the next ten years. An increased level of effort will be applied to fish surveys in WC-1 and WC-2 if or when quarry activities are ever planned to approach these streams; a Water Approval application will be prepared at that time and submitted to NSE with expert review by DFO. Mitigation was recommended in the Draft EA (Section 5.2.2) document to protect downstream fish habitat. This mitigation will also serve to protect any potential fish habitat upstream of the fish passage barriers identified in WC-1 and WC-2 during the current EA field survey. The EA text has been updated to include this clarification.
14	Lisa Paon, Fish Habitat Biologist – Fisheries and Oceans Canada	It is recommended that the proponent implement appropriate mitigation measures to minimize potential impacts to fish habitat that may be linked to sedimentation originating from the quarry and associated activities.	See Section 5.2.2 of the EA document. Mitigation was recommended to minimize potential impacts from erosion and sedimentation.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
15	P. Nearing, Nova Scotia Environment	Page 2.3, Section 2.3, Paragraphs 4: Minimal information (size, number, product stored) provided in this section regarding on-site storage tanks. Suggest providing additional details as to location (also show on map), age of the tanks, type of construction, containment available, inspection details, frequency of filling, incident reports (in particular any that had the potential to impact surface water and/or groundwater), after hours security at the site, spill response plan, location of existing monitoring wells (if they exist) in the area, any test results from the monitoring wells, etc..	The location of the tanks varies because the equipment is portable and is typically set up in different locations each time it is moved in. The age of the tanks is 15 years or newer. The tanks were either purchased or supplied by Irving Oil and are constructed of steel. They are typically filled 3-5 times per week and are inspected before filling. There has never been an incident involving a spill. There are spill kits on site and Aberdeen Paving is implementing a job procedure for oil spills that will be reviewed with the employees. Additional details will be provided in the Industrial Approval application stage.
16	P. Nearing, Nova Scotia Environment	Page 2.8, Section 2.6, Paragraph 9: The statement is made, “In the event of a leak or spill during refueling, maintenance, or general equipment operation, immediate action will be taken to stop and contain the spilled material.” A further statement is made “A spill contingency plan will be developed in support of the application for amendment to the existing Industrial Approval. “ Presumably the plan will also address spills resulting from normal operation of the storage tanks. Please confirm. Are spill response equipment/materials currently available at the site and if so are they tested/inspected on a regular basis? Are employees trained in their use? It is suggested the spill response plan contain elements related to training of personnel and agreement(s) with local agencies The agreement should ensure that the initial response to any incident (those involving equipment and materials related to the quarry operation, but occurring outside the quarry boundary), is handled by the closest response group. This will ensure timely response to spills which have the potential to impact surface water and/or groundwater.	Yes, the plan will also address spills resulting from normal operation of the storage tanks. Spill response equipment was recently purchased and will be tested/inspected on a regular basis. Employees will be trained in their use.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
17	P. Nearing, Nova Scotia Environment	Page 5.32, Section 5.6, Paragraph 3: This paragraph states "The regional groundwater flow patterns are expected to be southeast towards the wetlands and a series of lakes and rivers to the southeast and east. Due to its topographical location within this regional context, the Project is expected to lie within a local groundwater recharge area. Inference of the regional groundwater flow direction has been made based on topography." Will this be field verified?	This can be field verified. See response for Comment 20.
18	P. Nearing, Nova Scotia Environment	Page 5.33: This page appears before page 5.32 due to a copying/binding error. Please correct in the final version.	Comment acknowledged and error has been corrected.
19	P. Nearing, Nova Scotia Environment	Page 5.33, Table 5.3: This table contains information on 4 wells. The location of 2 of the wells is shown on Figure 4. Suggest showing the location of all 4 wells, along with the existing quarry boundary, project extension boundary and numerical contour dimensions on a single drawing.	Comment acknowledged. The approximate locations of two wells identified within 800 m of the Project area (1389 Highway No. 340 and 2138 Hardscratch Rd) are shown on Figure 3. The wells and numerical contour dimensions for the other two wells have been added to Figure 3. Existing quarry boundary and project extension boundary is already shown on Figure 3.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
20	P. Nearing, Nova Scotia Environment	Page 5.35, Section 5.6.2, Paragraph 4: The report notes "However, due to the close proximity of the wells located at 1389 Highway No. 640 and 1238 Hardscratch Rd. to the extension area and the low reported well yield (0.4 gpm), it may be prudent for the proponent to conduct groundwater sampling and confirm water levels in this well, in advance of the extension." Suggest that both wells be sampled and levels verified to obtain baseline data prior to the extension. This should be included as part of the Industrial Approval application. It is further suggested that new monitoring well(s) be installed on the quarry property, downgradient of the quarry working area, somewhere in the southeast quadrant. Regular sampling could then be carried out as part of the terms and conditions of the approval.	Report text has been modified to recommend baseline sampling and confirmation of groundwater levels for both locations, in advance of the extension. Report text has been modified to include installation of a groundwater monitor well in the southeast quadrant of the property to confirm groundwater level and to confirm groundwater flow direction for the site. As noted in the report, groundwater quality and groundwater quantity effects are not anticipated in downgradient drilled wells (i.e., southeast and east) due to: the presence of an intervening water barriers; due to long distance (>1400 m); very low bedrock hydraulic conductivity; and anticipated natural attenuation processes. As such, we do not foresee groundwater sampling to be required at this location. However, we recommend meeting with the NSE Regional Hydrogeologist to determine an acceptable groundwater monitoring program for this location.
21	P. Nearing, Nova Scotia Environment	Page 5.36, Section 5.6.2, Paragraph 3: This section states that "Bedrock underlying the Hardscratch Quarry and extension area consists of Middle Ordovician granite. In general, massive granite is not known to be a significant acid drainage risk." Page 6.1, Section 6.0, Paragraph 5: This section notes "The potential for acid drainage production in this area is presently unknown; however, generally massive granite is not known to be a significant acid drainage risk." Although it appears that acid drainage should not be a problem, it is still not a certainty and thus should be confirmed due the potential impact on surface and groundwater.	Comment acknowledged. The proponent will submit a sample of aggregate for acid generating potential testing to confirm the absence of acid generating material.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
22	P. Nearing, Nova Scotia Environment	Page 2.5, Section 2.3, Paragraph 1: It is stated that "Surface runoff and quarry drainage are collected on the quarry floor, which has the capacity to hold a significant quantity of water." Suggest defining "significant quantity of water" in more numerical terms, in particular in relation to 1:25 and 1:100 year storm events.	The capacity of the quarry floor is not considered part of the primary stormwater management system, which is designed to convey excess runoff and attenuate peak flows. However, the intention was to indicate that the quarry itself has capacity to act as a secondary containment which adds an extra level of conservatism. The text in Section 2.3 has been modified.
23	P. Nearing, Nova Scotia Environment	Page 2.5, Section 2.4, Paragraph 4: It is noted that "There is little overflow from the settling ponds as the majority of the water collected on the quarry floor and in the settling pond infiltrates, evaporates and/or is directed off site." Suggest making reference to Appendix C (Hydrology Study), which discusses the numerical aspects in more detail.	Comment acknowledged and Section 2.4 has been updated to cross-reference Appendix C.
24	P. Nearing, Nova Scotia Environment	Page 2.7, Section 2.6, Paragraph 2: This section notes that "In the unlikely event that overflow, in the event of a significant rain fall, exceeds final effluent discharge limits as determined through monitoring, contingency measures may include pumping of sediment laden water to vegetated areas (away from watercourses) or through filter bags for additional filtration and/or use of additional filtration devices or structures." Is equipment (water test kits, pumps, filter bags, etc.) for this purpose currently available at the site and if so are they inspected/tested on a regular basis? Are employees trained in their use? Suggest the stormwater management plan, which will be submitted during the Industrial Approval application process, incorporate these details.	The Stormwater Management Plan to be developed as part of the Part V application will address equipment and training to reduce risk of offsite sedimentation during storm events.
25	P. Nearing, Nova Scotia Environment	Page 5.2, Section 5.2.1, Paragraph 1 and see also Figure 3, Page 5.3 and Figure 4, Page 5.4: The text states "Provincial mapping did not show any watercourses on the site other than a holding pond (Figure 3, Sensitive Areas)." The holding pond is not readily evident on Figure 3. This needs clarification.	The location of the holding pond or open water area has been added to Figures 3 and 4.
26	P. Nearing, Nova Scotia Environment	The wetland naming convention used in this paragraph (e.g. WL1-R, WL5-M) does not appear to match the convention (e.g. WL01, WL05) used on Figure 4. This should be clarified not only in this paragraph but throughout the report. In addition the relationship (i.e. originates from, passes through, etc.) between the watercourses and wetlands should be confirmed as it is currently confusing. This likely due in part to the naming convention.	The wetland naming convention has been updated throughout the report to match Figure 4.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
27	P. Nearing, Nova Scotia Environment	Figure 3, Page 5.3 and Figure 4, Page 5.4: The Ducks Unlimited wetland is not readily identifiable on the figures. This should be identified.	Figures 3 and 4 have been updated to name the Ducks Unlimited (Beaverdam Meadows) wetland.
28	P. Nearing, Nova Scotia Environment	Page 5.5, Section 5.2.1, Paragraph 5: The following statement is made "Watercourse 2 (WC-2) feeds WC-1 in the southwest corner of the proposed project extension area (Figure 4)." This should be clarified as it appears WC-2 feeds WC-1 in the southeast corner of the property.	Text in Section 5.2.1 has been updated for clarity.
29	P. Nearing, Nova Scotia Environment	Page 5.6, Table 5.1: The measured DO values appear to be somewhat low based on the measured water temperature. Please comment.	The DO probe was calibrated to manufacturer's specifications prior to use. The DO values recorded are not indicative of anoxic or hypoxic conditions and are anticipated to adequately support aquatic life.
30	P. Nearing, Nova Scotia Environment	Page 5.6, Table 5.1: Please comment on the sample location for WC-1, i.e. upstream or downstream of the feed in point from DC-1.	Given the length of WC-1, multiple locations throughout the watercourse were sampled. The methodology text has been updated to clarify this fact. All data collected is now also available in Appendix E, including the location of the water sample. One WC-1 water sample (Reach 1) was taken upstream of the confluence with DC-1. All others were taken downstream of the confluence.
31	P. Nearing, Nova Scotia Environment	Page 5.6, Table 5.1: It would be beneficial to have some background surface water analysis (quality & quantity) data to serve as a baseline for comparison after the quarry is extended. Suggest a location on WC-1, upstream of the feed in location from WC-2 and downstream of all potential impacts from the quarry operation.	As noted in Section 5.2.1, surface water data was presented for WC-1 and WC-2 for multiple parameters. The proponent is willing to undertake additional analysis as specifically directed by NSE in permit conditions and approvals.
32	P. Nearing, Nova Scotia Environment	Page 5.29, Section 5.6.1, Paragraph 7: It is noted that "Figure 1 shows the local topography and drainage, as well as the present and proposed extended quarry outline, with the 800 m assessment boundary." Adding the numerical contour values would clarify the drawing.	Topography contours have been added to Figure 1.
33	P. Nearing, Nova Scotia Environment	Section 5.0: The Surface Water Resources Section (5.2) does not contain a specific heading on water quality or water quantity/quality effects as does the Groundwater Resources Section (5.6). It may be beneficial to have a similar layout arrangement for readability.	Water quantity is considered under the Groundwater VEC (Section 5.6 of the EA). The existing conditions discussion has been updated to be set up with headings more similar to the Groundwater VEC.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
34	P. Nearing, Nova Scotia Environment	Appendix C, Page 2.2 and 2.5: There is a discrepancy in the increase volume reported for site runoff due to the quarry extension. Page 2.2 notes "398,944.0 m^3" while page 2.5 states the figure as "417,082.0 m^3". Please verify and correct.	Page 2.5 in Appendix C has been updated to 398,944.0 m^3 instead of 417,082.0 m^3.
35	P. Nearing, Nova Scotia Environment	Appendix C, Page 2.3, Paragraph 2: The text indicates the model estimates are for 6 hours but the hydrographs (Figures 2.1 & 2.2) appear to show flow for more than 6 hours.	The model estimations are based on a 6 hour hydrograph (6 hour precipitation input) and on a 12 hour hydrograph which is approximately the time that takes the water to reach the detention facilities (i.e. the water flow continues after precipitation is finished).
36	P. Nearing, Nova Scotia Environment	Please comment on the discrepancy and the potential impact on runoff retention/control facilities.	This question is unclear. The proponent would be pleased to provide additional information to clarify.
37	P. Nearing, Nova Scotia Environment	Appendix C, Page 2.4, Paragraph 1: The statement is made "It is recommended to size the flow retention structures to retain the volume from the 1:25 year rainfall event." Please provide the rationale for selecting the 1:25 year rainfall event versus the 1:100 year rainfall event for sizing the flow retention structure.	The storage ponds are designed to fully capture the 1:25 year storm and allow some time for peak flow attenuation before any water is discharged into the receiving environment. The excess runoff created by larger storms (including the 1:100 year storm) will be controlled with the appropriate discharge features (orifice and a weir). The orifice will release runoff in a controlled manner to achieve the 24 hour drawdown requirement while the weir will only act to avoid overtopping of the pond(s) by excess runoff. The requirement to fully capture the 1:25 year storm and manage the 1:100 year storm using discharge features is quite common. One of the main reasons for taking this approach is to maintain a feasible volume for the ponds.
38	P. Nearing, Nova Scotia Environment	Appendix C, Page 2.5, Paragraph 1: The comment is made "Therefore, the difference in flow hydrographs between the 1:25 and 1:100 year rainfall events are shown on Figure 5." There is does not appear to be a corresponding Figure 5. Please verify and correct.	Text on page 2.5 in Appendix C has been updated to say Figure 2.3.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
39	P. Nearing, Nova Scotia Environment	Appendix C, Page 2.5, Paragraphs 1 & 2: The following statements are made: - "Based on Figure 2.3, the weir structure should be sized as a minimum to convey 1.05 m^3/s." - "A recommended drawdown period of 24 hours is expected to decrease suspended sediment concentrations by as much as 80%. Based on the low flow threshold of 24 hour discharge for runoff events equal or smaller than the 1:25 year rainfall event, the mean discharge capacity should be 0.421 m^3/s." The 1.05 m3/s flow is considerable higher than the mean discharge flow of 0.421 m^3/s. If the outlet weir is to be designed for the 1:100 year storm excess peak flow, should not the storage capacity be designed for the runoff volume of the same magnitude storm event to ensure suspended sediment concentrations are kept as low as possible?	Text in has been updated for editorial error (that/than). The storage capacity of the detention pond is designed to fully capture the 1:25 year storm and manage the 1:100 year storm. The pond(s) requires two outlets (an orifice and an emergency weir). The orifice controls the release of water to comply with the 24 hour drawdown requirement while the weir maintains a safe water level by releasing the excess surface runoff. In the case of the 1:100 Y storm, the pond(s) will store water for the first few hours (approximately 6 to 8 hours) only releasing a controlled amount by the orifice. By the time the pond is reaching full capacity some of the volume in the pond(s) will be available again because the orifice discharges continuously. Any extra excess will exit the pond using the emergency weir. This approach ensures that a large percentage of the water will be detained and released in a controlled manner.
40	Darrell Taylor, Environmental Analyst, Nova Scotia Environment	Section 5.2: Mapping in this section is inconsistent with two different water bodies labeled as Agard Lake. See Figures 3 and 4.	Figure 3 has been updated where Agard Lake was incorrectly identified.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
41		Section 5.2: Text indicates Agard Lake as the ultimate receptor of any pollutants from the quarry. According to Figure 3 Beaverdam Meadows wetland lies between Agard Lake and the quarry. This wetland and associated open water (as shown on Figure 1 and 4) should be protected, in addition to water courses located within the project area.	Field surveys found that neither watercourse on the Project site is expected to bear fish as a result of the multiple barriers to fish passage. As well, future quarry expansion will advance in the north and northeast direction (refer to Figure B1 in Appendix B). Appropriate mitigation will be undertaken to prevent downstream effects on fish and fish habitat and wetlands, and if development were to affect streams or any of the wetlands on site, appropriate applications would be submitted to NSE at the time.
42	Darrell Taylor, Environmental Analyst, Nova Scotia Environment	Section 5.2, Page 5.7: The Lake George Protected Water Area is mentioned in text as lying north of the project area. It would be beneficial to help ensure protection of this area if the watershed boundaries and associated drainage patterns were clearly delineated on maps along with the project area. This would help ensure no potential effects from the quarry to this important water resource as a drinking water supply.	A figure showing the watershed boundaries for the Lake George Protected Water Area has been added to Appendix E. With implementation of the mitigation described herein to protect on-site surface water and prevent effects downstream in Agard Lake, no impact to surface waters is anticipated to result from the proposed Project Activities.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
43	Darrell Taylor, Environmental Analyst, Nova Scotia Environment	Section 5.2: It would be beneficial for the Surface Water Resources section to be fleshed out similarly to the Groundwater Resources section with both water quality and quantity impacts more fully assessed. Baseline and post-development monitoring of ambient conditions of the watercourses down gradient of the quarry would be helpful to ensure protection and predictions of the EA assessment.	The level of analysis in the surface water discussion is consistent with scope of data collected. That is, we are able to present our findings on water quality and physical stream habitat based on a single point in time field measurement. It is not advisable to extrapolate beyond these statements of findings. The mitigation discussion is focused on the main risk to the aquatic surface water environment from mining activities – erosion and sediment control. A short "intro" section has been added to the mitigation discussion to provide additional context. The format of the existing conditions has been updated to more closely match the Groundwater Resources VEC (Section 5.6). The surface water data collected during the field assessment for the current EA does serve to provide baseline conditions for the watercourses on the quarry property. Additional monitoring can be considered if/when quarry activities are planned to approach the watercourses and can be part of future Water Approval applications and permitting.
44	Darrell Taylor, Environmental Analyst, Nova Scotia Environment	Appendix E, Fish Habitat Survey: The information in Appendix E (Fish Habitat Survey) was limited to three pages of photos. All related information should be included for reference and assessment.	Data from field-sheet was converted from electronic format and included in Appendix E. Also added to Appendix E was the Protected Water Area map.
45	Sarah MacKay, NS Department of Natural Resources	There are some minor typographical and spelling errors to address.	Text has been updated as indicated for comments 45 and 46.
46	Sarah MacKay, NS Department of Natural Resources	Labeling of wetlands in Figure 4 does not conform to description in Section 5.2.1.	The naming convention in Section 5.2 has been updated.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
47	Sarah MacKay, NS Department of Natural Resources	Locations of sensitive species shown in Figure 3 rather that Figure 4 (see Section 5.3.1, page 5.14).	Text has been updated in Section 5.3.1.
48	Sarah MacKay, NS Department of Natural Resources	DNR is concerned about the loss and/or continued degradation of wetlands in the project area. These wetlands support several species with moderate to strong coastal plain affinity (*Glyceria obtusa, Carex bullata, Agalinis neoscotica, Juncus subcaudatus, Thelypteris simulata, and Vaccinium corymbosum*, among others). These vascular plants are diagnostic indicators of wet Coastal Plain forest. In Canada, Coastal Plain Forest ecosystems have only been classified in Nova Scotia -- they are a nationally unique habitat type, with high biodiversity value. The potential for these forests to support rare and range limited species, particularly in the Tusket watershed, will increase if forest harvesting and hydrographic impacts are abated. DNR is concerned about potential losses and/or further compromises to the ecological integrity of these wetland resources.	Due to the nature of quarry activities, complete avoidance of wetlands within the Project area is not possible. However, the Project footprint has been re-evaluated so as to minimize the loss and degradation of wetlands. As a result, the southern half of the project area, which encompasses WL10 to WL15, will be set aside as a wetland conservation zone. See Section 5.5.2 and revised Figure B1 in Appendix B. The setting aside of the aforementioned conservation zone, coupled with on-site wetland compensation initiatives (for affected wetlands) will reduce impacts of the project on species of coastal plain flora. Appropriate on-site coastal plain species will be used to help vegetate created wetlands, either through a propagation method or direct transplanting See Section 5.5.2. It should be noted that many species of Coastal Plain Flora, including those found within the Project area, are generally associated with open wetland ecosystem types (rather than those with well-established tree canopies) due to being poor competitors with other plants and being somewhat dependant on disturbance processes. As such, the ability of the treed wetlands within the Project area to provide habitat for Coastal Plain Flora may not markedly increase with their successional development.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
49	Sarah MacKay, NS Department of Natural Resources	DNR suggests that the eastern boundary of the existing quarry is too close to the Beaver Dam Meadows wetland and that any further intrusion is not at advised.	Over the next ten years, the quarry extension will advance in the north and northeast direction and away from Beaver Dam Meadows (refer to Figure B1 in Appendix B).
50	Sarah MacKay, NS Department of Natural Resources	DNR notes the immediate 10 year projection for quarry expansion will occur in the north to north-east quadrant of the project area and will directly impact two wetlands. The entire project will result in the complete or partial loss of the 15 wetlands within the Project extension area over the duration of the Project. The proponent has not discussed an alternative of a smaller Project that avoids all or most of the wetlands.	As noted in response to #48 above, the Project footprint has been re-evaluated to greatly reduce the loss and degradation of wetlands through avoidance. That is, the southern half of the Project area, which encompasses WL10 to WL15, will be set aside as a wetland conservation zone. See Section 5.5.2 and revised Figure B1 in Appendix B. Where wetland alteration is unavoidable, the proponent will prepare wetland alteration applications, (which will include an assessment of the functional attributes of the wetland). If approval is granted, compensation for wetland habitat (including on-site initiatives) will be undertaken. See Section 5.5.2.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
51	Sarah MacKay, NS Department of Natural Resources	DNR notes the Tusket watershed has global significance because of the Atlantic Coastal Plain Flora, and potential impacts to local hydrology associated with the placement of this project is a significant concern.	Impacts on Coastal Plain Flora will be mitigated through development of a wetland conservation area (see Section 5.5.2 and revised Figure B1 in Appendix B) and on-site creation of appropriate wetland habitat. Furthermore, impacts on the rarity / sensitivity of individual species have been discussed in relation rankings provided by NSDNR and other authorities (see Section 5.3). It should be noted that many Coastal Plain plants are associated with disturbed areas, and the abundance of certain species on site has likely been increased as a result of anthropogenic activities. For example, *Agalinis neoscotica* was associated with old logging roads and ditches within the Project area. Also refer to hydrology study (Appendix C)
52	Sarah MacKay, NS Department of Natural Resources	The proponent is required to provide the geo-locations for RED and YELLOW listed taxa under the NS General Status of Wild Species as described in the "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document". DNR is, however, expanding the scope or our reviews of EAs to assess status of ecosystems, e.g. uniqueness and rarity. The information from General Status will be included, as well as information on species assemblages with biophysical parameters. Although not required at this time, DNR requests a table of geo-locations for species ranked between S1-S3S4, by the Atlantic Canada Conservation Data Centre if such information was obtained during field surveys. These data will assist DNR's evaluation of the project.	Comment acknowledged. Geo-locations of all taxa assigned rankings of S1-S3S4 by the ACCDC are provided in Table F2, Appendix F.

Table J-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
53	Sarah MacKay, NS Department of Natural Resources	DNR requests a more comprehensive examination and discussion of impact avoidance and mitigation options for rare species than currently provided in section 5.3.2.	Impacts to the population of boreal American aster will be avoided through designation of a wetland conservation area (see Sections 5.3.2 and 5.5.2). Similarly, a 10 m buffer will be established around the known population of nodding ladies'-tresses.
54	Sarah MacKay, NS Department of Natural Resources	Bird surveys in the area reveal no nighthawks, chimney swifts, olive-sided flycatchers, Canada warbler or any other species of bird listed as at risk or of conservation concern. This is unusual given the number of rich wetlands and diversity habitats. This may be due to the timing of surveys in late August. DNR suggests a spring breeding bird survey is required to assess whether birds of conservation concern occur within the project area.	Section 5.4.2. Outlines the commitment to conduct a breeding bird survey in the spring of 2010.
55	Sarah MacKay, NS Department of Natural Resources	DNR notes that the base data is from 1997. DNR suggests an aerial photograph should be utilized to support base data which may be considered out of date. A newly-built household hazardous waste transfer station is located within the 800 metre buffer of the proposed quarry and, although mentioned on page 5.44 under "Land Use", the facility is not indicated on the figures presented, nor is the landfill. Drainage from both of those facilities would flow towards the Beaverdam Meadows.	Figure 1 has been updated to include the location of the transfer station and the landfill.
56	Sarah MacKay, NS Department of Natural Resources	Page 5.37, Section 5.7, Archaeological and Heritage Resources: DNR suggests that representatives of the Yarmouth Reserve of the Acadia First Nation should have been contact. The reserve is mentioned on Page 5.44 ("Land Use") but there does not appear to have been consultation.	Information letters were sent to representative organizations Confederacy of Mainland Mi'kmaq and Kwikmug Maw-Klusuag Mi'Kmaq Rights Initiative to encourage the submission of comments, concerns, and questions regarding the Project. See Appendix D for copies of the letters. These organizations did not express any written concerns about the proposed Project.
57	Sarah MacKay, NS Department of Natural Resources	Page 5.44, Section 5.9.1, Description of the Existing Environment - Mining: A gold mine shaft is incorrectly identified as the nearest mine shaft to the property. The abandoned mine openings database indicates a shaft was sunk by E.S. Matheson & Associates approximately 3 kilometers to the south of the proposed quarry boundary (location was revised since the new database was released, former location showed it 1.5 kilometers to the south). Mica within pegmatite dykes was the commodity sought. A good reference to that location is Geological Survey of Canada (GSC) Map #1186A, contained within GSC Memoir 349.	Section 5.9.1 has been updated with this information.