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Final Report: Environmental Assessment Registration for Whycocomagh Quarry Extension Project

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File: 121510121

March 2010

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1.0 PROPONENT AND PROJECT IDENTIFICATION

1.1 PROPONENT INFORMATION

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

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1.2 PROJECT INFORMATION

Name of the Undertaking: Whycocomagh Quarry Extension Project
Location of the Undertaking: Stewartdale, Inverness County, Cape Breton, NS

2.0 PROJECT INFORMATION

2.1 DESCRIPTION OF THE UNDERTAKING

Alva Construction Limited (Alva; the Proponent) owns and operates the Whycocomagh Quarry, located in Stewartdale, Inverness County, Cape Breton Island, Nova Scotia (Figure 1). The quarry property is in the Whycocomagh District of the Municipality of the County of Inverness. It is currently operating under an Industrial Approval (Approval No. 2008-065008) that was obtained from Nova Scotia Environment (NSE), pursuant to Division V of the Activities Designation Regulations. The current Approval is effective from 2008 until February 28, 2011. A copy of the Approval permit is appended to this report (Appendix A).

Alva proposes to extend the approved quarry site to occupy 47 ha to allow for continued aggregate production (blasting, crushing and stockpiling) and will supply DOT&C Type 1, 2, 1S (Class A, B, C, E), asphalt aggregates, armour stone, rip rap, and concrete aggregates for local construction needs. The extension of the existing quarry will commence in the south west direction. Since no washed aggregate will be produced, there will be no need for production water for this operation.

The Proponent owns the existing quarry lands as well as the adjacent proposed extension land area. The existing quarry has been in operation since September 28, 2000, with a total disturbed area to date of approximately 3.78 ha. The quarry has produced more than approximately 225,000 tonnes of aggregate. Timber had been previously harvested from the site by the owner and 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 carefully considered so as to minimize potential environmental impacts including impacts to streams located on the proposed extension property. Extension area boundaries were also developed to maintain setbacks from residential properties similar to those now in place with respect to current quarry operations.

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 24 hrs/day, five days/week, 40 weeks/year or more, depending on the demand for aggregates. Based on current estimates, there are over 10 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 50 years or more.

2.2 GEOGRAPHIC SETTING

Whycocomagh Quarry is in the small community of Stewartdale (situated to the northwest of Whycocomagh Village), Inverness County, Cape Breton Island, Nova Scotia (Figure 1). It is located at the following geographic coordinates: 45°59'11.25" N and 61°9'17.33" W. The Project property is bounded at its northeast extent by Campbell Mountain Road and at its southwest extent by Whycocomagh Port Hood Road, and the existing quarry operation is accessed via a private road. The quarry and proposed quarry extension area are situated on lands that are owned by the Proponent that have undergone various stages of clearing over the past nine years. The surrounding lands are mostly undeveloped. Most of the property is forested and areas of uncut forest are evident outside the quarry boundaries and along the edges of the access road.

The Project area supports a number of upland habitat types including mature and immature hardwood and mixedwood forests, abandoned pasture, shrub thicket, and areas which are at an early stage of regeneration following disturbance from tree harvesting activities. Forest cover within the eastern half of the property is highly variable and discontinuous as a result of extensive past anthropogenic activities. In particular, old roads and clearings provided by abandoned pastures and logging activities have highly fragmented the forest within this area. This fragmentation is reflected by an abundance of exotic plants throughout the eastern half of the property. Although some old roads and recent cut-over areas are present in the western half of the property, the forests within this area are relatively intact.

Based on available mapping and aerial photography, residential development in the immediate vicinity of the existing Whycocomagh Quarry is relatively low. There are approximately three structures unrelated to the existing quarry within 800 m and no businesses or schools (Figure 1). There are approximately thirteen additional structures within 800 m of the proposed extension site (*i.e.,* not currently within 800 m of the existing quarry).

The quarry is located just outside of the boundary of the Eastern District Planning Commission's (EDPC) Whycocomagh Plan Area, on land that is not zoned for any particular use.

2.3 PROJECT COMPONENTS

The existing quarry operations consist of a laydown area for the portable crushing equipment, various aggregate stockpiles, quarry floor and working face, weight scales, and a 500 m private access road off of Campbell Mountain 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. There is no planned storage of fuel oil or other hazardous materials on-site.

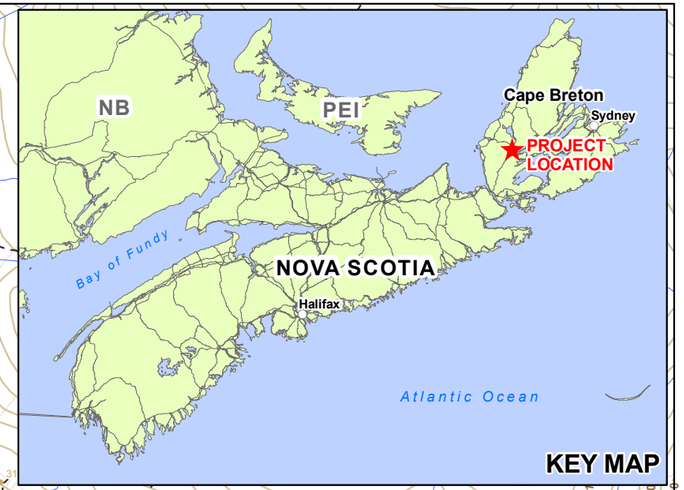
Topsoil, grubbing material and overburden that have been stripped prior to drilling and blasting are stored on-site. These materials have been stabilized for subsequent use during site reclamation. The piles have been hydroseeded to reduce potential for erosion and sedimentation. Similar practices will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

Map Features

- Building
- Spot Height (m)
- Road
- Road (Unpaved)
- Elevation Contour (10 Metre Intervals)
- Watercourse
- Existing Quarry Boundary
- Project Property
- 800 Metre Project Property Buffer
- 800 Metre Existing Quarry Boundary Buffer (Working Face)
- Property Boundary
- Cemetery
- Inverness County Pits & Quarries Database
- Building
- Wetland
- Waterbody
- Whycocomagh - Indian Reserve Lands

Data References:
- Base Data from Nova Scotia Geomatics Centre, Nova Scotia Topographic Database
- Wetlands from Nova Scotia Department of Natural Resources (NSDNR), Wetland Inventory Mapping

0 125 250 375
Metres



Skye River
Indian River
Churchview
HWY-252
N

DATE: 15/12/2009	ALVA CONSTRUCTION LIMITED - WHYCOCOMAGH QUARRY
PREPARED BY: G. Mesheau	**Project Location**
PROJECT NO.: 121510121	FIGURE NO.: **Figure 1**

Stantec

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 sites within the quarry limits. As the quarry is extended, and additional space is created, a dedicated stockpile area will be created.

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, which has the capacity to hold a significant quantity of water. Excavation will not take place below the groundwater table.

The general direction of quarry advancement will be south and southwest from the existing quarry face.

2.4 SITE PREPARATION AND CONSTRUCTION

The existing quarry has been in operation for nine 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. Currently there are no conditions in place for overflow from the quarry floor, as it has never been an issue. Additional surface water management capacity will be created, as needed, as the quarry develops. Water that has pooled on the quarry floor may be used to provide a water supply for dust suppression during crushing in dry periods, if needed.

2.5 OPERATION AND MAINTENANCE

The proposed Project activities will be consistent with the current quarry operations approved by NSE (Approval No. 2008-065008) 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 six to ten 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 working face of the quarry is approximately 9 m in height and does not go below the natural water table (*i.e.,* the quarry floor is not under water and has not flooded since the quarry opened). Alva will continue to excavate from the working face and will not excavate deeper into the quarry floor.

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 150 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 24 hrs/day, 5 days/week, 40 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 at least five employees throughout the year, and this number increases to ten during aggregate production. 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 to control sedimentation, as required. 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 currently collects on the quarry floor and there is no settling pond. Details regarding the size of potential settling capacity required for proposed extended quarry

operations and potential runoff mitigation measures are discussed in Appendix B and will be further refined at the Industrial Approval application stage.

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 for clear flows and high flows in the facilities Approval permit (Appendix A). In the unlikely event that overflow, during 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 that is pooled on the quarry floor. To minimize the generation of dust, the working areas and laydown areas will be covered with blasted rock. Dust generated by truck 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 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, exterior decorative lighting, such as spotlights or floodlights with a function of highlighting features of buildings *etc.*, 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, particularly during the migratory season for most birds, when the risk of drawing birds to the site is greatest.

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 quarry 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. 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.

Refueling of equipment will be conducted on-site on a regular basis, under contract by a tanker truck. Refueling activities will not be conducted within 100 m of any surface water, and equipment operators will remain with the equipment at all times during refueling in accordance with the Petroleum Management Regulations of the Nova Scotia *Environment Act.*

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. 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

Alva 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 this 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 Alva Construction Limited to extend the existing quarry footprint and continue operations at their quarry in Stewartdale. The quarry is currently operating under an Industrial Approval (No.2008-065008), issued by NSE effective until February 2011. 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 Whycocmagh 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 currently sufficient for current and extended operations. Additional flow retention structures will be installed/constructed 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.

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 on December 22, 2009. A disposition table presenting all received government comments and comment responses has been included in Appendix C.

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*, *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 April 21, 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. The Proponent and consultant also met with representatives with the Nova Scotia Office of Aboriginal Affairs, Kwilmu'kw Maw-klusuaqn (KMK) and Nova Scotia Environment at a monthly Environmental Assessment Technical Committee meeting in Millibrook, NS to discuss the proposed Project and potential First Nations and aboriginal interests.

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 noted above:

- 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 July 2009 a Project Information Bulletin (Appendix D) was 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 immediately adjacent 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. The Proponent also met with Chief Googoo of the Waycobah First Nation, located within approximately 750 m south of the existing quarry, on July 15, 2009 to inform him of the Project. On July 20, 2009 the Proponent and JWSL met with representatives with the Nova Scotia Office of Aboriginal Affairs, Kwilmu'kw Maw-klusuaqn (KMK) and Nova Scotia Environment at a monthly Environmental Assessment Technical Committee meeting in Millibrook, NS to discuss the proposed Project and potential First Nations and aboriginal interests.

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 September 16, 2009 the Proponent received a letter from the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) requesting that a Mi'kmaq Ecological Knowledge Study (MEKS) be completed for the proposed extension area. The Proponent has investigated options for conducting an MEKS.

5.0 VALUED ENVIRONMENTAL/SOCIO-ECONOMIC COMPONENTS (VEC) AND EFFECTS MANAGEMENT

5.1 ASSESSMENT METHODS

Field studies were conducted by Stantec between June 8 and August 6, 2009, to investigate and establish the existing conditions and to determine appropriate mitigation, if necessary, to minimize 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 biologist employed by Stantec. An aquatic field survey was undertaken by qualified aquatic specialists. A desktop assessment of potential archaeological and heritage resources was undertaken by a professional 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 Public Works, and the Nova Scotia Department of Natural Resources.

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.

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. There are no known agricultural, recreational, industrial or potable uses of the surface water located on the Alva Project Property. One of the watercourses located on the Project Property feeds the Indian River, which is used for recreational fishing activities. Indian River is located outside the Project boundary but mitigation is suggested below to prevent downstream effects from the watercourse located on site that is known to feed Indian River. 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 June 10, 2009 by two Stantec Limited aquatic scientists. Field-based stream assessments included a fish habitat survey and water quality sampling within the two

defined watercourses inside the Project boundaries. Provincial mapping showed two watercourses on the site: a defined stream and a small pond. Field investigation confirmed that the pond was in fact a wetland (WL02), and the mapped watercourse drained from this wetland. The watercourse is a tributary to Indian River, which drains into Skye River. Skye River, in turn, feeds Whycocomagh Bay. On-site investigation confirmed one additional watercourse (Figure 2).

Map Features

- Rare Plant - Bebb's Sedge (*Carex bebbii*)
- Waycobah First Nation Water Supply Exploration Well
- Waycobah First Nation Municipal Water Supply Production Well
- Building
- Road
- Road (Unpaved)
- Contour (5m)
- Watercourse
- Surveyed Watercourse (June 2009 Survey)
- Existing Quarry Boundary
- Project Property PID 50107184
- Cemetery
- Inverness County Pits & Quarries Database
- Building
- Field Delineated Wetland (August 2009 Survey)
- Wetland Buffer Areas
- Wetland
- Waterbody

Restricted and Limited Use Lands

- Whycocomagh - Indian Reserve Lands

Data References:
- Base Data from Nova Scotia Geomatics Centre, Nova Scotia Topographic Database, 1997
- Wetlands from Nova Scotia Department of Natural Resources (NSDNR), Wetland Inventory Mapping
- Indian Reserve Lands from NSDNR, 2007
- Wildlife Areas from NSDNR, 2007

0 100 200
Metres

N

Skye River

WL-1

WL-2

WL-3

WL-4

Watercourse #1

Watercourse #2

Indian River

TW09-1

PW1

PW2

DATE: 05/11/2009 PREPARED BY: G. Mesheau PROJECT NO.: 121510121	ALVA CONSTRUCTION LIMITED - WHYCOCOMAGH QUARRY **ENVIRONMENTALLY SENSITIVE AREAS**	FIGURE NO.: **Figure 2** Stantec

The habitat surveys were conducted based on internal Stantec sampling protocol and the Environment Canada CABIN protocol (Canadian Aquatic Biomonitoring Network; Reynoldson *et al*. 2007). Habitat surveying was also influenced by the Ontario Benthos Biomonitoring Network (OBBN) protocols (Jones *et al.* 2005). 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, width, and velocity of the stream were also taken and the presence of existing anthropogenic impacts was noted.

Watercourse descriptions are provided below for the two assessed streams, including the results of the fish presence-absence survey. This information details the watercourse survey results and characterizes each watercourse. By characterizing the watercourses, Alva can ensure that appropriate mitigation is implemented. Additionally, any site-specific concerns that may require special mitigation can be identified.

Key water quality results are outlined for each watercourse. 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 will be compared with the CCME guidelines for the protection of freshwater aquatic life (CCME-FAL 2007) to determine the likelihood that each watercourse can or cannot 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.

The presence or absence of fish was confirmed using a backpack electrofishing unit (Model LR-24). Fish were identified to species and the fork length of each individual was taken. Fish presence-absence surveying was carried out in the lower reaches of the mapped watercourse (WC-1) as well as in the Indian River where WC-1 feeds into it. The unmapped watercourse (WC-2) was not electrofished as it no longer connects to Indian River or other known fish bearing waters, and exhibited a gradient prohibitive to fish passage. Site photos were also taken along the stream reach and can be found in Appendix E.

Watercourse Descriptions

Watercourse 1 (WC-1) is located in the center of the Project Area and Watercourse 2 (WC-2) is located in the southwestern section of the Project Area (Figure 2). Both can be characterized as steep, clear-water streams dominated by rocky substrate. WC-1 drains from wetland two (WL-2). Both streams are under the influence of anthropogenic effects from an existing, frequently travelled gravel road. WC-1 drains directly into the Indian River (outside the Project Area) through a culvert that passes under the gravel road. The culvert was perched on the downstream side at the time of the survey but likely could still allow fish passage during high flow periods. WC-2 was

historically connected to the Indian River but during the June 2009 field investigation it was confirmed that the upstream end of the existing road culvert has been completely buried. The stream now drains into the roadside ditch on the opposite side of the road than Indian River. There are multiple old, overgrown dirt roads within the Project Area and outside of it that run very close to or historically crossed WC-1 and WC-2. Any residual anthropogenic effects from these old, currently unused roads are anticipated to be negligible.

Both streams include riffle, run and pool areas, with estimated slopes of the streams ranging from less than 5% to nearly 10% in various areas throughout their length. Because of the steep gradient in areas, there is an abundance of cascades and pools, particularly in WC-1 which has substantially higher flow than WC-2. Substrate types ranged from sand to gravel, pebble and cobble in both streams; there were some areas of silt cover in WC-1.

Each stream does become intermittent in sections and are anticipated to be groundwater fed in multiple areas. WC-1 supported a substantially higher volume of water at the time of the survey, is more deeply entrenched and shows greater evidence of scouring and erosion compared to WC-2. In some places, WC-1 is located in the bottom of a deep ravine estimated to range in height from 5 to 10 m above stream bed. Macrophytes, algae, woody debris and detritus are present in WC-1 but not common. In WC-2, macrophytes were absent from the surveyed area, woody debris and algae was present and detritus was abundant. WC-2 was entrenched up to 1.5 m in some places. Additional physical habitat features are summarized for each watercourse in Table 5.1.

Table 5.1 Summary of Stream Assessments at Whycocomagh Quarry

Date & Time	**6/10/2009 (10:45)**	**10-Jun-09**
Site Coordinates	**642381E, 5094071N**	**642131E, 5093789N**
Site Description	WC-1: Unnamed Tributary from Indian River, middle of Site	WC-2: Unnamed stream, at south west end of property
Site Measurements and Characteristics		
Precipitation Previous 24 hours	None	None
Wetted Width (min. - max. range)(m)	0.23 - 1.02	0.27 - 0.77
Bankfull Width (min. - max. range) (m)	0.52 - 1.75	0.65 - 0.94
Velocity (avg. in thalweg) (m/s)	0.08	ND
Depth (min. - max. range) (m)	0.005 - 0.075	0.025 - 0.17
Woody Debris	Present	Present
Detritus	Present	Present
Macrophytes	Present	Absent
Algae	Present	Absent
Canopy Cover (%)	0 - 100	50 - 100
Riparian Vegetation (Dominant)	Forest, Mainly Deciduous	Forest, Mainly Coniferous
Water Quality		
DO (mg/L)	11.45	12.05
DO(%)	96.5	102.5
Water Temperature (C)	8	8.29
Specific Conductivity (µS/cm)	48	22
pH	7.37	7.4
TDS (g/L)	0.031	0.015

The *in situ* water quality results collected in each stream (Table 5.1) confirm that both WC-1 and WC-2 have the potential to support aquatic life when compared to the CCME-FAL guidelines for pH (6.5 – 9). The dissolved oxygen (DO) levels met the minimum recommended guidelines for cold and warm water species of aquatic organisms at early and late life stages (*e.g.,* 5.5 - 9.5 mg/L minimum).

None of the watercourses identified on the Project Property are known to interact with drinking water supplies or other protected surface waters. The groundwater section (Section 5.6.2) includes an assessment of water supply wells within 800 m of the project site. Two properties with possible water wells were identified between the Project boundary and major rivers that would be expected to act as groundwater flow barriers to subsurface effluents leaving the Project site. Further consideration of these two properties is presented in Section 5.6.2. Two municipal water supply wells for the Waycobah First Nation are located at the edge of the 800 m of the project radius (see Section 5.6.2).

The only lake located within the vicinity of the Project boundary is Lake Ainslie; the southern point of the lake extends to approximately 10 km northeast of the Project area. This lake is not designated as a reservoir (Service Nova Scotia, 2006). There is no known Protected Water Areas (PWA) in the vicinity of the Project Property. With implementation of the mitigation described herein to protect on-site surface water and prevent effects downstream in Indian River, no impact to surface waters is anticipated to result from the proposed Project Activities.

Fish Survey Results

WC-2 was not fished because of the lack of connectivity to known fish bearing waters and because the steep gradient in the downstream section of the watercourse is anticipated to prevent any fish from inhabiting the stream. In WC-1, the area downstream of the gravel road was fished given that the gradient suggested that fish may be able to access at least some areas. This stream section is approximately 300 m outside of the Project Area. Fishing results from this section of the stream are provided in Table 5.2. The large pool upstream of the gravel road was also fished but no fish were caught. The vertical rock face (>1.5 m) immediately upstream of this pool and the steep slope of the stream (*e.g.,* nearly 10%) prevents fish passage further upstream (see photo 7, Appendix E). Therefore, it is not anticipated that the section of WC-1 falling within the Project boundaries bears any fish. However, since the stream bears fish downstream of the Project boundaries (*i.e.,* immediately upstream of Indian River), appropriate mitigation must still be undertaken to prevent downstream effects on fish and fish habitat. Additionally, the presence of Atlantic salmon (*Salmo salar*) and brook trout (*Salvelinus fontinalis*) was confirmed within the Indian River in the vicinity of the WC-1 outfall.

Table 5.2 Fish Catch Summary, WC-1 and Indian River

Site	Date Fished	Brook Trout	Atlantic Salmon	Total # Fish
WC-1	10-Jun-09	4		4
Indian River (WC-1 Outfall Area)	10-Jun-09	4	3	7

Brook trout and Atlantic salmon are popular sport fish requiring gravel beds in well-oxygenated, cool waters for spawning. The Nova Scotia Department of Natural Resources (NSDNR) lists brook trout as yellow, or sensitive to human activities or natural events. Neither COSEWIC (Committee on the Status of Endangered Wildlife in Canada) nor *SARA* (*Species at Risk Act*) list brook trout, although ACCDC (Atlantic Canada Conservation Data Centre) does consider it to be globally widespread and abundant and locally widespread, fairly common, and apparently secure with many occurrences, but of long term concern. Atlantic salmon is listed as "Red" by NSDNR, meaning that it is either known or thought to be at risk. Under *SARA* and COSEWIC, it is only the inner Bay of Fundy population of Atlantic salmon that is listed as at-risk. The ACCDC considers Atlantic salmon to be globally widespread and abundant but locally rare (G5 S2). Their designation states that the species may be vulnerable to extirpation due to rarity or other factors.

Both the brook trout and the Atlantic salmon are members of the salmon family (Salmonidae) and are anadromous (spawn in freshwater, return to sea as adults), although they are known to have purely freshwater populations (Scott and Crossman 1998). Salmonids are generally considered a sensitive family of fish, indicative of good water quality in relation to pH, dissolved oxygen, and metals (or other contaminant) levels.

Summary

Two distinct watercourses were confirmed in the Project Area based on the 2009 surface water assessment. Water quality measures collected *in-situ* at the time of the survey confirmed that both watercourses had the potential to support aquatic life. During the June sampling period, traditional salmonid habitat was observed within the assessed area of WC-1. In the area immediately upstream of Indian River where fish passage is not prevented by stream gradient, gravel beds were observed in the stream, as were resting pools and riffles (creating well-oxygenated water). Both brook trout and Atlantic salmon are sensitive to contaminants, sedimentation, metals and changes in pH and water temperature. Therefore, the potential for downstream effects within WC-1 and within Indian River must be mitigated.

At the time of the survey, WC-2 did not connect directly to Indian River, but fed the ditch system on the upgradient side of the dirt access road running parallel to Indian River. Mitigation for protection against downstream effects on Indian River will be implemented within this watercourse due to potential for connectivity to Indian River to be restored within the life time of quarry activities on the Project Property.

The implementation of mitigation measures within WC-1 and WC-2 to prevent downstream effects on Indian River will also serve to protect the surface water quality within each of the watercourses within the Project Property. This in turn allows WC-1 and WC-2 to continue to support a range of aquatic life, as it is anticipated that both watercourses support a benthic invertebrate assemblage.

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

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 fish habitat by chemical, physical, or biological means *(i.e.* HADD). The guiding principle of this policy is to achieve no net loss of the productive capacity of fish habitats. As specified in Nova Scotia Pit and Quarry Guidelines, no active areas 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. Natural vegetation will be maintained within this buffer.

It is unlikely that watercourses will be approached by Project activities in the near future of the development of the quarry extension. 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 connectivity of both watercourses to Indian River). 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.

If the watercourses proposed for alteration support productive fish habitat, approval must also be granted under the federal *Fisheries Act*. The first goal will be to avoid alteration of watercourses and the fish habitat they support, particularly WC-1 since it does feed Indian River. It is understood that if harmful alteration, destruction or disruption (HADD) of fish habitat is unavoidable and appropriate approvals are granted by Fisheries and Oceans Canada, habitat compensation would likely be required to ensure no net loss. It is currently unknown if alteration of these watercourses will be required during the life of the quarry extension. WC-2 does not likely support 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 in the downstream section of the on-site stream (WC-1) and in Indian River, to which WC-1 connects.

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. 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 fish and fish habitat assessment and the mitigation proposed (including fish habitat compensation, if required), 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 on two occasions, June 8 and August 4-6, 2009. Vascular plant inventories of the property were compiled on each of the surveys and habitat descriptions were performed. The Project area supports a number of upland habitat types including mature and immature hardwood and mixedwood forests, abandoned pasture, shrub thicket, and areas which are at an early stage of regeneration following disturbance from tree harvesting activities. The property also supports wetland habitats in the form of freshwater marsh, tall shrub swamp, and deciduous treed swamp.

The majority of the property is covered by stands of immature mixed and hardwood forest. Red maple (*Acer rubrum*), paper birch (*Betula papyrifera*) and balsam fir (*Abies balsamea*) are the dominant trees throughout, but a number of other species are also present, including American beech (*Fagus grandifolia*), white spruce (*Picea glauca*), black spruce (*Picea mariana*), and white ash (*Fraxinus americana*). Shrub cover is primarily provided by balsam fir, red maple, American beech, paper birch, fire cherry (*Prunus pensylvanica*) and white spruce. Common herbaceous species include wild lily-of-the-valley (*Maianthemum canadense*), bracken fern (*Pteridium aquilinum*), wild sarsaparilla (*Aralia nudicaulis*), goldthread (*Coptis trifolia*), and eastern hay-scented fern (*Dennstaedtia punctilobula*). Red-stemmed moss (*Pleurozium schreberi*), hair-cap moss (*Polytrichum spp*.), and stair-step moss (*Hylocomium splendens*) are the most prominent mosses on the forest floor.

Stands of mature tolerant hardwood are prominent on the steep slope at the western end of the property. Sugar maple (*Acer saccharum*) dominates the overstory within this area whereas balsam fir provides a moderate sub-canopy and shrub layer. Other common tree species found throughout the forested slope include yellow birch (*Betula alleghaniensis*), paper birch, American beech, eastern white pine (*Pinus strobus*), and eastern hemlock (*Tsuga canadensis*). Intermittent shrub layer is provided by black spruce, American fly-honeysuckle (*Lonicera canadensis*), and possum-haw viburnum (*Viburnum nudum*). The cover of herbaceous

vegetation within the tolerant hardwood stand is low and predominantly comprised of forbs, including evergreen woodfern (*Dryopteris intermedia*), New York fern (*Thelypteris noveboracensis*), wild sarsaparilla (*Aralia nudicaulis*), whorled aster (*Aster acuminatus*), clinton lily (*Clintonia borealis*), and common hawkweed (*Hieracium lachenalii*).

A small patch of tolerant hardwood which could be described as “nutrient-rich seepage forest” was noted within the northern corner of the Project area. This stand is approximately 20 x 70 m in size and runs along the property boundary. This habitat can be roughly indicated by the presence of species associated with relatively high nutrient and moisture availability, including two-leaf toothwort (*Cardamine diphylla*), Dutchman's breeches (*Dicentra cucullaria*), and silvery spleenwort (*Deparia acrostichoides*), This habitat was not observed elsewhere on the property. However, the tolerant hardwood stand on the steep slope at the western end of the property contained several small seepages towards the crest of the hill which dissipated within several meters of their origin. Although the slope was well-drained, the presence of taxa, such as tall rattlesnake-root (*Prenanthes altissima*), indicate relatively rich soil conditions within this area.

Tree harvesting activities have resulted in patches of regenerating forest, which are currently at an early successional stage, being found within both the eastern and western ends of the property. Although some overstory cover is provided by residual trees, these areas are dominated by shrubs. This shrub cover is provided by regenerating trees, most notably red maple and fire cherry , as well as red raspberry (*Rubus idaeus*), and smooth blackberry (*Rubus canadensis*). Herbaceous cover is varied, but rough-leaf goldenrod, sweet vernal grass (*Anthoxanthum odoratum*), common hawkweed, kentucky bluegrass (*Poa pratensis*), and Canada goldenrod (*Solidago canadensis*). Although low, some moss coverage is provided by species such as three-lobed bazzania (*Bazzania trilobata*) and red-stemmed moss.

The areas of abandoned pasture present within the eastern end of the property are characterized by intermittent tree and shrub cover, and a prominent herbaceous layer. Scattered red maple, common apple (*Pyrus malus*), white spruce, and large-tooth aspen (*Populus grandidentata*) provide the tree cover. Common apple is the most abundant shrub within this area, but red maple, white spruce, and fire cherry are also scattered about. The herbaceous layer is comprised of a diversity of forbs and graminoids, including both native and exotic species. Dominant taxa include sweet vernal grass, parasol white-top (*Aster umbellatus*), English plantain (*Plantago lanceolata*), colonial bentgrass (*Agrostis capillaris*), rough-leaf goldenrod (*Solidago rugosa*), fireweed (*Epilobium angustifolium*), little starwort (*Stellaria graminea*), pearly everlasting (*Anaphalis margaritacea*), meadow timothy (*Phleum pretense*) and several species of bluegrass (*Poa spp*.).

A patch of shrub thicket is located in the north-central part of the property. Although this habitat is imperfectly drained, it is not saturated to a degree that would classify it as a wetland. Nonetheless, much of the vegetation within this area approximates that which may be found in tall shrub swamp wetlands. Tree cover within the thicket is minimal but some scattered white spruce and willow (*Salix sp*.) are present. Speckled alder (*Alnus incana*) provides the extensive shrub coverage that characterizes this habitat type although other species such as choke cherry

(*Prunus virginiana*) and red raspberry are also common. Sensitive fern (*Onoclea sensibilis*), rough-leaf goldenrod, and interrupted fern (*Osmunda claytoniana*) are the most dominant herbs. The forbs swamp aster (*Aster puniceus*) and dwarf red raspberry (*Rubus pubescens*) as well as graminoids, particularly fowl manna-grass (*Glyceria striata*) and bristly-stalk sedge (*Carex leptalea*) are also common.

Pockets of freshwater marsh are dominated by herbaceous vegetation. The graminoids broad-leaf cattail (*Typha latifolia*) and fringed sedge (*Carex gynandra*) are particularly extensive although other species such as stalk-grain sedge (*Carex stipata*) and fowl manna-grass are also common. Forb cover is prominent in areas and primarily provided by spotted joe-pye weed (*Eupatorium maculatum*), and the exotic species creeping butter-cup (*Ranunculus repens*) and purple loosestrife (*Lythrum salicaria*). The marshes do not support any trees but speckled alder does provide some shrub cover along the margins.

Tall shrub swamp habitat is characterized by a dense coverage of speckled alder. A number of other woody species contribute to the shrub layer within this habitat type however, as well as provide some low and intermittent tree coverage including willow, balsam fir, red maple, American larch (*Larix laricina*), and white spruce. Herbaceous vegetation is dominated by the forbs sensitive fern and spotted jewel-weed (*Impatiens capensis*), whereas the graminoids fringed sedge and fowl manna-grass are also common.

A small deciduous treed swamp is dominated by red maple, although balsam fir is also prevalent and traces of sugar maple and heart-leaved paper birch (*Betula cordifolia*) are also present. Some shrub coverage is also provided by red maple. A prominent herbaceous layer is comprised of graminoids and forbs, particularly fringed sedge, bristly-stalk sedge, cinnamon fern, and the exotics creeping butter-cup and colt's foot (*Tussilago farfara*). Other common herbs include fowl manna-grass, rough-leaf goldenrod, parasol white-top (*Aster umbellatus*), American water-pennywort (*Hydrocotyle americana*), and interrupted fern.

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 the Nova Scotia Department of Natural Resources (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 Data 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 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.

A total of 171 red or Yellow-listed vascular plant species have been recorded within 100 km of the Project area. Based on the results of the habitat model, 36 red or Yellow-listed vascular plant species were considered to be potentially present within the Project area, including seven Red-listed and 29 Yellow-listed species. No federally or provincially listed "species at risk" were identified as being potentially present within the Project area. Table F-1 in Appendix F lists these species and their habitat preferences. The results of the model suggest 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.

All species of vascular plant encountered during the surveys were identified and their population statuses in Nova Scotia 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 the provincial *Endangered Species A*ct (NSDNR 2007c). Whereas no "at risk" species, as identified by COSEWIC or the provincial *Endangered Species Act* were found during the surveys, one species was Red listed by NSDNR (2007a) and is given a ranking of S1S2 by the ACCDC (2009) indicating that it is of conservation concern. A list of the 255 vascular plant taxa found on the site during field surveys is provided in Appendix F.

Bebb's sedge (*Carex bebbii*) was encountered along the edge of a freshwater basin marsh (Wetland 2) in the north central part of the property. This species is Red listed by NSDNR indicating that it is considered to be at risk or potentially at risk within the province (NSDNR 2007a). Similarly, the ACCDC has assigned a ranking of S1S2 to this species indicating that it is extremely rare to rare within the province and may be especially vulnerable to extirpation (ACCDC 2009). Bebb's sedge flowers from June to August and is generally found within wet places with calcareous or neutral soils including open wetlands, gravelly lakeshores, stream banks, swales, meadows, and forest seeps (Zinck 1998; Hinds 2000; and FNA 2003). In Nova Scotia it is previously known from Hants County, Antigonish County, and central Cape Breton (Zinck 1998).The population of Bebb's sedge that was encountered on the property included three clumps, each with approximately five fertile stems. These were found growing in a relatively open area of the marsh where competition from other herbaceous species was low, and were in close association to pointed broom sedge (*Carex scoparia*), to which Bebb's sedge superficially resembles. Efforts to find additional occurrences of Bebb's sedge on the property (following its initial identification) were unsuccessful.

Although the populations of broad-leaved twayblade (*Listera convallarioides*) and tall hairy groovebur (*Agrimonia gryposepala*) are considered secure by NSDNR (2007a), the ACCDC provides a ranking of S3 to these species indicating that they are uncommon within the province. As such, they may be considered to be of conservation concern.

Broad-leaved twayblade is a small orchid that is typically associated with rich deciduous slopes, climax forests, and streamsides (Zinck 1998). Within the Project area, a population of approximately100 individuals was found scattered alongside the bank of watercourse #2.

Tall hairy groovebur is a tall perennial herb that is typically associated with thickets, the margins of rich woods, intervals, and slopes (Zinck 1998). Patches of this species were found scattered throughout such habitats within the Project area.

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

Project activities have the potential to influence plant populations through direct habitat loss or indirectly through changes in habitat conditions, such as may be brought about by altered hydrological regimes. Although the property provides habitat for several rare or uncommon plants, the population of Bebb's sedge, which is considered at risk within the province by NSDNR (2007a), is of highest conservation concern. However, this species is restricted to a wetland in the north-central part of the property and quarrying and quarry related activities will not be conducted within 30 m of this wetland. However, due to the limited number of occurrences of Bebb's sedge on the property, its population may be vulnerable to natural changes in its habitat, as could be brought about by variation in annual water availability or successional processes. It is not expected that any immediate or future activities relating to the Project will cause a significant adverse effect on the populations of broad-leaved twayblade or tall hairy groovebur, and as such, no specific mitigative measures are recommended for these species.

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 wetland and forest plant communities should be used. Specific mitigation for Bebb's sedge will be developed in consultation with NSDNR prior to any disturbance of Wetland 2. Quarry reclamation will contribute to the re-establishment of vegetative habitats over time.

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 reviews of existing data. Field surveys were conducted by Stantec ecologists on two occasions, June 8 and August 4-6, 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) and Amphibians and Reptiles of Nova Scotia (Gilhen 1984), were also consulted to provide records of wildlife in the vicinity of the Project area and to help direct field surveys.

The property has moderate wildlife habitat diversity. Mixedwood and deciduous forest stands of varying character dominate the property, but a tall shrub thicket, four wetlands, and a number of early-successional upland community types, including abandoned fields and areas regenerating from tree harvesting activities, are also present. Forest cover within the eastern half of the property is highly fragmented by old roads and clearings provided by abandoned pastures and past logging activities. In contrast, forests within the western half of the property are relatively intact. The wetlands of the property include both marshes and swamps. These wetlands are small in size and contain little or no surface water during most times of the year. Additionally, two small streams run through the property.

Birds

The Maritimes Breeding Bird Atlas (MBBA) database (Erskine 1992, MBBA 2009) provides information on the distribution and abundance of birds across the Maritime Provinces of Canada. The MBBA may be used to provide an indication as to which species may be expected in the Project area. However, this reference is of limited usefulness because that data is recorded in 10 km X 10 km census squares, making it difficult to determine whether a particular species has been observed in close proximity to the Project area. As such, information on the distribution and abundance of birds in the vicinity of the Project area was supplemented with a breeding bird survey.

The MBBA square in which the Project is located was used to determine the approximate number of breeding birds that may be found within the vicinity of the Project area. 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.

Prior to conducting the field bird survey, recent air photography of the Project area was reviewed to determine what habitat types were present. The route walked during the field

survey was selected to maximize the number of habitat types visited. The field survey was conducted on June 8, 2009. The survey began at approximately 5:00 AM and was completed by 11:30 AM. The birder conducting the survey has approximately 20 years experience conducting breeding bird surveys and is proficient at identifying birds visually and by their vocalizations. Additional observations were made during wetland and vegetation surveys in August of 2009. Birds recorded during the surveys were not limited to breeding birds only; all bird observations were recorded to increase the knowledge base of avian species inhabiting or transiting the Project area. The breeding status of each species was determined with the criteria used in the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). During the surveys, most birds were identified by listening to their song.

The population status of each encountered species was determined from existing literature. Lists of provincially rare or sensitive birds were derived from the General Status of Wildlife in Nova Scotia (NSDNR 2007a), Species at Risk in Nova Scotia (NSDNR 2005), and the ACCDC database (ACCDC 2009). The statuses of nationally rare species were obtained from COSEWIC (2006).

A total of 70 bird species have been recorded in the atlas square for the Project area, 36 of which were identified during the site visits. In addition two species were identified during the field surveys which had not been recorded in the MBBA atlas square: brown creeper (*Certhia americana*) and Lincoln's Sparrow (*Melospiza lincolnii*). Of the species encountered during the field surveys, the breeding status of one was confirmed, seven identified as probable, and 24 classified as possible. An additional six species were observed on site which exhibited no indication of breeding. Appendix H lists all bird species identified within the breeding bird atlas square and the field surveys.

Of the species encountered during the field surveys, boreal chickadee (*Poecile hudsonica*) may be considered of greatest conservation concern. Boreal chickadee is given a ranking of “Yellow” by NSDNR indicating that its population status is considered sensitive to human activities or natural events. The ACCDC classifies boreal chickadee as “S4” indicating that its population is generally widespread and common throughout the province. Boreal chickadees may inhabit mixed forests but their preference is for solid coniferous stands which provide suitable tree cavities for nesting. They are abundant throughout the Boreal forest of North America and Nova Scotia approaches the southern end of their range distribution. Due to their preference for boreal forest conditions, the Yellow status assigned to this species by NSDNR is expected to represent their potential sensitivity to climate change predictions within the province rather than more localized human influences. A single boreal chickadee was observed during the August survey where it was part of a mixed fleeding flock, comprised of black-capped chickadees (*Parus atricapillus*) and other taxa. Due to not being encountered during the breeding bird survey conducted in June, the nature of the observation in August, and the lack of abundant conifer-dominated forest stands within the Project area, it is unlikely that the property provides important habitat for this species. As such, the individual observed is more likely to be an infrequent visitor to the property rather than a resident breeder.

The MBBA atlas square identified olive-sided flycatcher (*Contopus cooperi*) as being a potential breeder within the area. This species is Yellow listed by NSDNR and is given ranking of S4B by the ACCDC. Within Nova Scotia, olive-sided flycatcher is typically associated with early post-fire landscapes, coniferous forest edges, or clearings provided by meadows, rivers, bogs, swamps, or ponds. Clearings provided by abandoned pastures and patches or early successional forest within the property do provide some potentially suitable habitat for this species. However, because these habitats were visited during the breeding bird survey and no observations of olive-sided flycatcher were made, this species is not expected to reside on the property.

The ACCDC modeling exercise identified a total of 16 red or Yellow-listed avian species that been recorded within 100 km of the Project site. However, only one Yellow-listed species, Northern Goshawk (*Accipiter gentilis*) was considered to be potentially present in the Project area. This species prefers to nest in mature mixedwood or hardwood stands generally away from areas heavily used by humans. The mixedwood and hardwood stands located in the central and western portions of the property would have the highest potential to provide nesting habitat for this species. However, northern goshawks are unlikely to occupy the Project area due to not being encountered during field surveys (their conspicuous nature makes them hard to miss).

Mammals

Information regarding the presence of rare mammals and sensitive mammal habitat within the Project area was derived from field surveys and a review of the Nova Scotia significant habitat mapping data base (NSDNR 2007b). Field surveys were conducted concurrently with vegetation and breeding bird surveys in June and 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 woodland habitats. Evidence of the following species were recorded during the field surveys: American red squirrel (*Tamiasciursus hudsonicus*), white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans)*, star-nosed mole (*Condylura cristata*), eastern chipmunk (*Tamias striatus)*, snowshoe hare (*Lepus americanus*), and Cape Breton moose (*Alces alces pop. 1*). None of these species are Red or Yellow listed, or considered “at risk” by provincial or federal sources.

A total of five Red or Yellow-listed mammal species have been recorded within 100 km of the Project area. Of these, two Red-listed were species identified during the modeling exercise as potentially being present in the Project area. These include lynx (*Lynx canadensis*) and American Marten (*Martes americana*), both of which are listed as endangered under the Nova Scotia *Endangered Species Act*. In addition, one Yellow-listed species, fisher, was identified as being potentially present.The lynx is now restricted to the Cape Breton Highlands and to areas of higher elevation in central and eastern Cape Breton. Lynx numbers are typically highly correlated with snowshoe hare (*Lepus americanus*) numbers because snowshoe hares are their

principle prey item. In boreal areas snowshoe hare populations typically undergo ten year cycles in which the population increases then crashes. The Project area is located on the edge of the normal distribution of lynx in Cape Breton. Although the property is unlikely to be frequented by this species, lynx may wander into the Project area in search of food, especially during the years following a crash of the snowshoe hare population..

The Project area is located approximately 20 km southwest of the known range of the nearest population of American Marten in southwest Victoria County. 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 American marten range. The Project area does not provide preferred American marten habitat due to the lack of mature softwood forest cover and limited amount of mature mixedwood forest cover as well the rather fragmented nature of the surrounding habitat and the close proximity of humans. Nevertheless, given the fairly close proximity to known American marten core habitat there is some potential for this species to occasionally wander into the Project area. Although previously extirpated from Nova Scotia as a result of over trapping and habitat loss, a small population of fishers has become established through reintroduction efforts. The closest known fisher record is approximately 33 km away from the Project area. Fishers prefer large tracts of mature coniferous or mixedwood forest. Although they will also make use of second growth forests they generally avoid areas of human habitation and early successional forests. Fishers have large home ranges and typically travel along regular hunting circuits which may be up to 16 km in diameter. Although no evidence of fishers was encountered during the field surveys, their large ranges would inhibit considerable amounts of spoor in any particular area, and evidence of this species could therefore be easily missed. Although the fragmented and immature nature the Project area's forests are not ideal fisher habitat, the property does have some potential to provide habitat for this species. However, given the large home ranges of fishers, loss of suitable habitat as a result of Project activities is unlikely to cause an important adverse effect on this species.

A review of the NSDNR significant habitat mapping database (NSDNR 2005) did not reveal the presence of any rare or sensitive mammal species in the immediate vicinity of the Project area or critical habitat such as deer wintering areas. All of the habitats present in 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 vegetation and bird surveys during June and August of 2009.

Four herpetile species were encountered during the surveys. Taxa encountered include green frog (*Rana clamitans*), redback salamander (*Plethodon cinereus*), wood frog (*Rana sylvatica*),

and yellow-spotted salamander (*Ambystoma maculatum*). Most herpetile observations were made within the wetlands of the property.

A review of the ACCDC data search and *Amphibians and Reptiles of Nova Scotia* (Gilhen 1984) indicate that one rare herpetile, wood turtle (*Glyptemys insculpta*), has been recorded within the vicinity of the Project area. Wood turtles are considered threatened by COSEWIC, are listed as 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. They have been reported within 2 km of 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. Although two watercourses are present on the property, they are unlikely to support wood turtles. The lack of sandy banks along the watercourses limits nesting opportunities for this species and the shallow water depths are not suitable for hibernaculum sites. However, wood turtles may be found to nest in gravel pits at considerable distances (~ 500 m) from watercourses. Whereas two tributaries of the Indian River exist on the property and the existing quarry is within several hundred meters of at least two Skye River tributaries, there is some potential for this species to access the quarry pits for nesting purposes.

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

Most migratory bird species in Canada are protected by 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 that are not considered pests, such as raptors, are protected under the provincial *Wildlife Act*. In addition, all mammal species not designated as game animals or other harvestable wildlife is protected at all times of the year under the provincial *Wildlife Act*.

The *MBCA* is often relevant for quarry and other land developments because it prohibits destruction of migratory bird nests and young during breeding periods. 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 it is not practical to clear outside this time period, a breeding bird survey should be undertaken by a qualified biologist to ensure the identification of active nests which can then be buffered until the young have fledged.

Of the wildlife identified within the Project area, boreal chickadee may be considered of highest conservation concern. However, the property does not provide ideal habitat conditions for boreal chickadee and the individual observed is more likely to be an infrequent visitor to the property rather than a resident breeder. Furthermore, although the population of this boreal species within the province may be sensitive to human activities, climate change rather than more site-specific factors associated with Project activities is likely to be its major anthropogenic stressor.

As such, the Project is not expected to cause a significant adverse effect to the population of boreal chickadee and no species-specific mitigative measures are recommended.

The field survey did not reveal the presence of any rare mammal or herpetile species in the Project area. Although a number of species of conservation concern have been recorded in the vicinity of the property, it is unlikely that they inhabit the property. However, due to the proximity of the Project area to watercourses, there is some potential for wood turtles to utilize the quarry pits for nesting purposes. If turtles are found within the Project area, a contingency plan will be developed to mitigate the effects of the Project on this species. 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 in the Project area.

In summary, assuming recommended mitigative measures are applied (*e.g.,* compliance with *MBCA*) significant Project-related effects on wildlife are not likely to occur. Quarry reclamation will contribute to the re-establishment of wildlife habitats over time.

5.5 WETLANDS

5.5.1 Description of Existing Conditions

Four wetlands are present on the property (Figure 2). These wetlands consist of a forb basin marsh, a complex of graminoid basin marsh and tall shrub swamp, a tall shrub flat swamp, and a deciduous treed basin swamp. Descriptions for each wetland are presented in the following sections and the type of plants recorded in each wetland can be found in Appendix I.

Wetland 1

Wetland 1 is a very small (0.015 ha) forb basin marsh, located within the eastern half of the property. This small wetland is anthropogenic in origin, as evidenced by mounded substrate along its periphery. It is primarily surrounded by immature mixed forest but also by abandoned pastureland to its north. The wetland is situated in a topographically defined basin that collects surface water runoff and receives groundwater seepage. It does not have any inflow or outflow channels.

The marsh is dominated by herbaceous vegetation. In particular, spotted Joe-pye weed (*Eupatorium maculatum*) is dominant throughout the extent of the wetland. Underneath its extensive coverage, the exotic forb creeping butter-cup (*Ranunculus repens*) is prominent throughout the marsh. Ostrich fern (*Matteuccia struthiopteris*) is also prevalent within the wetland, especially towards its edge. A number of other herbs are also common including: sensitive fern (*Onoclea sensibilis*); hedge bindweed (*Calystegia sepium*); broad-leaf cattail; brittle-stem hempnettle (*Galeopsis tetrahit*); and mad dog skullcap (*Scutellaria lateriflora*). Woody vegetation is absent from the marsh, except for some low coverage provided by common elderberry (*Sambucus canadensis*) along its edge.

A vegetation survey was conducted in the wetland that revealed the presence of 32 species of vascular plants. None of these species are considered rare, at risk, or sensitive within the province or at the national level (COSEWIC 2009, NSDNR 2007a; and NSDNR 2007c). One species, tall hairy groovebur, is given a ranking of "S3?" by the ACCDC (2009) indicating that it may be considered uncommon within the province. This species was observed in moderate abundance along the northern edge of the wetland and the adjacent upland habitat.

Overall, the wetland has low value as wildlife habitat. Its small size and lack of open water prevent it from being an important source of food or habitation for waterfowl or mammals. However, the wetland does provide some herpetile, and two amphibians were identified within its boundaries: wood frog and redback salamander. Neither of these species are considered to be rare or sensitive nationally or provincially (COSEWIC 2009, NSDNR 2007a; and NSDNR 2007c).

The wetland is located in a small basin formed by a gentle slope on its northern side and a steeper gradient to its south. It is inundated seasonal and during high precipitation events by surface water runoff and groundwater seepage. The wetland does not have any surface inflow or outflow channels. The marsh would provide some hydrological function related to storm water retention, but its small size limits its importance for doing so.

The wetland has little socio-economic value. There is no evidence to indicate that it is currently used for recreational, agricultural, cultural, or business purposes. However, as evidenced by the mounding of substrate along its western edge, the wetland is anthropogenic in nature (at least in part) and may have been initially created to provide agricultural services, such as a watering hole for livestock. The wetland is not part of any protected area such as a national or provincial park, national wildlife area, federal migratory bird sanctuary, ecological reserve, provincial wildlife management area, wildlife refuge, or game sanctuary.

Wetland 2

Wetland 2 is a small (0.086 ha) complex of graminoid basin marsh and tall shrub swamp. This wetland is anthropogenic, at least in part, as evidenced by a constructed ridge at its southern and eastern edges. The wetland is surrounded by open immature mixed forest and is primarily fed by a small stream (Watercourse 1) at its northern end.

The northern and western ends of the wetland are comprised of tall shrub swamp. This habitat type is characterized by a dense growth of speckled alder, although shrub coverage is also provided by red maple and willow. A number of herbaceous plants are prominent beneath the shrub coverage, including parasol white-top , fowl manna-grass, sensitive fern, and spotted jewel-weed.

The marsh component of the wetland is dominated by herbaceous vegetation, particularly graminoids. Broad-leaf cattail is the most dominant species within this habitat type, although fowl manna-grass, fringed sedge, and stalk-grain sedge (*Carex stipata*) are also major components of the vegetative community. Although a number of forbs are found within the

marsh, the exotic species purple loosestrife (*Lythrum salicaria*) is the most abundant, being particularly prominent in the marsh's northern end.

A vegetation survey was conducted in the wetland that revealed the presence of 63 species of vascular plants. Considering the small size of the wetland, it may be characterized as having high species richness. One of the taxa found in the wetland, Bebb's sedge, is Red listed by NSDNR indicating that it is considered to be at risk or potentially at risk within the province (NSDNR 20079a). Similarly, the ACCDC has assigned this species a ranking of S1S2 indicating that it is extremely rare to rare within the province and may be especially vulnerable to extirpation (ACCDC 2009). The population of Bebb's sedge within the wetland was located at the southern end of the wetland in a relatively open area of the marsh where competition from other herbaceous species was low. Three clumps of Bebb's sedge, each with approximately five fertile stems were observed within the wetland and represent the only known occurrences of this species on the property. No other plant species within the wetland are considered at risk, sensitive, rare, or uncommon within the province or at the national level (ACCDC 2009; COSEWIC 2009, NSDNR 2007a; and NSDNR 2007c).

A wildlife survey conducted in the wetland identified three bird species and an amphibian. Birds identified within the wetland boundary or along its edges include cedar waxwing (*Bombycilla cedrorum*), red-eyed vireo (*Vireo olivaceus*), and ruby-throated hummingbird (*Archilochus colubris*). Green frog was the lone amphibian observed within the wetland. Neither of these species are considered rare or sensitive at either the national or provincial levels (COSEWIC 2009, NSDNR 2007a; and NSDNR 2007c). Although water levels within the wetland would fluctuate considerably during the course of a year, the wetland appears to retain some surface water at all times, and in doing so would provide important herpetile habitat. The small size of the wetland prevents it from providing habitat for waterfowl.

The wetland is located in a small basin formed by a gentle slope on its northern and eastern ends and by a mounded ridge along its eastern and southern edges. The wetland is primarily fed by a small stream (Watercourse 1) at its northern end but would receive additional surface water runoff and seepage from the surrounding upland areas. Water levels within the wetland, particularly the marsh component, would fluctuate considerably with the season and the occurrence of precipitation events. During high precipitation events, such as storms, the wetland would moderate water flow by acting as a reservoir for flood waters. The marsh may also act to improve water quality by acting as a reservoir for particulate matter carried in surficial runoff from Watercourse 1, which flows across a gravel road before entering the wetland. This watercourse is a tributary to Indian River which is known to provide significant fish habitat to salmon and brook trout. Because primary production from emergent macrophytes is expected to be high, the wetland is also likely an important sink for nutrients which have been washed from the surrounding topography.

The wetland has little socio-economic value. There is no evidence to indicate that it is currently used for recreational, agricultural, cultural, or business purposes. The wetland is, at least in part, anthropogenic in nature, as evidenced by the nature of the banks which form its southern and

eastern edges. The historic creation or enhancement of the wetland may have been performed for agricultural purposes, such as the provision of a watering hole for livestock. The wetland is not part of any protected area such as a national or provincial park, national wildlife area, federal migratory bird sanctuary, ecological reserve, provincial wildlife management area, wildlife refuge, or game sanctuary.

Wetland 3

Wetland 3 is a small (0.205 ha) tall shrub flat swamp surrounded by immature mixed forest. The swamp is located within a poorly defined basin and receives water inputs from surface runoff and groundwater seepages. There are no streams which feed the wetland and it does not have a surface-level outflow. The character of the wetland has been influenced by anthropogenic activities, such as tree harvesting, as evidenced by the presence of cut stumps, garbage, and old skidder tracks within its boundaries and along its edges.

The swamp is currently characterized by a dense shrub cover, predominantly provided by speckled alder although scattered occurrences of willow are also present. Cut stumps within the wetland indicate that it was previously a treed swamp and is currently in a regenerative state following logging activity. Although low, some intermittent tree cover is currently provided by balsam fir, red maple, American larch, and white spruce. A well-developed herbaceous layer is provided by a variety of forbs and graminoids, most notably sensitive fern, spotted jewel-weed, fringed sedge, fowl manna-grass, and rough-leaf goldenrod. Several areas which are relatively free of woody vegetation and dominated by herbaceous vegetation, particularly spotted Joe-pye weed are found throughout the swamp.

A vegetation survey was conducted in the wetland that revealed the presence of 71 species of vascular plants. None of these species are considered rare, at risk, or sensitive within the province or at the national level (COSEWIC 2009, NSDNR 2007a; and NSDNR 2007c). One species, tall hairy groovebur, is given a ranking of “S3?” by the ACCDC (2009) indicating that it may be considered uncommon within the province. This species was observed scattered about the wetland and was of low abundance.

A wildlife survey conducted in the wetland revealed the presence of one species of bird and one amphibian. Blue-headed vireo (*Vireo solitarius*) was the lone bird observed in the wetland whereas herpetile observations were limited to green frogs. The wetland would not provide suitable waterfowl habitat and although well vegetated, it does not contain an abundance of any plant species that are known to be an especially important food source for wildlife.

The swamp receives water inputs from the surrounding upland habitats via surface water drainage and groundwater seepage. Although the wetland does not receive water from any well-defined inflow channels, some of the water from the surrounding terrain is directed to the wetland along old skidder tracks. No surface water was observed during the August survey, but patches of exposed substrate were scattered throughout the wetland, indicating that it is periodically inundated, such as after high precipitation events or snow melt periods. During such

times, the wetland would act to store flood water and in doing so, may also contribute to water quality through a combination of physical processes and interaction with vegetation. However, the small size of the wetland limits its importance for providing these hydrological and biogeochemical functions within the watershed.

The wetland has little socio-economic value. There is no evidence to indicate that it is currently being used for recreational, agricultural, cultural, or business purposes. However, the wetland has supported some tree harvesting activities, as evidenced by cut stumps and skidder tracks. The wetland is not part of any protected area such as a national or provincial park, national wildlife area, federal migratory bird sanctuary, ecological reserve, provincial wildlife management area, wildlife refuge, or game sanctuary.

Wetland 4

Wetland 4 is a small (0.062 ha) deciduous treed basin swamp surrounded by immature mixed forest. The wetland is situated in a topographically defined basin that collects surface water runoff and receives groundwater seepage. It does not have any surface inflow or outflow channels. Some tree harvesting activities have taken place within the wetland.

The swamp has a moderate tree cover which is primarily provided by red maple and to a lesser extent, balsam fir. Other trees are also present, including sugar maple and heart-leaved paper birch. An intermittent shrub cover is provided by red maple. Herbaceous cover is extensive throughout the wetland, and provided by a diversity of graminoids and forbs. Of particular prominence are fringed sedge, bristly-stalk sedge (*Carex leptalea*), cinnamon fern, and the exotic species creeping butter-cup and colt's foot (*Tussilago farfara*). A number of other species are also common however, including fowl manna-grass, rough-leaf goldenrod, parasol white-top, American water-pennywort (*Hydrocotyle americana*) and interrupted fern.

A vegetation survey conducted in the wetland revealed the presence of 61 species of vascular plants. None of these species are considered at risk, sensitive, rare, or uncommon within the nationally or provincially (ACCDC 2009; COSEWIC 2009; NSDNR 2007a; and NSDNR 2007c).

A wildlife survey conducted in the wetland revealed the presence of two species of bird and one amphibian. Blue-headed vireo and cedar waxwing were the birds observed in the wetland whereas herpetile observations were limited to a wood frog. The wetland would not provide suitable waterfowl habitat and although well vegetated, it does not contain an abundance of any plant species that are known to be an especially important food source for wildlife.

The swamp receives water inputs from the surrounding upland habitats via surface water drainage and groundwater seepage. No well-defined inflow or outflow surface channels are present, but an intermittent outflow channel was observed at the wetland’s southeastern end. No surface water was observed during the August survey, but some small patches of exposed substrate were scattered throughout the wetland, which indicate that it is partly inundated at certain times of the year. Following high precipitation events or snow melt periods, the wetland may provide some function in relation to flood water storage. In doing so, it may also contribute

to water quality through a combination of physical processes and interaction with vegetation. However, the small size of the wetland limits its importance for providing these hydrological and biogeochemical functions within the watershed.

The wetland has little socio-economic value. There is no evidence to indicate that it is currently being used for recreational, agricultural, cultural, or business purposes. However, the presence of cut stump s within the wetland indicates that it has supported some past economic activity. The wetland is not part of any protected area such as a national or provincial park, national wildlife area, federal migratory bird sanctuary, ecological reserve, provincial wildlife management area, wildlife refuge, or game sanctuary.

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

In Nova Scotia, wetlands are protected by the *Environment Act*. Both federal and provincial policy identify a hierarchical progression of alternatives to adversely affecting wetland functions; which include (a) avoidance of impacts;(b) minimization of unavoidable impacts, and (c) compensation for impacts that cannot be avoided. 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 as well as a wetland alteration application under the Activities Designation Regulation.

Quarrying and quarry related activities will not be conducted within 30 m of Wetland 2 so as to maintain its hydrological connectivity to Watercourse 1, its ability to provide habitat for rare flora (*Carex bebbii*), as well as other functions. In addition, in order to minimize indirect impacts to this wetland that may be caused by vehicular traffic on the property, a culvert will be installed for the portion of Watercourse 1 that feeds the wetland and which currently spills over a gravel road to its north.

Additional wetlands (1, 3, and 4) should be avoided by quarrying and quarry related activities, if possible, including buffer zones of 30 m minimum. Mitigative measures will be taken during Project activities to prevent indirect hydrologic effects and sedimentation. This will be accomplished through the use of flow retention structures and energy dissipation measures.It is unlikely that Wetlands 1, 3, or 4 will be approached by Project activities in the near future of the development of the quarry extension. However, due to the nature of quarry activities, avoidance of all wetlands may not be feasible over time. If avoidance of wetlands is not possible in the future, the Proponent will be obliged to minimize impacts to wetlands and to seek government approval to alter these habitats and to provide habitat compensation to ensure no net loss of the functions provided by these habitats. If NSE grants permission 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.

In summary, assuming the application of proposed mitigation measures, including avoidance and minimization of both direct and indirect influences by employing wetland buffers and maintaining existing site drainage conditions; as well as providing compensation for loss of

wetland functions where impacts are unavoidable, 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. 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.

Groundwater yield of dug or drilled water wells can vary greatly, depending on the hydraulic properties of overburden or bedrock aquifers through 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. The Alva quarry extension will not, however, be excavated below the water table.

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.

Blasting effects are very 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 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.

Physiography and Drainage

The estimated 47 ha Project area is somewhat rectangular in shape with its longest dimension extending from NE to SW. It is approximately 1300 m long (northeast/southwest direction) and 300 m wide (north-northwest/south-southeast direction) at its longest/widest points (Figure 1).

Topography in the area is controlled by the Skye River floodplain (average elevation 10 m), which deeply incises the approximately 300 m high pre-Cambrian-aged highlands to the northwest (Campbell's Mountain), southwest (Skye Mountain) and northeast (Whycocomagh Mountain) of the Project *(*Figure 1*).* The topography of the Project area generally slopes downward towards the east, southeast, south or southwest, depending on the location on the site. Elevations in the Project area range from approximately 50 m to 100 m above sea level.

The site is drained by two small streams that flow southward towards Indian River, a tributary of the Skye River which is located 440 m to the east of the Project site. The Sky River flows south to Whycocomagh Bay at St. Patrick's Channel. Several wetlands are also identified on the Project Site (Section 5.5).

Surficial Geology

The surficial geology in the Project area (Figure 3) 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 glaciofluvial kame and esker deposits and alluvial deposits. The available mapping also shows ground moraine as silty till plain surficial deposits within the Project area, to a lesser degree than the other units.

As shown in Figure 3, in the surficial deposits in the eastern portion of the Project Area and in the vicinity of the existing quarry operations, consist of glacial fluvial kame and esker deposits that were deposited along the flanks of the highlands. These deposits consist of poorly to well sorted gravel, sand and silt, deposited by streams of glacial melt water. Available mapping shows silty till plain deposits to the northwest of the glaciofluvial deposits. Silty till plain or ground moraine deposits consist of silty and compact till derived from local and distant sources. According to Stea, Conley and Brown, these tills were released from the base of ice sheets by melting or lodgment. Alluvial deposits cover a majority of the eastern portion of the Project area. These deposits consist of gravel, sand and mud deposited by streams and rivers after the retreat of the last glaciers, and may locally overly the kame and esker deposits and glacial till.

Bedrock Geology

The Project area is underlain by two, northwest to southeast trending, Pre-Cambrian aged bedrock units as shown on Figure 3 (White and Boehner, 2008) The Bras D'Or Gneiss – Skye Mountain Metamorphic Suite underlies a majority of the site and is described as biotite, biotite-cordierite, and sillimanite-bearing paragneiss, migmatitic paragneiss, marble, quartzite, amphibolites and minor tonalitic orthogneiss. A narrow band of calcsilicate rock of the George River Metamorphic-Blues Brook Formation transects the western area of the Project extension area and is described as mainly quartzite interbedded with minor carbonate rocks. These ancient meta-sedimentary bedrock units would be expected to be well consolidated, extremely hard and resistant to erosion, and would require blasting as part of any excavation operation.

Unconformable contacts with younger sedimentary bedrock of the Lower Carboniferous aged Horton Group (Creignish Formation) occurs along Highway 252, located 450 m to 500 m east of the Project boundary.

Map Features

- Building
- Spot Height (m)
- Road
- Road (Unpaved)
- Watercourse
- Existing Quarry Boundary
- Project Property (Revised)
- 800 Metre Project Property Buffer (Revised)
- Inverness County Pits & Quarries Database
- Building
- Wetland
- Waterbody

Bedrock Geology

Carboniferous

- CHSsh - Horton Group - Strathlorne Formation: grey to minor red shale with thin interbeds of oolitic limestone; grey, micaceous and quartz-rich sandstone is interbedded and may dominate in significant intervals of the formation
- CHCc - Horton Group - Creignish Formation: grey and greenish-grey, pebble to boulder conglomerate and sandstone; pale green, moderately sorted with abundant rock fragments; reddish-brown conglomerate, pebble sandstone and coarse sandstone

Late Neoproterozoic

- ZSMqd - Skye Mountain Quartz Diorite: medium- to coarse-grained, inequigranular diorite to quartz diorite
- ZSMgn - Bras D'Or Gneiss - Skye Mountain Metamorphic Suite: biotite, biotite-cordierite, and sillimanite-bearing paragneiss, migmatitic paragneiss, marble, quartzite, amphibolite and minor tonalitic orthogneiss

Neoproterozoic

- ZGRBst - George River Metamorphic Suite - Blues Brook Formation: mainly metasandstone and metasiltstone interbedded with minor slate, carbonate rocks, quartzite and rare basaltic lithic tuff
- ZGRBq - George River Metamorphic Suite - Blues Brook Formation: mainly quartzite interbedded with minor carbonate rocks
- Mineral Occurrences (Copper)

Data References:
- Base Data from Nova Scotia Geomatics Centre, Nova Scotia Topographic Database
- Wetlands from Nova Scotia Department of Natural Resources, Wetland Inventory Mapping
- Bedrock Geology: White, C.E. and Boehner, RC 2008: Bedrock geology map of the Whycocomagh area, NTS sheet 11F/14, Inverness County, NSDNR, Mineral Resources Branch, Open File map ME 2008-1, scale, 1:50,000

0 200 400 600
Metres

N

Surficial Geology - Pre Last Glaciation

Pre-Quaternary

- Bedrock - Various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till, shaped by glacial erosion
- Residuum - Fragmented rock consisting of angular blocks and finer interstitial debris; overlain by thin, discontinuous veneer of till

Surficial Geology - Last Glaciation

Quaternary - Wisconsinan

- Silty Till Plain (Ground Moraine) - Silty, compact, material derived from both local and distant sources
- Stony Till Plain (Ground Moraine) - Stony, sandy matrix, material derived from local bedrock sources
- Glaciofluvial Deposits (Kames and Eskers) - Gravel, sand and silt, diamicton layers, poorly to well bedded, horizontal to angular beds, faulting and collapse features common

Surficial Geology - Post Last Glaciation

Quaternary - Holocene

- Alluvial Deposits - Gravel, sand, mud; bedded, coarse at base, finer at top, stream channels generally gravelly sand, floodplains sand
- Colluvial Deposits - A complex mixture of glacial deposits, weathered and frost shattered rock and soils

Cu
Cu
Skye River
Indian River

DATE: 18/02/2010 PREPARED BY: G. Mesheau JW PROJECT NO.: 121510121	ALVA CONSTRUCTION LIMITED - WHYCOCOMAGH QUARRY **Geology**	FIGURE NO.: **Figure 3** Stantec

Hydrogeology/Groundwater

Based on topography (Figure 1), the regional groundwater flow patterns are expected to be southeast and east into the Skye River from highlands located to the northwest and southwest (Skye Mountain). 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. Apparent shallow groundwater flows in various directions across the Project site. Shallow groundwater in the eastern area of the site near the existing quarry operations would be expected to flow east towards the Skye River or one of its tributaries. The shallow groundwater flow from the majority of the proposed extended Project area is expected to be to the south-southeast towards streams and wetlands feeding the Indian River.

A review of available mapping information was conducted to determine the probable locations of water wells within 800 m of the Project area. Within the 800 m of the Project boundary, no buildings are shown to be located north of the Project area, two buildings are identified along the Whycocomagh-Port Hood Road, which is located south of and runs parallel to the Project area, and several buildings are identified along Reservation Road south of the Indian River (Figure 1). There are also several buildings east of the Project area along Highway 252 on the eastern side of the Skye River in the community of Churchview. As indicated, only two properties with possible water wells are identified between the Project boundary and major rivers that would be expected to act as groundwater flow barriers to subsurface effluents leaving the Project site.

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 1940 and 2009 to determine well construction information for groundwater wells within the Project vicinity. This search revealed information for wells drilled in the communities of Churchview and Whycocomagh; however there was no match between these wells and the addresses/properties within the 800 m Project area. Based on study team knowledge of the area, it was determined that two municipal water supply wells for the Waycobah First Nation are located at the edge of the 800 m of the project radius, as shown on Figure 2. Public water supply wells for the Whycocomagh Provincial Park are also identified, however these are located about 2 km farther to the southeast, and are well outside the assessment boundary.

Table 5.3, presents a summary of the available well log information for three drilled wells completed with steel well screens set across the water bearing sand and gravel hydrostratigraphic unit and two drilled bedrock wells located on the lands of the Waycobah First Nation. The approximate location of two of these wells (PW1 and PW2) is shown on Figure 2; a third test well (TW09-1) was recently installed within 100 m of PW2. Only one well (PW2) is currently in use as the main water supply well for the Waycobah First Nation community, having an operational yield in the order of 410 L/min (90 igpm). This well, along with two other shallow

screened wells on the site are completed in the overburden (sand and gravel) aquifer. The two drilled bedrock test wells were located along the east toe of Skye Mountain to assess bedrock water potential.

Table 5.3 Summary of Drilled Well Information for Waycobah First Nation, Whycocomagh, Nova Scotia

NSEL Well Record No.	Des-cription /Location	Hydro-stratigraphic Unit	Date Drilled	Well Depth (m)	Casing Length (m)	Dia-meter (mm)	Till Thick-ness (m)	Water Level (m)	Air Lift Yield (igpm)
960734	PW1 (Spring Well)	Sand and gravel	16-Aug-96	14.0	15.5	203	15.5	4.5	50
981908	PW2 (Main Well)	Sand and gravel	16-Sep-98	18.6	11.6	203	16.9	0.9	100
-	TW09-1 (near PW2)	Sand and Gravel	6-May-09	18.8	13.0	203	18.3	1.0	41
971590	TW97-1 (near PW1)	Phillite, Schist, Marble (George River fm)	19-Dec-97	60.1	13.1	152	7.0	3.8	2.4
971591	TW97-1 (Water Tank)	Phillite, Siltstone (George River fm)	23-Dec-97	30.5	11.6	152	11.3	na	<0.5

Notes: m – metres; mm – millimeters; igpm – imperial gallons per minute
Source: NS Well Logs Database (NSE 2009)

While the Waycobah wells are located at the edge of the 800 m assessment boundary of the Project area, the aquifer (interbedded fine to coarse sand and gravel) supplying water to these municipal supply wells is partially within the 800 m of the Project area. Undetected or mismanaged major fuel or chemical spills within the quarry could theoretically pose a potential risk to the Waycobah municipal water supply and other potable wells completed in the local sand and gravel aquifer. An evaluation of the potential hazards and potential contaminant transport pathway is presented in Section 5.6.2.

To provide a general description of aquifer properties in the vicinity of the Project area, a summary of domestic well records for the nearest communities of Churchview, Stewartdale and Whycocomagh, Nova Scotia is provided in Table 5.4. Although it cannot be confirmed whether any of these wells are located within 800 m of the Project, the conditions encountered within these wells are indicative of the likely conditions of the soil and bedrock aquifers located on the Project site and within these communities. Water supply wells in the communities of Churchview, Stewartdale and Whycocomagh are completed in three hydrostratigraphic units, including: overburden (sand and gravel), Horton Group (siltstone, shale, sandstone, conglomerate) and Windsor Group (gypsum, limestone, mudstone, siltstone, sandstone, conglomerate, shale). No domestic wells are identified for the George River formation which underlies the Project.

Table 5.4 Summary of Domestic Water Wells Records in Churchview, Stewartdale and Whycocomagh, NS

	Well Depth (m)	Casing Length (m)	Estimated Yield (igpm)	Water Depth (m)	Overburden Thickness (m)
Overburden Aquifer					
Minimum	5.8	5.8	3.0	0.9	5.8
Maximum	61.0	38.1	100.0	4.6	41.5
Average	25.2	17.8	22.2	2.9	22.4
Median	18.6	13.1	5.0	3.4	18.0
Number	11	11	9	3	11
Horton Group					
Minimum	11.6	6.1	3.0	5.5	1.2
Maximum	76.8	36.6	75.0	37.4	25.9
Average	32.3	15.1	13.5	14.0	11.6
Median	27.4	12.8	8.0	7.6	8.5
Number	15	15	15	8	11
Windsor Group					
Minimum	19.8	5.5	0.2	6.1	4.6
Maximum	68.6	50.3	50.0	17.4	27.4
Average	39.1	20.3	23.6	11.0	13.9
Median	30.5	14.0	20.0	11.4	9.1
Number	7	7	7	6	6
George River Group					
Minimum	30.5	11.6	0.1	-	7.0
Maximum	61.2	13.1	2.4	3.8	11.3
Average	76.5	12.4	<1	-	9.2
Median	76.5	-	-	-	9.2
Number	2	2	2	2	2

Note: Information was obtained from the NSE Well Log Database including wells constructed between 1940 and 2009.
Only three pumping tests were performed on wells completed into the George River formation bedrock aquifer (NSE Pumping test Inventory). Tests on 93 m to 106 m deep wells at Neil's harbor and James River indicate a characteristically low Transmissivity of 0.4 m^2/day, a low hydraulic conductivity of 5x 10^{-5} cm/s, and low sustainable yields of 7.7 to 15.5 L/min (1.7 to 3.4 igpm). This suggests a very tight bedrock with a low potential for contaminant transport at depth.

Water Quality

Water quality potential is determined from known water quality characteristics for each unit, including naturally occurring water quality concerns such as hardness, salt iron and manganese.

Wells drilled into the Horton Group sandstone aquifer can be generally expected to yield water of acceptable quality, with most parameters meeting the guidelines for Canadian Drinking water Quality, and a tendency towards hardness and alkalinity. Iron and manganese can occur where coal shales are present.

Wells completed into the calcareous shale of the Windsor Group typically provide a hard to very hard, calcium bicarbonate water type of moderate to high dissolved solids. Wells completed into the gypsum or halite members of the Windsor Group generally yield very hard calcium-sulfate or sodium chloride water with high TDS of unacceptable quality for potable use.

Little information is available for the George River Group. Two test wells in George River Group completed at Waycobah First Nation yielded low yields (< 10 L/min) of poor quality hard and alkaline water with elevated iron and manganese concentrations. Based on study team

experience within the area, generally saline groundwater is present in bedrock beneath the sand and gravel aquifer along Indian Brook and Skye River. Depending on lithology, this unit has been known to provide reasonably good quality groundwater.

Based on the study team's knowledge of previous pumping tests completed in the vicinity of the Waycobah First Nation the unconfined sand and gravel aquifer can be expected to yield a slightly hard (82 mg/L), slightly alkaline (alkalinity 78 mg/L, pH 7.8), mixture of calcium bicarbonate and sodium chloride water of moderate TDS (200 mg/L), with all parameters typically meeting Guidelines for Canadian Drinking Water Quality (Health Canada 2008). Depending on location and screen depth, some areas exhibit a strong sodium chloride water type believed to be associated with the underlying bedrock aquifer.

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 down gradient 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. 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, although this has not yet been required for current quarry operations.

The quantity of groundwater captured by this quarry is expected to be minimal due to the apparent very low hydraulic conductivity of the metasediments and meta volcanic bedrock. Furthermore, there are no plans to quarry below the bedrock groundwater table. Any water discharged from this quarry is expected to originate predominantly from direct precipitation. Discharge volumes would be expected to vary from low to negligible in the hot summer months when evapotranspiration exceeds precipitation, to substantial after major storm events (*e.g.,* a 100 mm rainfall could result in up to 40,000 m^3 of water in the total foot print).

Water Quality Effects

Changes in groundwater quality adjacent to the quarry may theoretically occur as a result of excavations in the recharge area of down gradient receptor wells. 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 water table dewatering is occurring). 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 Whycocomagh Quarry consists of Skye Mountain Metamorphic gneiss and the extension area consists of George River Metamorphic suite consists of mainly quartzite interbedded with minor carbonate rocks. In general, felsic gneisses and quartzite interbedded with carbonates are not known to be a significant acid drainage risk.

The presence of a copper mineral occurrence is noted in the vicinity of the Whycocomagh Quarry (White and Boehner, 2008). Although there is no known significant acid generation from the quarries in the area, sulfide mineralized zones can occur in the underlying bedrock. The Proponent will conduct acid producing potential testing of aggregate retrieved from the existing quarry area and within the extension area, to confirm the absence of sulfide mineralized zones and the absence of acid producting potential.

There is potential for quarry activities to affect the closest potential supply wells located along Whycocomagh-Port Hood Road immediately south of the Project Subsequent field truthing confirmed a drilled well at 5243 Whycocomagh Port Hood Road and a spring fed water supply at 5433 Whycocomagh Port Hood Road. However, due to the distance and location of these water supplies from the Project and considering there are no plans to quarry below the bedrock water table, impacts to the two water supplies identified along the Whycocomagh Port Hood Road is unlikely. However, the presence of these wells should be noted. There is a very low potential risk of spills originating within the quarry to be transported via deep bedrock groundwater to the wells in the community of Churchview located within the 800 m zone east of the Project area. The presence of the Skye River would act as a boundary between any spills on the quarry property and the water supply wells to the east. Therefore impacts to the groundwater supplies within the community of Churchview are not anticipated due to the natural attenuation primarily by dilution and dispersion and the presence of the Skye River as a water boundary.

It should be noted that there is a very low potential risk of a major chemical or fuel release within the quarry property, as re-fueling activities will not be conducted within the quarry area. Potential hazards are limited to the unlikely event of a chemical or fuel release such including a minor release such as a rupture of a hydraulic hose. In such an event, emergency response action measures would be undertaken immediately by the Proponent including containment and use of remediation aids such as placement of absorption booms and pads. In addition, a Spill Response Plan (see below), will be prepared by the Proponent. However, in the unlikely event of an undetected chemical or fuel release within the quarry area, and given the high level of concern with protection of the two screened wells located on the lands of the Waycobah First Nation, evaluation of the theoretical potential contaminant transport pathways is discussed further below.

In consideration of the unlikely event of an undetected major chemical or fuel spill release within the quarry, considering the low permeability of the underlying bedrock (*i.e.,* low ability to transmit water), the most likely contaminant transport pathway between this quarry and down gradient wells is via surface water runoff (Indian and Skye Rivers), and the potential recharge of shallow sand and gravel aquifers located along the banks of these rivers.

Shallow groundwater and surface water are interactive in Nova Scotia, and while the situation of an undetected major fuel or chemical release is not expected, the potential contaminant pathway through shallow groundwater and surface waters has been considered. Most domestic scale dug or screened wells completed into the surficial aquifers (*i.e.,* sand and gravel units) would be unlikely to induce significant infiltration of the surface water (due to low pumping rates). However, higher yielding major municipal supply wells or infiltration galleries located down-stream of the Project, such as the water supply well for the Waycobah First Nation, could theoretically induce surface water flow. Considering this, the individuals who draw water from the Waycobah First Nation water supply are identified as potential receptors, in the unlikely event of an undetected major fuel or chemical release.

Because of the high pumping rate of the Waycobah supply well (*i.e.,* 70 imperial gallons per minute) and because it obtains water from the sand and gravel aquifer that is down-gradient of the quarry, there is a potential pathway for any undetected future surface releases within the quarry to enter Indian Brook which could eventually affect the shallow sand and gravel aquifer that hosts the Waycobah First Nation water supply wells. However, there is a very low probability of such an event to occur due to a variety of factors including the lack of a credible large scale contaminant source in the quarry (*e.g.,* fuel or chemical storage) and separation distance to the wells (800 m). In order for such an unlikely event to occur, an undetected surface release would have to be transported via surficial flow in the overburden within the quarry site or within surface waters leaving the quarry site, to the Indian River, and then be transported down the Indian River and induced infiltration from the river back into the aquifer by sustained well pumping. Again, this potential would require significant stream impacts over extended periods of time, and sustained high pumping rates at the Waycobah wells. Potential to affect these wells through a quarry spill scenario is considered remote; however spill response planning is recommended below to reduce the risk even further.

Mitigation of Effects

Based on the separation distance between the quarry and the nearest water wells, and the presence of intervening surface water barriers (*e.g.,* Indian Brook and Skye River), 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. If the quality of Indian Brook is managed through best practices and monitoring, potential for groundwater-surface water interaction impacts on the downstream Waycobah First Nation wells is also highly unlikely. However, given the high level of concern with well protection and requirement to mitigate any residual risk, due to unlikely spills or releases, a Spill Response Plan will be prepared which would include: identification of potential hazards; prevention initiatives; and outline of an action plan for response and recovery measures to be put in place in the unlikely event of a spill within the quarry.

No water quantity effects due to level lowering are anticipated. Considering the presence of a drilled well and a spring fed water supply located along the Whycocomagh Port Hood Road and immediately south of the Project, some water level monitoring may be warranted to identify any long term water level changes down gradient of the Project. 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 at the two identified locations.

Significant water quality impacts on bedrock groundwater supplies are not anticipated due to distance, very low bedrock hydraulic conductivity, presence of intervening hydraulic barriers (exception of future wells along Port Hood-Whycocomagh Road), and 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 offsite 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 will replace or repair any water supply well found to be adversely affected by their quarry operation.

Monitoring

While highly unlikely, there is a small potential risk of Project-related effects on the sand and gravel outwash aquifer hosting the Waycobah First Nation water supply wells through possible groundwater-surface water interaction between Indian Brook and the sand and gravel aquifer. As such, there is an indirect potential risk to the potable groundwater resource for this area if Indian River is affected by Project runoff. Although this is considered a very low probability (and therefore low risk) surface water leaving the Project site before it reaches the Indian River should be routinely monitored for water quality.

As a precautionary measure, due to the presence of the Waycobah First Nation, water supply wells to the southwest, an on-site groundwater monitoring program is recommended to monitor groundwater quality leaving Project area, as a means to provide an early warning of any

chemical impacts in the unlikely event of a chemical or fuel release within the Project area. In addition, this would allow the proponent to determine the location of the water table on-site. The groundwater monitoring wells should be situated downgradient of the existing quarry in the eastern area of the site.

In addition to the schedule analysis required as per the NSDEL Pit and Quarry Guidelines, surface water should be routinely sampled for petroleum hydrocarbons, general chemistry and metals. Surface water samples should be collected from the site discharge control structure and sampled quarterly for the first two years to establish baseline conditions. After two years, sampling should be conducted annually (*i.e.,* in June).

The drilled well and spring source identified at 5243 Whycocomagh Port Hood Road and 5433 Whycocomagh Port Hood Road, respectively, should be inspected. A program of water level and water quality monitoring should be conducted at these locations in conjunction with proposed surface water monitoring. The proposed water level and water quantity monitoring should include a program of baseline water level and water quality monitoring is recommended to establish pre-expansion conditions.

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. Maps consulted included those by A.F. Church (1871) and Faribault (1884).

The Nova Scotia Museum's Archaeological Site Database shows no recorded pre-Contact archaeological sites within the study area but does have record of five sites along the shores of Whycocomagh Bay, approximately two kilometers south of the study area.

The potential for a site to contain First Nations archaeological resources is generally determined by the presence of resources that the Mi'kmaq people depended upon, such as food and water,

as well as proximity to watercourses that were large enough to be used as a transportation route or were used to access such a route (BlCg-1 to BlCg-5 (Maritime Archaeological Resource Inventory Form Database). Given the location of the study area the potential for it to contain pre-Contact archaeological resources should be considered moderate to high. The nearest watercourses are the Skye and Indian Rivers, located to the east and south of the site, and Wycocomagh Bay, which leads to the Bras D'or Lake system. There is often certain significance to geographical names and the names "Indian River" and "Indian Rear", just north of the study area, suggests the presence of the Mi'kmaq, at least during historic times. There is sufficient evidence, however, to suggest that Whycocmagh has been traditional ground for the Mi'kmaq for over 1000 years.

The historic settlement of the Whycocomagh area did not begin until the first quarter of the nineteenth century when John MacKinnon arrived to a 400 land grant in 1821. His arrival was part of an immigration boom for Cape Breton Island, the majority of who were farmers and fishermen from Scotland. By all accounts the settlement was a success but it remained very small (there were 854 residents in 2001). The settlement outside of the village was to be found along the road that led from Whycocomagh north past the study area and this is evident by the presence of both the MacLean Church (1856-1960) and associated cemetery in the southeast corner.

The Mi'kmaq maintained a strong presence in Whycocomagh throughout the nineteenth and twentieth centuries and the Whycocomagh #2 Reserve was established there in 1823. The 1871 census of the Mi'kmaq lists 100 names, including many prominent ones such as Denny, Googoo, Noel, and Sylliboy. Today the Whycocomagh Reserve is part of the Waycobah First Nation.

Based on the background research the First Nation historical archaeological potential for the Project area is considered moderate to high. The research showed that the majority of historic settlement likely took place along the existing road but the possibility exists for farming settlements off the road as well.

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 moderate to high potential for identifiable human use in the pre-Contact and 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. As such, development and operation of the proposed quarry may have adverse environmental effects on unknown heritage resources. It is recommended that an archaeologist conduct an archaeological impact assessment of the Project area including a pedestrian survey of the site.

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 and the Manager

Special Places at the Nova Scotia Museum. 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 an archaeological impact assessment be undertaken to identify unknown heritage resources and to ensure that significant Project-related effects on these resources are not likely to occur.

5.8 ATMOSPERHIC ENVIRONMENT

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

5.8.1 Description of Existing Conditions

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 Port Hawkesbury at the old Post Office. In 2005 and 2006 sulphur dioxide was the only contaminat measured. The annual average for 2005 (based on 10 months of data) was 2.8 ppm and the average for 2006 was also 2.8 ppm (Environment Canada 2008).

In June of 2009 the Government of Nova Scotia, in collaboration 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 Whycocomagh Quarry is located in a rural setting with little to no 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)*. These guidelines may have also been used as a reference by provincial or federal regulators. The air quality guidelines of tolerable, acceptable, and desirable, as defined under *CEPA*, will be used in the evaluation of significance. 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 in the same way as any sound, 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 dB_A.

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

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).

Boundaries

The spatial boundary for the assessment of the Atmospheric Environment is the approximate zone of influence affected by the quarrying activities. This zone lies within close proximity to the community of Whycocomagh, Nova Scotia and the Waycobah First Nation Reserve.

Temporal boundaries for the assessment of the Atmospheric Environment have been developed in consideration of those time periods during which Project air and sound emissions have the potential to degrade ambient air and sound quality. In general, emissions that could affect air and sound quality will be relatively short-term from such operations as blasting and crushing; however, emissions from such sources as vehicles and construction equipment will be fairly regular.

Other temporal considerations for atmospheric emissions include variations in meteorological conditions, which are related to the capacity for contaminant and sound transport. Sensitivity of receptors to certain atmospheric contaminants (*e.g.,* dust) may also vary by season (*i.e.,* more sensitive in warm weather with increased outdoor activities).

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 TSP 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 contributors are discussed in detail in the following paragraphs:

- 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 nuisance problems and can have an effect upon attainment of ambient 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. The potential drift distance of particles caused by wind is determined by the initial injection height of the particle, the terminal settling velocity of the particle, and the degree of atmospheric turbulence.
- Particulate emissions can occur whenever vehicles travel over both paved and unpaved surfaces. Particulate emissions from paved roads are caused by direct emissions from vehicles such as exhaust, brake wear and tire wear emissions and resuspension of loose material on the road surface. Resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface.
- 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. Monitoring of particulate emissions (dust) will be conducted at the request of NSE.

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.

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 19 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. 2008-065008), 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 extension of the Whycocomagh Quarry can be controlled with standard mitigation practices and therefore the Project is not likely to have a significant adverse effect on the Atmospheric Environment.

5.9 SOCIO-ECONOMIC ENVIRONMENT

5.9.1 Description of the Existing Environment

Population and Employment

The existing Whycocomagh Quarry is located in Stewartdale, Inverness County, Cape Breton Island, Nova Scotia. The quarry property is in the Whycocomagh district of the Municipality of the County of Inverness. The quarry and proposed extension area are situated in a rural setting. Approximately 18 residences are located within 800 m of the existing quarry site. All of these 18 residences are also located within 800 m of the proposed Project (i.e., quarry extension), as is one additional residence (Figure 1). The population in the general area (*i.e.,* Inverness County) is 19,036 (Statistics Canada 2006). The population in this area decreased by 4.5% between 2001 and 2006. The employment rate in the County is 50.8% and the unemployment rate is 15.0% (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 (18%); and business, finance and administration occupations (14%). Occupations unique to the primary industry are the County's fourth largest employment category (12%) (Statistics Canada 2006).

The closest town to the Project is Stewartdale, which is located in Census Subdivision B of Inverness. Between 2001 and 2006, the subdivision's population decreased 6.9% to 5,369 residents (Statistics Canada 2006). The employment rate in the region is 50.4% and the unemployment rate is 14.9%. Over half of the labour force consists of sales and service

occupations (21%); trades, transport and equipment operators and related occupations (20%); and occupations unique to the primary industry (17%).

The existing quarry currently employs a minimum of five people year-round. The number of employees increases to 10 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 customers. Hauling activity can vary according to market demand, but an average of 150 truck-loads of aggregates is transported from the quarry per day. The quarried material is typically used for local construction projects, such as road building and municipal, residential, and commercial developments.

Land Use

There are a number of current land uses within 800 m of the Project site including other pits and quarries, urban/residential areas, agricultural areas and plantations. These land uses are not expected to interfere with or be interfered by the extension of the Project. The parcel on which the proposed quarry extension will be situated is currently owned by the Proponent.

A cemetery and First Nations reserve (Waycobah First Nations) are also located near the Project site. The cemetery is located approximately 500 m southeast the existing quarry and the reserve is location approximately 750 m in the same direction. Archaeological and heritage resources, including First Nations resources, are addressed in Section 5.7.

The quarry property is not located within the boundaries of any of the Eastern District Planning Commission's (EDPC) designated Plan Areas for Inverness County and is therefore not subject to any municipal zoning requirements.

Mining

A review of the NSDNR Abandoned Mine Openings Database indicates that there are 15 mine shafts within a 10 km radius of the boundaries of the Project property. These shafts are located in the following areas:

- Four (4) shafts at Brigend Brook (Soapstone/Talc);
- Three (3) shafts at Iron Mine (Iron);
- One (1) shaft at Mullach Brook (Gold);
- One (1) shaft at Whycocomagh (Gold); and
- Six (6) shafts at Whycocomagh Mountain (Copper).

The four mine shafts at Brigend Brook are in close proximity to the Project property. The shafts have not been operational since the 1940s or earlier, and no evidence of the pits remains (MacDonald 1992). Accordingly, no interaction is predicted between these former mine shafts and the proposed quarry extension. The status of the other 11 shafts is not known. However,

they are all of sufficient distance from the Whycocomagh Quarry and extension property that they are not anticipated to interact in any way with the Project.

Agriculture

Although three tracts of agricultural land are located within 800 m of the Project property the Project is not located in a region where conflict with current and future agricultural practices is anticipated. In the community-based development plan for the municipality, agricultural development was not identified as an objective of the Whycocomagh district (Municipality of the County of Inverness 2003).

Forestry

Intensive forestry or silviculture operations have not been identified in the region within and surrounding the Project area.

Transportation

Whycocomagh Quarry is located approximately 750 m west of the intersection of Route 252 and MacDonald Drive. The Project property is bounded at its northeast extent by Campbell Mountain Road and at its southwest extent by Whycocomagh Port Hood Road.

Three unidentified roads (two of which are unpaved) cross the Project property. The existing quarry operation is accessed via a private road that branches off of the unidentified paved road. This private road will continue to provide access to the proposed quarry extension area.

The average number of trucks hauling aggregates from the extended quarry could be up to 150 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 nearest lakes to the Project that are included in the Provincial recreational fish stocking program are Bras d'Or Lake (the northern basin of the lake), Whycocomagh Bay (located approximately 3 km east of the Project property) and Lake Ainslie (located approximately 8 km north of the Project property).

Moose and antlerless deer hunting are permitted in the region surrounding the Project area. The Whycocomagh Quarry is situated in Moose Management Zone 4 and Deer Management Zone 6. Two distinct hunting seasons occur in Moose Management Zone 4, the first season in 2008 took place from the last Monday of September until the following Saturday, inclusive, and the second season began on the first Monday of October and ended on the following Saturday. Due to low deer density, no antlerless deer hunting stamps were available for Deer Management Zone 6 in 2008 (NSDNR 2008). The seasons for hunting deer during 2008 were as follows: the special youth season ran from October 17 to October 25; the general open season ran from October 31 to December 6; and the bow hunting season ran from September 27 to October 30 and December 8 to December 13. All of these deer hunting seasons excluded Sundays (NSDNR 2008).

Whycocomagh Provincial Park is located approximately 4 km from the Project property boundary.

Human Health

Human health related aspects and potential effects on environmental health include potential impacts on air quality. Air quality is addressed in Section 5.8.

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. The direct and indirect employment associated with current operation of Whycocomagh Quarry may be considered a beneficial to the regional economy. Employment levels at the quarry are not anticipated to change as a result of the Project. Project-related employment effects may therefore be considered neutral.

Extension of the Whycocomagh 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, in the case of public infrastructure such as highways, communities, public works agencies, and taxpayers, should result in financial benefits (NSDNR 2006).

Land Use

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

Transportation

The Project is not anticipated to result in a significant increase in truck traffic on public roads above that associated with the existing Whycocomagh 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. An active quarry is already operational on site which likely would deter animals 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 Alva to pursue their activities on the property.

Human Health

Human health related issues pertaining to air quality are discussed in Section 5.8. The Project is not expected to result in any significant impacts with respect to the safety of travelers, as it is not anticipated to meaningfully affect traffic on public roads. The health and safety of nearby residences is not expected to be affected by the Project.

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

5.10.1 Description of the Existing Environment

There are approximately ten other pits and/or quarries located in the immediate vicinity of the existing quarry site as indicated on provincial mapping (Figure 1). As 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 and operation will be conducted in accordance with terms and conditions of the existing Industrial Approval for Alva's 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 quarry extension area for the period of time prior to quarry reclamation and revegetation. There is one watercourse running through the centre of the Project property (WC 1) and another watercourse (WC 2) in the south west corner of the property. Four wetlands have been identified within the study area based on a desktop assessment of wetland mapping from NSDNR and field verification.

It is unlikely that watercourses and wetlands will be approached by Project activities in the near future of the development of the quarry extension. However, if avoidance of watercourses and wetlands is not possible in the future, approval to alter these habitats must be granted under the Nova Scotia Activities Designation Regulation and habitat compensation provided to ensure no net loss of these habitats.

Although highly unlikely, there is an indirect risk to the potable groundwater resource for the Waycobah First Nation water supply wells if Indian River is affected by Project runoff. A stormwater management plan, spill response plan and surface water monitoring plan will be submitted as part of the quarry development plan during the Industrial Approval application process to further reduce any residual concern in respect to this issue.

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.

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 40 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 NSEL 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.

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12.0 Appendices

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APPENDIX F Vascular Plants and Wildlife Identified in the Study Area during Modelling and in the Field
APPENDIX G Population Status and Location of Select Vascular Plants Recorded in Study Area
APPENDIX H Breeding and Population Status of Birds Recorded in the Project Area and the Breeding Bird Atlas Square
APPENDIX I Plants Recorded within Wetlands

APPENDIX A
REGISTRY OF JOINT STOCKS AND INDUSTRIAL APPROVAL

Print Close Window

PROFILE - ALVA CONSTRUCTION LIMITED - as of: 2009-10-29 10:55 AM

Company/Society Name:	ALVA CONSTRUCTION LIMITED
Registry ID:	2244933
Type:	N.S. Limited Company
Nature Of Business:	
Status:	Active
Jurisdiction:	Nova Scotia
Registered Office:	5600 LOCHABER ROAD ANTIGONISH NS Canada B2G 2L6
Mailing Address:	P.O. BOX 1193 ANTIGONISH NS CANADA B2G 2L6

PEOPLE

Name	Position	Civic Address	Mailing Address
A.G. MACDONALD	Director	15 HERITAGE DRIVE ANTIGONISH NS B2G 2T6	
ALLISTER N. MACDONALD	Director	12 NICHOLSON COURT ANTIGONISH NS B2G2V4	
ALLAN MACDONALD	Director	38 PONDEROSA DRIVE ANTIGONISH NS B2G 2R5	
ALLISTER	PRESIDENT		

MACDONALD			
A.G. MACDONALD	SECRETARY		
ALLAN MACDONALD	VICE-PRESIDENT		
A.G. MACDONALD	Recognized Agent	15 HERITAGE DRIVE ANTIGONISH NS B2G 2T6	PO BOX 1193 ANTIGONISH NS B2G 2L6

ACTIVITIES

Activity	Date
Annual Renewal	2009-01-12
Annual Renewal	2008-01-21
Special Resolution	2007-06-21
Special Resolution	2007-06-21
Filed Document	2007-06-21
Filed Document	2007-06-21
Annual Renewal	2007-01-29
Annual Renewal	2006-03-28
Special Resolution	2005-07-29
Annual Renewal	2005-02-22
Annual Renewal	2004-02-27
Annual Renewal	2003-01-20
Annual Statement Filed	2003-01-20
Annual Renewal	2002-01-24
Annual Renewal	2001-02-26
Annual Renewal	2000-02-08
Address Change	1999-02-26

Annual Statement Filed	1999-02-26
Annual Renewal	1999-01-25
Annual Renewal	1998-02-26
Annual Renewal	1997-03-20
Annual Statement Filed	1997-03-19
Filed Debenture	1996-11-07
Change of Directors	1996-02-09
Annual Report Filed	1996-02-09
Special Resolution	1996-01-30
Agent Filed	1993-02-23
Registered Office Change	1993-02-23
Incorporated	1993-02-22
Registered	1993-02-22

RELATED REGISTRATIONS

This Company ...	
COLIN R. MACDONALD CONSTRUCTION	Registered

NOVA SCOTIA
Environment
Environmental Monitoring and Compliance

Suite 12
218 MacSween Street
Port Hawkesbury, Nova Scotia
Canada B9A 2J9

902 625-0791 T
902 625-3722 F
www.gov.ns.ca

Our File Number: 92100-30-2008-065008

January 20, 2009

Mr. Allan MacDonald
Alva Construction Limited
5600 Lochaber Rd
PO Box 1193
Antigonish, NS
B2G 2L6

Dear Mr. MacDonald:

RE: Approval to Construct and Operate - Quarry
Approval No. 2008-065008
PID # 50107184

Enclosed please find Approval # 2008-065008 to operate the Quarry at Stewartdale, Inverness County, Nova Scotia.

Strict adherence to the attached terms and conditions is imperative in order to validate 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 David Fougere, Eastern Region, Port Hawkesbury Office at (902) 625-0791.

Yours truly

Dave Fougere
Inspector

cc

Eimas #: 2008-065008

NOVA SCOTIA
Environment

APPROVAL

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

APPROVAL HOLDER:	Alva Construction Limited
SITE PID:	50107184
APPROVAL NO:	2008-065008
EXPIRY DATE:	February 28, 2011

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:

Renewal and operation of a Quarry, and associated works, at or near Stewartdale, Inverness County in the Province of Nova Scotia.

Administrator Jacqueline Landry

Effective Date January 26, 2009

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Environment

Approval Holder:	Alva Construction Limited
Project:	Quarry
Site:	Stewartdale, Inverness County PID # 50107184
Approval No:	2008-065008
File No:	92100-30
Map Series:	11F14
Grid Reference:	E455900 N5094137

Reference Documents:

- Application dated October 14, 2008 and attachments.
- Expired Approval # 2000-016643 - Alva Conrtruction Limited
- Alva Construction Process Description, Campbells Mountain Road, Stewartdale, Inverness County, Nova Scotia.

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 Eastern Region, Port Hawkesbury Office, of Nova Scotia Environment located at the following address:

Nova Scotia Environment
Environmental Monitoring and Compliance Division
Eastern Region, Port Hawkesbury Office
218 MacSween Street, Suite 12
Port Hawkesbury, NS B9A 2J9

Phone: (902) 625-0791
Fax: (902) 625-3722

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 operate the Facility, situated at or near Stewartdale Inverness County (the "Site").

b) The Facility shall be constructed and operated as outlined in the application for industrial approval dated October 14, 2008 and supporting documentation.

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

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 maintained for inspection upon request by the Department.

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) **Total Suspended Solids**

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: Site Boundaries

iv) **Sampling Frequency**

1) The Approval Holder shall sample if there is a discharge from the site or at the request of the Department.

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 maintained for inspection upon request by 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 maintained for inspection upon request by the Department.

11. Rehabilitation

a) The Approval Holder shall maintain security in a form acceptable to the Department in the amount of $2,500.00 an acre.

b) The Approval Holder shall apply the principal of progressive rehabilitation to the site to the satisfaction of Department. The rehabilitation plan shall be revised, updated and submitted every three years 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

c) Before the expiry of the interim security, the Approval Holder shall post a final security which shall be calculated using the rehabilitation plan and factors in item b) above. The final security shall be revised every three years in accordance with the revised rehabilitation plan.

d) 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 (b) or other terms as specified by the Department,

e) 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.

f) 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
Alva Quarry Extension Hydrology Study

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

Alva Quarry Extension Project
Hydrology Study

Alva Construction Limited
P.O. Box 1193
5600 Lochaber Road
Antigonish, NS B2G 2L6

File: 121510121.

November 2009

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1.0 Introduction

In support of the Environmental Assessment registration document a hydrologic study was conducted for the area covering the existing Whycocomagh Quarry and the proposed quarry extension Project. The purpose of the hydrologic study was to determine potential changes on the hydrologic regime on the project site and on downstream hydrologic elements due to the proposed extension of the quarry.

1.1 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 extension conditions. For this case in particular two extension scenarios have been proposed referred to as Scenario I and Scenario II and are described in detail in the following section.
2. Estimate the total capacity required for the retention/siltation facilities (*i.e.,* retention ponds) for each of the two proposed extension scenarios.
3. Assess any potential impacts of the proposed quarry extension on downstream hydrologic elements with respect to water quantity and quality and propose mitigation measures.

1.2 SITE DESCRIPTION AND BACKGROUND

The proposed quarry extension lands (referred to as the “site”) are located in Stewartdale, Inverness County, Cape Breton, Nova Scotia. The proposed extension is situated within the same property of the existing Alva Construction Limited Whycocomagh Quarry (PID 50107184). The entire property has a total area of 46.98 Ha and is shown on Figure 1.

The parcel of land is somewhat rectangular in shape with its longest dimension extending from NE to SW. The existing quarry encompasses an area of 3.78 Ha and has been operating since the year 2000. The aggregates from the quarry are extracted by blasting, crushing and stockpiling of material on site which is primarily offered to the local construction market. It is expected that the operation of the proposed quarry extension will be the same as the existing quarry.

Existing site topography slopes to the south on the western section of the site and towards the southeast on the eastern section of the site. Surface water is conveyed by a series of small tributaries of the Indian and Skye Rivers, both rivers drain to Bras D'Or Lake. During a site visit conducted on June 10th, 2009 by Stantec representatives, two surface streams and a small number of unmapped wetlands were identified on the site. The streams were mapped with a GPS tracker and labelled unnamed Watercourse 1 and unnamed Watercourse 2 (Figure 2).

Based on available stream and contour mapping (5 m resolution) the site was divided into 5 subwatersheds. Four of them belong to the Indian River watershed and one to the Skye River watershed. As mentioned previously, a series of wetlands were also identified during the site visit. Their approximate locations are also shown on Figure 2.

Map Features

- Subwatersheds
- Stream Buffer
- Scenario
- Building
- Spot Height (m)
- Road
- Road (Unpaved)
- Elevation Contour (10 Metre Intervals)
- Watercourse
- Existing Quarry Boundary
- Project Property (Revised)
- 800 Metre Project Property Buffer (Revised)
- 800 Metre Existing Quarry Boundary Buffer (Working Face)
- Property Boundary
- Cemetery
- Inverness County Pits & Quarries Database
- Building
- Wetland
- Waterbody

Data References:
- Base Data from Nova Scotia Geomatics Centre, Nova Scotia Topographic Database
- Wetlands from Nova Scotia Department of Natural Resources (NSDNR), Wetland Inventory Mapping

0 125 250 375
Metres

N

Scenario 1

Scenario 2

Skye River

Indian River

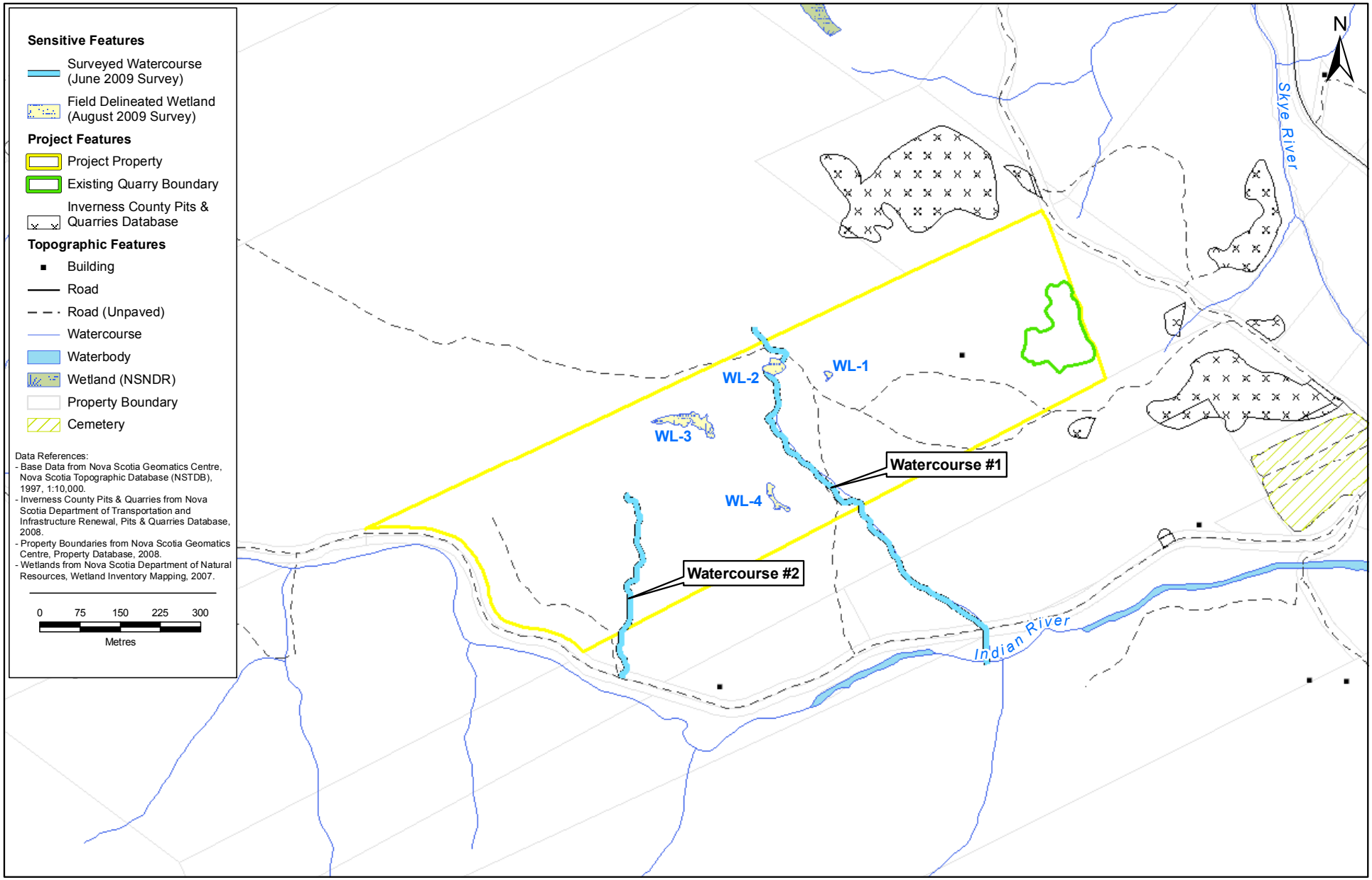
Churchview

HWY-252

DATE: 16/12/2009	ALVA CONSTRUCTION LIMITED - WHYCOCOMAGH QUARRY
PREPARED BY: G. Mesheau	**Site Plan with Project Scenarios**
PROJECT NO.: 121510121	FIGURE NO.: **Figure 1**

Stantec

The proposed quarry extension is intended to be carried out over the next 50+ years until complete development is achieved. Therefore this hydrologic study was based on two expansion scenarios. Scenario I included the extension of the existing quarry operation towards the west until it reaches the unnamed watercourse 1 (Figure 1). A 30 m buffer zone around each side of the stream has to be included to comply with existing guidelines. Scenario II will include the western side of the property minus the buffer zones for both the unnamed Watercourses 1 and 2. A 30 m buffer area around the entire perimeter of the property is also included. The total extension area will be approximately 10.96 Ha for Scenario I and 15.80 Ha for Scenario II, for a total extension area of 26.76 Ha.



DATE: 19/10/2009	ALVA CONSTRUCTION LIMITED - WHYCOCOMAGH QUARRY	FIGURE NO: **Figure 2**
PREPARED BY: G. Mesheau	**WETLANDS and WATERCOURSES**	Stantec
PROJECT NO.: 121510121		

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.

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 US Army Corp of Engineers and is widely accepted and utilized 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 8204500 (Port Hood) operated by Environment Canada. Station 8204500 is located approximately 28 km to the west of the site. The surface slope, area and other physical parameters were approximated using GIS tools. The concentration time was estimated with the Upland Method included in the National Engineering Handbook, Part 630, Chapter 4 (Natural Resources Conservation Service, 1993).

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 8201716 (Eddy Point), operated by Environment Canada. This station is the nearest station with available data and is located approximately 50 km south of the Project site.

3.0 Results

3.1 MEAN ANNUAL SITE RUNOFF ESTIMATION

Based on climate normals (1971-2000) from station 8204500 (Port Hood), the average annual precipitation at the site is in the order of 1298.2 mm.

Total annual evapotranspiration in the area has been estimated using the Thornthwaite Equation. Annual evapotranspiration is therefore in the order of 551 mm, or 42.4% of the average annual precipitation. Infiltration is assumed to be in the order of 12% 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 22, 2009). The annual infiltration is therefore in the order of 155.8 mm.

The remaining 45.6% of the average annual precipitation can contribute to surface runoff and corresponds to 591.4 mm per year. It has been estimated that surface runoff from the site will increase by 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 (>50 years) 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 780.64 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 1.

Table 1 Existing and post development surface runoff volume estimations

Scenario	Area (Ha)	Effective annual Precipitation (mm)	Runoff Volume (m^3)
Existing condition	26.76	591.4	158,258.6
Scenario I Extension	10.96	780.64	85,558.1
Scenario II Extension	15.80		123,341.1

Therefore, the average annual site runoff due to the proposed quarry extension is in the order of 85,558.1 m^3 for Scenario I and 123,341.1 m^3 for Scenario II, respectively with a total volume of 208,899.2 m^3 or a 32% increase from the existing condition.

3.2 FLOW RETENTION AND SILTATION TREATMENT SIZING

A summary of the hydrologic model setup is provided on Table 2.

Table 2 Summary of hydrologic parameters used in HEC-HMS

Parameter	Scenario I	Scenario II
Initial and Constant Loss Method	Initial Loss: 2.5 mm Constant Rate: 3.8 mm/hr Imperviousness: 60%	Initial Loss: 2.5 mm Constant Rate: 3.8 mm/hr Imperviousness: 60%
Clark Unit Hydrograph Routing Method	Concentration Time: 0.16 hr	Concentration Time: 0.13 hr
Included Storms	6 hour 1:25 year return period 6 hour 1:100 year return period	6 hour 1:25 year return period 6 hour 1:100 year return period
Subcatchment Area	0.1096 km^2	0.158 km^2
Baseflow	Not considered	Not considered
Attenuation effects due to channel storage	Not considered	Not considered
Modeling interval	5 min	5 min

The parameters used in the hydrologic model to size the flow retention and discharge structures for the two extension scenarios are included on Table 3.

Table 3 Model Parameters used in HEC-HMS

Scenario	Area (Ha)	Flow Path Length (m)	Slope (m/m)	Concentration Time (min)
Scenario I	10.96	400	0.05	9.6
Scenario II	15.80	330	0.05	7.8

For all calculations it was assumed that all surface runoff originating from the upstream regions of the catchment area located off-site will be diverted around the proposed quarry extension, and therefore no off-site area will contribute to on-site surface runoff.

Flow hydrographs developed for the 1:25 and 1:100 year storms are shown in Figures 3 and 4, below.

Figure 3 Flow Hydrographs for Scenario I - 1:25 and 1:100 year Rainfall Events

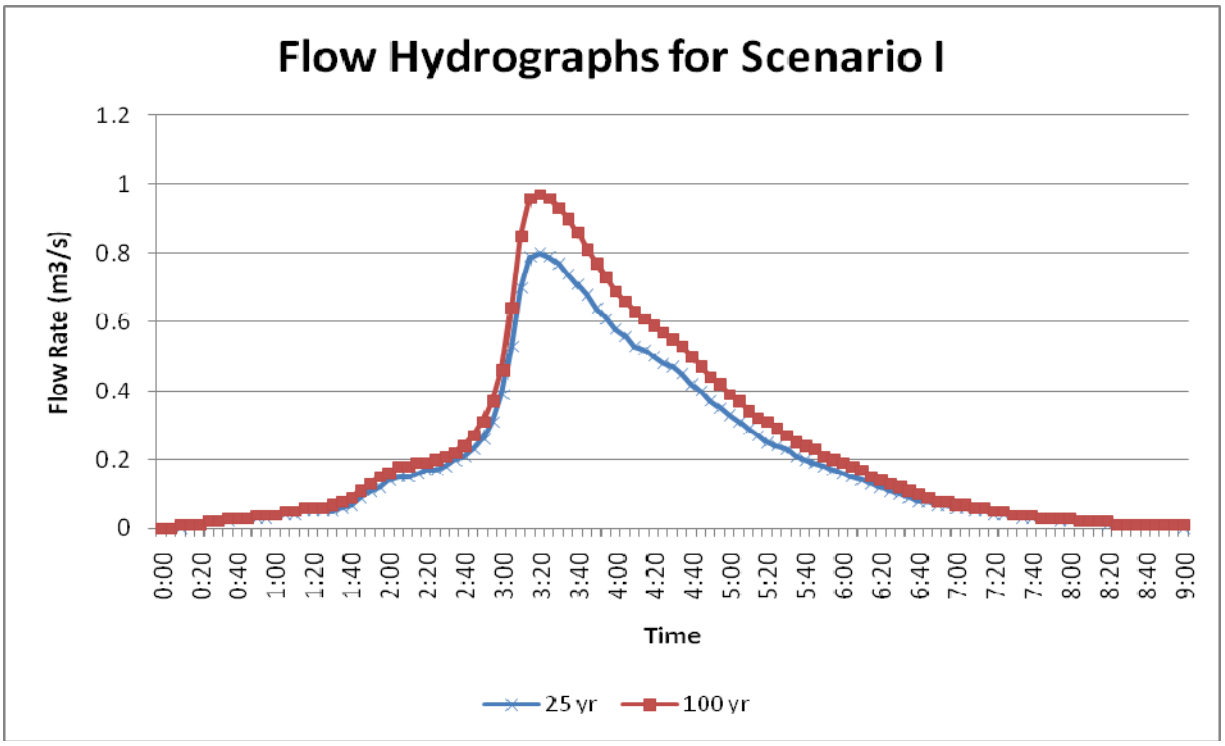
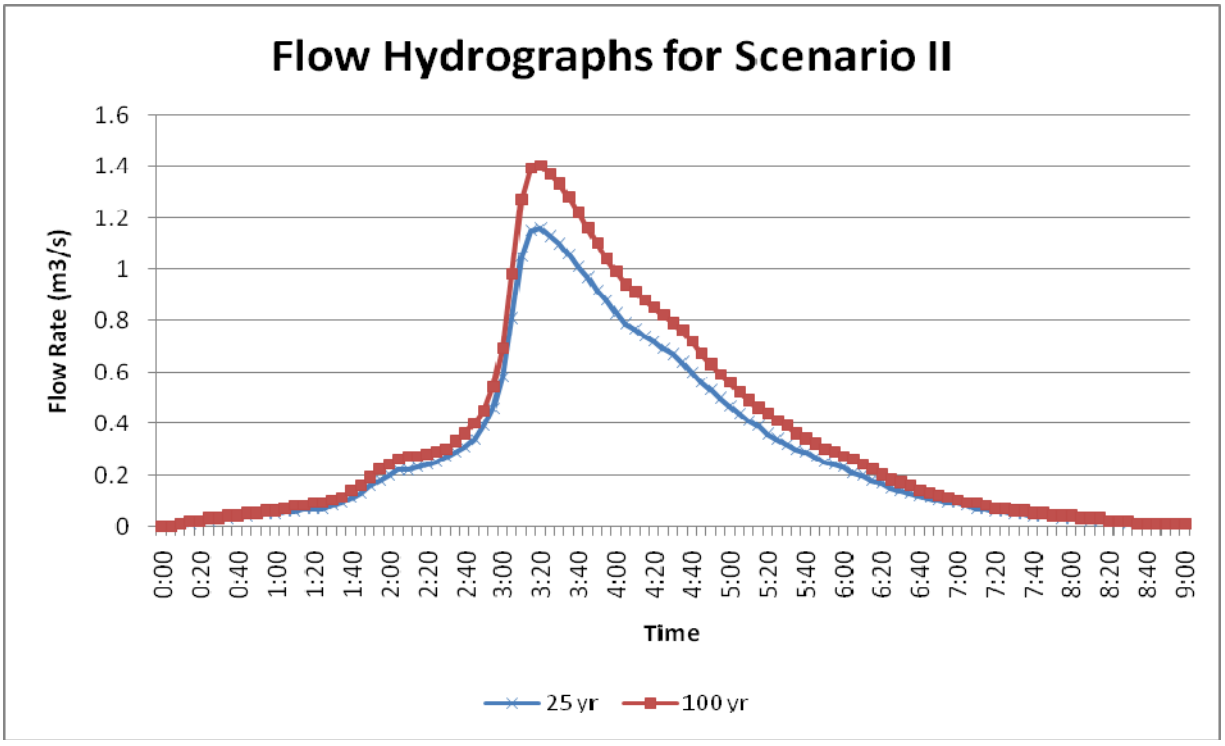


Figure 4 Flow Hydrographs for Scenario II - 1:25 and 1:100 Year Rainfall Events



Based on model estimations for the 6 hour 1:25 year and 1:100 year rainfall events, the total change in runoff volumes as a result of the ultimate level of proposed quarry extension are shown in Table 4.

Table 4 Change in Runoff Volume for Different Scenarios

Extension Stage	Return Period	Peak Flow (m^3/s)	Volume (m^3)
Scenario I	1:25	0.80	6,570
	1:100	0.97	7,850
Scenario II	1:25	1.16	9,460
	1:100	1.40	11,310

It is recommended to size the flow retention structures to retain the volume from the 1:25 year rainfall event. Therefore, the retention structure for Scenario I should be sized to store 6,570 m^3 of runoff, and the retention structure for Scenario II should be able to accommodate an additional 9460 m^3. The total volume of retention storage for the site for the ultimate level of quarry extension (including all scenarios) should be in the order of 16,030 m^3.

Based on the simulations completed for the 1:100 year 6 hour duration rainfall event, the peak flows for Scenario I and Scenario II are estimated to be in the order of 0.97 m^3/s and 1.40 m^3/s, respectively. The construction of stormwater retention structures will have an attenuation effect on the peak flows from the 1:100 year rainfall event, therefore, the discharge structures 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.

The difference in flow hydrographs between the 1:25 and 1:100 year rainfall events for each scenario are shown on Figures 5 and 6. As indicated, the weir structures should be sized as a minimum to accommodate 0.17 m^3/s and 0.24 m^3/s for Scenario I and Scenario II, respectively.

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 that the 1:25 year rainfall event, the mean discharge capacity should be 76 L/s for Scenario I and 109 L/s for Scenario II. 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 5 **Excess flow rate from the 1:100 year rainfall event with storage attenuation for Scenario I**

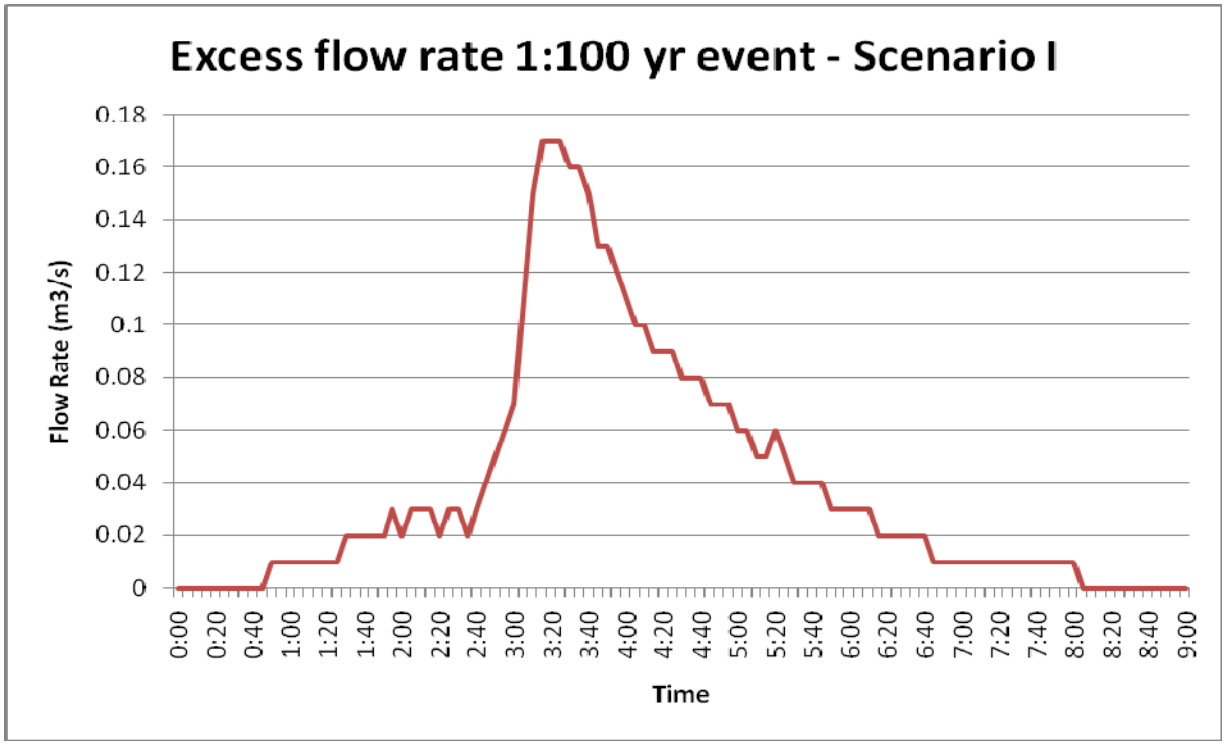
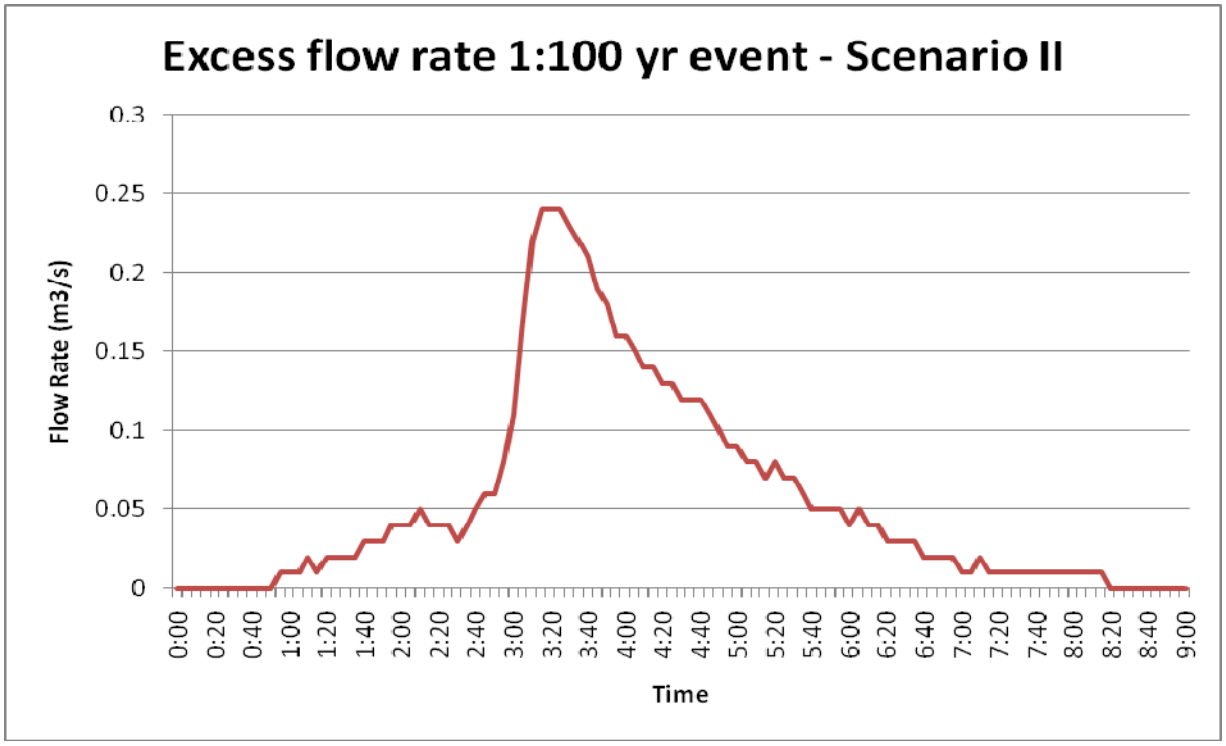


Figure 6 Excess flow rate from the 1:100 year rainfall event with storage attenuation for Scenario II



3.3 EFFECTS ON DOWNSTREAM FLOWS AND WATER QUALITY

The full quarry development is anticipated to increase the total mean annual runoff at the site by 50,640 m^3. The mean annual runoff will be divided between five different subwatersheds within the site. Four of these subwatersheds drain to the Indian River and one drains to the Skye River.

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 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 observed in at least one of the unnamed tributaries within the site, a minimum 30 m buffer zone must be maintained between the quarry operation and the streams. Surface runoff from the site should not be sent to the streams before being stored 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 a good aquatic environment near the site.

4.0 Conclusions

The following conclusions are offered based on the desktop hydrology study for the proposed Whycocomagh Quarry Extension Project.

The existing site runoff for the site is estimated to be in the order of 158,258.6 m^3.

The total increase in the mean annual runoff for the site resulting from the proposed extension (including Scenarios I and II) is in the order of 50,640.6 m^3 or a 32% increase from the existing condition.

The flow retention structures for the proposed quarry extension should be able to accommodate a volume of 6,570 m^3 for Scenario I and 9,460 m^3 for Scenario II. The dimensions of the proposed retention ponds will depend on site characteristics, as an example, a retention pond able to accommodate 6,570 m^3 should have approximate dimensions of 58 m x 58 m x 2 m.

The outlet structures for each retention pond should be able to accommodate discharges of 0.17 m^3/s and 0.24 m^3/s corresponding to the difference in flows between the 1:25 and the 1:100 AEP.

Based on a recommended retention time of 24 hours for any precipitation event equal or smaller than the 1:25 year rainfall event, the weirs should be designed to conform with discharge capacities of 76 L/s and 109 L/s for Scenario I and Scenario II. 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.

5.0 Closure

This report has been prepared on behalf of and for the exclusive use of Alva Construction Limited. 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 Limited attests that to the best of our knowledge the information presented in this report is accurate.

6.0 References

6.1 LITERATURE CITED

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.

Environmental Assessment Registration, Panuke Quarry Expansion Project. Jacques Whitford, Dartmouth, Nova Scotia, 2008.

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

6.2 PERSONAL COMMUNICATION

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

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APPENDIX C
Government Comments Draft EA - Disposition Table

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
1	Peter Lane – Environment Canada	The proponent must ensure its activities are managed so as to comply with the Species at Risk Act (SARA). The SARA is one of three elements of Canada's Strategy for the Protection of Species at Risk. The other two are the federal-provincial/territorial Accord for the Protection of Species at Risk and the Habitat Stewardship Program for Species at Risk. Guidance on considering wildlife at risk in EAs is available in the recently published document. Environmental Assessment Best Practice Guide for Wildlife at Risk in Canada, Available online at www.cws-scf.ec.gc.ca/publications/evallindexe.cfm	Comment acknowledged. The report has been prepared with the intent of being consistent with the noted references.
2	Peter Lane – Environment Canada	Clearing and grubbing of land can impact active nests or birds caring for pre fledged chicks. One method frequently used to minimize the risk of destroying bird nests consists of avoiding certain activities, such as clearing, during the nesting period for migratory birds in the region. Risk of impacting active nests or birds caring for pre-fledged chicks, discovered during project activities outside the May 1st to August 31st window, can be minimized by measures such as the establishment of vegetated buffer zones around nests, and minimization of activities in the immediate area until nesting is complete and chicks have naturally migrated from the area. It is incumbent on the proponent to identify the best approach, based on the circumstances, to complying with the MBCA.	Comment acknowledged. Proponent will take reasonable measures to comply with MBCA, as noted in section 5.4.2., including seasonal avoidance of clearing activities and use of buffer zones, as appropriate.
3	Peter Lane – Environment Canada	It is understood that the proponent will maintain a 30 m buffer zone between project activities and any existing wetlands. It has also been identified that in the future the avoidance of wetlands may not be possible. In the event that avoidance is not possible, the reasons why elimination of adverse effects on wetland functions were not possible should be clearly demonstrated in the EA, and EC should be contacted for advice on next steps to follow for compliance with the FPWC. The Federal Government has adopted The Federal Policy on Wetland Conservation (FPWC) with its objective to "promote the conservation of Canada's wetlands to sustain their ecological and socioeconomic functions, now and in the future." In support of this objective, the Federal Government strives for the goal of No Net Loss of wetland function on federal lands or when federal funding is provided. The goals of the policy are to be considered in these circumstances, and the hierarchical sequence of mitigation alternatives (avoidance, minimization, and as a last resort, compensation) recommended in the FPWC should be followed.	Comment acknowledged. Section 5.5.2. outlines mitigative measures consistent with provincial and federal policy, text within this section has been modified to clarify hierarchical sequence of mitigative measures.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
4	Peter Lane – Environment Canada	The Proponent should consult EC general guidance1 that could be applicable to any quarry project for additional information that should be considered in the EA of this project. The guidance is available from the Regional Environmental Assessment Committee (REAC) website at: http://www.tseequebec. gc.ca/Atlantic/index.asp under the tab "Guidance Material Developed by REAC". User name and password are required to access the REAC website. If you do not already have access to this website, you can obtain access information from Derek McDonald (Canadian Environmental Assessment Agency) at 426-9458 or Derek.mcdonald@ceaa-acee.gc.ca. The guidance in itself does not substitute for the need for an RA to investigate and assess impacts associated with project-specific activities and site-specific environmental sensitivities, and does not constitute an agreement to assist with implementation of mitigation and follow-up in an EA. However, after applying the guidance, an RA should be in a position to make specific requests for pertinent EC expertise.	Comment acknowledged.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
5	Andrew D Cameron – Agriculture	The report indicates that there are" three tracts of agricultural land located within 800 m of the Project" and "not located in a region where conflict with current and future agricultural practices is anticipated." This is a vague description.	According to Section 10.0 of the EA, “there are approximately ten other pits and/or quarries located in the immediate vicinity of the existing quarry site, as indicated on provincial mapping (Figure 1).” This includes several that are located between the Project site and the tracts of agriculture land The agricultural land already coexists with these pits and quarries, as well as the existing Alva Quarry, without incident (i.e., complaints or issues). It is therefore reasonable to assume that the Project would not cause any conflict. A Plan for Community Based Development for the Municipality of the County of Inverness (2003), the Whycocomagh area does not list any objectives related to agricultural development. On the other hand, its stated objectives include infrastructure improvements and working with local businesses to improve employment opportunities in the area. The Alva Quarry supports both of these objectives by producing aggregates for local construction and providing local employment opportunities. The priorities in this plan for future development suggest that future conflict between agricultural development and quarry development is unlikely.
6	Andrew D Cameron - Agriculture	Our staff investigated and report -"at least one blueberry development owned by Ken MacPhee abutting the property of the expansion but not close to the current quarry location. Quarry is not close to dairy farms." Our question is -Will blasting have an impact on pollination? I suspect if there is a potential impact, a solution can be arranged. The proponent should work with the farmer to ensure blasting does not occur during the critical pollination period.	Comment acknowledged. The proponent will contact the owner of the blueberry development as quarry activities begin to approach that location to discuss potential issues and solutions.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
7	Derek McDonald - Canadian Environmental Assessment Agency	After reviewing the document, and consulting with Stantec to confirm a few details, I am of the opinion that a federal environmental assessment is likely not required for this project. I base this on being unable to identify any federal decisions required in order for the project to proceed. In other words, there do not appear to be any potential federal EA triggers.	Comment acknowledged.
8	Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	Aggregate products will be transported by, on average, 150 tandem and tractor trailer trucks per day along existing trucking routes. While the existing trucking routes are not specifically identified in the Assessment, it is expected that the Trans Canada Highway (TCH) 105 is a main routing component. As the ground transportation link to Newfoundland, the TCH 105 currently has heavy truck traffic. The volume of truck traffic with the quarry expansion is in keeping with current quarry volume and will therefore not impact tourism generated traffic beyond current levels.	Comment acknowledged.
9	Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	The site does not appear to be located in a manner which will affect the visual aesthetics of major highways, coastal views, scenic drives, or tourism services and amenities.	Comment acknowledged.
10	Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	Equipment operations and blasting will generate noise from the quarry site. There are provincial guidelines in place which require sound levels not exceed specific thresholds and be monitored. Where this is an expansion of an existing quarry, it is not anticipated that the sound quality will be degraded beyond current levels.	Comment acknowledged.
11	Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	There are eight accommodations, one festival or event, one provincial park, and three restaurants identified in the Whycocomagh area (Source: novascotia.com). Recreational hunting and fishing are permitted in the region surrounding the project area. Where there is currently a quarry operating, it is not anticipated that this expansion will have a negative impact on tourism experiences, businesses or services in the area. In consultation with Destination Cape Breton, the marketing organization for the island, it was noted that there had been no complaints or concerns rose with them by their industry partners in regard to this project.	Comment acknowledged.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
12	Heather MacMillan, Senior Policy Advisor, Policy and Coordination, Corporate Strategy and Operations	In summary, we suggest the following be considered should the project move forward: •Proponent takes into consideration scenic view planes in the Whycocomagh area. •Noise levels associated with the day to day operations should be monitored to ensure that they are kept to an acceptable level and monitored to ensure that there is no negative impact on local tourism operators.	Comment acknowledged. Please refer to Section 5.8 for additional information pertaining to noise mitigation and monitoring.
13	Rick Devine, Habitat Assessment Biologist- Department of Fisheries and Oceans	My understanding of the project is that the proponent plans to expand the existing quarry within the property boundaries. And that on the property are two watercourses as identified in the draft document WC 1 and WC 2. WC 1 was electrofished and found to have brook trout and Atlantic salmon outside of the property boundary. The portion of the brook that is within the property boundary is characterized as steep and intermittent and therefore the biologists on site did not feel that this habitat would support salmonids. So this portion of the stream was not electrofished. WC 2 was described as the same steep terrain and the link to Indian River stream maybe a barrier to fish passage so for these reasons was not electrofished. The expansion of the existing quarry may take years before the two streams could be affected. At that time a more in-depth analysis of the habitat and further electrofishing would be recommended to establish the presence or absence of fish. The water quality and quantity coming off a quarry is always a consideration for mine expansions.	Comment acknowledged. The mitigation discussion under Section 5.2.2 has been updated to reflect the need to re-assess aquatic environment if more than two years pass before quarry expansion has potential to affect the watercourses.
14	Andrew Murphy Manager, Air Quality - NSE	On page 5.35, it says "Ambient air quality is monitored in Nova Scotia by a network of sites operated by NSEL, Environment Canada, and Nova Scotia Power Inc." This is not an accurate statement. The provincial air quality monitoring network consists of 13 sites and operated jointly by NSE and Environment Canada. There are other monitors across Nova Scotia operated by private companies, such as but not limited to Nova Scotia Power, but these sites are not considered part of the provincial network and are not reported on by NSE.	Comment acknowledged. The text under Section 5.8.1 has been updated.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
15	Andrew Murphy Manager, Air Quality - NSE	On page 5.38 it says “Since 1997, the province began continuous reporting of an air quality index for the Port Hawkesbury region. Since reporting began, air quality has been predominately in the “Good” category.” The air quality index has now been replaced by the Air Quality Health Index (AQHI). The AQHI for Port Hawkesbury will be available in May 2010.	Comment acknowledged. The text under Section 5.8.1 has been updated.
16	David J. Fougere	Lorne MacNeil and I reviewed the draft EA for Alva's proposed expansion in Stewartdale, Inverness County. The document appears to cover off the items which will be addressed in the industrial approval and we have no specific comments on the document at this time	Comment acknowledged.
17	John Drage, Hydrogeologist, Water & Wastewater Branch - NSE	The EA report indicates there is a low risk that the proposed project will impact the public water supply wells owned by the Waycobah First Nation. However, these supply wells are located relatively close to the proposed project, and appear to be directly down-gradient. Therefore, as a precautionary measure, an on-site groundwater monitoring program should be considered. This would provide an early warning of any chemical impacts and water level impacts. In addition, this would allow the proponent to determine the location of the water table onsite, which will ensure they do not excavate below it, as proposed in the EA document.	Comment acknowledged. The report has been revised to include installation of a groundwater monitoring well. Please refer to Section 5.6.2.
18	John Drage, Hydrogeologist, Water & Wastewater Branch - NSE	On page 5.26 it is indicated that the two production wells are located about 800 m from the project boundary. Note that Figure 2 shows PW1 to be approximately 700 m from the project’s property boundary. Also, I’d recommend adding the location of the recently drilled test well (TW09-1) to Figure 2.	Comment acknowledged. Figure 2 has been revised.
19	John Drage, Hydrogeologist, Water & Wastewater Branch - NSE	On page 5.26, 3rd paragraph, there is a reference to a “Well Drillers Database” for wells constructed between 1967 and 2000. Is this meant to refer to the “NS Well Logs Database (2009)”, which includes wells constructed between 1940 and 2009?	Comment acknowledged. This report section was written prior to the release of the 2009 database. This reference has been revised and a new search confirmed there were no additional wells drilled in the project area in 2009.
20	John Drage, Hydrogeologist, Water & Wastewater Branch - NSE	Similar to comment number 3 above, the footnotes in Tables 5.3 and 5.4 refer to older databases. The most recent version of the provincial well database was released in 2009 and is named “NS Well Logs Database (2009)”. It can be accessed here: http://www.gov.ns.ca/nse/groundwater/welldatabase.asp	Comment acknowledged. Refer to comment #19.
21	Angela Swaine, Environmental Analyst - Nova Scotia Transportation and Infrastructure Renewal	Transportation and Infrastructure Renewal has no comments at this time on the Draft Report: Environmental Assessment Registration for Whycocomagh Quarry Extension Project.	Comment acknowledged.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
22	Darrell Taylor, Environmental Analyst	I believe that the assessment report would benefit from a consolidation of all relevant surface water related information in one section. Currently it is spread out throughout the entire document including being embedded in the Groundwater section 5.6. The rationale provided for selecting groundwater as a VEC equally applies to surface water.	Comment acknowledged and the text under Section 5.2 has been updated.
23	Darrell Taylor, Environmental Analyst	Surface water generally should be recognized as a VEC with all potential water uses assessed - as opposed to just one possible use (fish habitat). Other potential water uses include drinking water supply, agricultural, recreational, or industrial water uses. This project is sited very near residential development and the potential exists for several water uses to exist. Consideration of all potential uses should be included in this assessment.	Comment acknowledged and the text under Section 5.2 has been updated.
24	Darrell Taylor, Environmental Analyst	The assessment of impacts to surface waters should include whether any water withdrawals exist near or downstream of the project area, and if so, potential to impact, as well as proposed measures to protect such withdrawals.	Comment acknowledged and the text under Section 5.2 has been updated.
25	Darrell Taylor, Environmental Analyst	The report states that 2 watercourses and 4 wetlands exist in the project area. One wetland is hydrologically connected to one of the watercourses and would serve flow regulation and water quality filtration / protection related functions. Most of these waterbodies are tributary to Indian River which is significant fish habitat having salmon and brook trout present. All should be protected with mitigation proposed. The report suggests that this may not be the case in future as the mine gets developed, but compensation would be offered. It would be advisable to maintain and protect as many of these surface water resources on-site as possible, particularly watercourse #1 with its associated wetland, which in turn would help protect the Indian River receiving waters.	Additional protection of wetland #2 has been outlined. Refer to Section 5.5.2. The text has also been updated to clarify that mitigation is intended to apply to both watercourses. Refer to Section 5.2.2.
26	Darrell Taylor, Environmental Analyst	Surface water sampling is undertaken not only to assess suitability for freshwater aquatic life, but as baseline studies for water quality and quantity to assess post development impacts and predictions of this report. This doesn't seem to be generally recognized in the report.	Comment acknowledged and Section 5.2 has been updated.
27	Darrell Taylor, Environmental Analyst	Although watercourses on-site may have barriers to fish migration identified in their lower reaches, this should not preclude these stream from being protected using appropriate mitigation measures - so as to protect other aquatic life or any other water uses.	Comment acknowledged and Section 5.2 has been updated.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
28	Darrell Taylor, Environmental Analyst	This project represents a significant expansion - from about 4 ha to about 47 ha in area - with quarry life expectancy being 50 years. Ten other quarries are noted in the immediate vicinity. It would be prudent to carefully assess cumulative impacts from all these developments and any others in the area.	While the proponent is not aware of the details of other quarry developments in the region, it is assumed that other quarry developments, like the existing Alva quarry and proposed extension, are approved to operate according to NSE approval terms and conditions and the NS Pit and Quarry Guidelines, or Pit and Quarry Guidelines with other regulatory controls (i.e., NSTIR requirements). These operating conditions, including requirements to reclaim quarried lands and compensate for alteration of certain habitats (e.g., wetlands), will mitigate both project specific as well as cumulative effects among other projects in the region. The predicted adverse residual environmental effects (i.e., after application of proposed mitigation) from the proposed extension of the Whycocomah Quarry are not likely to be significant; its potential contribution to regional cumulative environmental effects is therefore also likely to be minor.
29	Darrell Taylor, Environmental Analyst	Acid mine drainage is mentioned in passing in the groundwater section, but not addressed well elsewhere in the report.	Comment acknowledged and the text under Section 5.6.2 has been revised.
30	Darrell Taylor, Environmental Analyst	It is noted that stormwater management plans, contingency plans, and water quality and quantity monitoring plans are all proposed to be submitted at the stage of application for an industrial approval. Therefore, no comment can be made on their adequacy at this stage.	Comment acknowledged.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
31	Darrell Taylor, Environmental Analyst	The findings of the hydrological report (Appendix G) and development scenarios #1 and #2 described therein should be included in the body of the report in a section dealing with surface water. The phased approach which seems to be proposed in Appendix G could be articulated in the body of the report with time lines and mitigation measures proposed. Progressive quarry development could be shown on maps or figures to aid understanding and help the overall assessment process.	The scenarios presented in Appendix B (was Appendix G) were prepared for the purposes of hydrological modeling only in consideration of the uncertainty if the stream will be buffered or proposed for alteration in the future. These modeling scenarios were not intended to suggest a quarry development or progression plan. Notwithstanding potential buffering of Watercourse no. 1 and Wetland no. 2, the assessment has been undertaken with respect to quarrying the entire site. It is reiterated that all applicable approvals (e.g., wetland or watercourse alteration) will be applied for from the appropriate regulatory departments well in advance of the planned habitat alterations.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
32	Sarah MacKay - NS Department of Natural Resources	Botanical inventories on the property revealed three species of conservation concern, including Bebb's Sedge (*Carex bebbii*) (RED - Nova Scotia General Status Ranks of Wild Species), and two uncommon plants (S3 - Conservation Data Centre) named Broad-leaved Twayblade (*Listera convallariodes*) and Tall Hairy Groovebur (*Agrimonia gryposepala*). The latter two plants have been listed as "Green" under the General Status of Wild Species. DNR agrees that impacts on the habitat and population of Bebb's Sedge would likely lead to its extirpation. DNR also agrees that additional inventory work for Bebb's Sedge and other rare plants on the property with a focus on wetlands and waterways is required. Finally, DNR suggests that mitigation for Bebb's Sedge as proposed in the document is limited and that appropriate buffers and operational setbacks need to be incorporated in the final registration. DNR suggests that wetland WL-2 should have flows restored through reparations to the road culvert that currently redirects flow into a roadside ditch, and that this wetland should be protected from impacts of the development. Similar consideration should be given to protecting wetland WL-1. Mitigative options to discuss approaches to protecting these two wetlands and the unique assemblages of plants should be incorporated in the final registration.	Additional inventory work for Bebb's Sedge and other rare plants on the property is not required. Complete species inventories of vascular plants were conducted at the time of visitation by experienced botanists and all wetlands and watercourses were targeted for possible rare plants during the surveys. In addition, because efforts to find *C. bebbii* in additional areas (following its initial identification in Wetland 2) were unsuccessful, this species is not expected to reside elsewhere on the property. Mitigation for Bebb's Sedge has been strengthened, including a buffered avoidance of WL-2 and reparations to the culvert which directs inflow to this habitat. Refer to revisions in Sections 5.3.2. and 5.5.2. Mitigative measures for WL-1 will follow provincial policy and regulations, as outlined in Section 5.5.2. Due to the anthropogenic nature of this wetland and its limited capacity as habitat and for providing, hydrological / biogeochemical functions; mitigative measures beyond those which are outlined, are not necessary.
33	Sarah MacKay - NS Department of Natural Resources Sarah MacKay - NS Department of Natural Resources	Geo-locations of all S1, S1S2, S3, and S3S4 plants, lichens, and animals (employing Atlantic Canada Conservation Data Centre (AC-CDC) status ranks) is necessary for a comprehensive spatial evaluation of local biodiversity values. A table with these data is needed in the final registration.	A table of the locations for all species given a ranking of S1, S1S2, S3, or S3S4 by the ACCDC, as well as any that are "Red" or "Yellow" listed by NSDNR are provided in AppendixG.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
34	Sarah MacKay - NS Department of Natural Resources	Results of the botanical inventory indicate the presence of nutrient-demanding hardwood forest and floodplain plants (e.g. *Carex gracillima, Cardamine diphylla, Dicentra cucullaria, Deparia acrostichoides, Polystichum braunii, Prenanthes alitissima*, and others). These may occur in seepage tracts and patches in the mature tolerant hardwood forest (Section 5.3.1); however, clarification is needed in accordance with the habitat classification framework outlined above. Nutrient-rich seepage forests have relatively high habitat value. This type of forest, if present, should be listed and mapped as an environmentally sensitive area (Figure 5.2).	Comment acknowledged. Presence and location of the noted habitat type is discussed in Section 5.3.1.
35	Sarah MacKay - NS Department of Natural Resources	Dutchman's Breeches (*Dicentra cucullaria*) is listed in Table D-2; however, its scientific name is given as *Dentaria dyphlla* [sic]. *Dentaria diphylla* is Two-leaf toothwort, which is listed elsewhere in Table D-2 as Cardamine diphylla. Clarification is required.	Table D-2 has been updated – binomial nomenclature for Dutchman's Breeches changed to *Dicentra cucullaria*, whereas that for Two-leaf toothwort (Cardamine diphylla) has not due to treatment by Zinck (1998) and the ACCDC.
36	Sarah MacKay - NS Department of Natural Resources	The development time line of the project extends out 50 years. A smaller footprint and assessments could be considered over shorter (~10 year) time periods. DNR understands of forest communities and their distribution will have improved and there will be increased capacity to provide assessment and comment.	The environmental assessment applies to the entire site and the study team is confident in its understanding and prediction of potential environmental effects and mitigative measures to reduce adverse effects. Where predictive or mitigative uncertainty exists, monitoring programs have been proposed. Additional and updated assessment will be undertaken as the quarry progresses in the context of additional regulatory applications to alter sensitive habitats (i.e., wetlands and watercourses). These new assessments will be undertaken according to the knowledge base, standards and regulatory requirements of the day.
37	Sarah MacKay - NS Department of Natural Resources	Section 5.2.1 should clarify that the watercourse is a tributary to Indian River, which drains in to Skye River and then into Whycocomagh Bay.	The text in Section 5.2.1 has been updated.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
38	Sarah MacKay - NS Department of Natural Resources	DNR would like to see an Appendix for mammals, bird and herptiles similar to the one provided for flora. This would provide detail for the results of the data search and modeling done for these species.	Data has been provided in Appendix F (was Appendix D).
39	Sarah MacKay - NS Department of Natural Resources	Section 5.14: The lynx breeding range on Cape Breton (CB) Island is laid out in the recovery plan for the species, and this area includes the CB Highlands and some areas of the CB Hills, including the area surrounding the proposed Quarry at Campbell's Mountain. To say that the area is outside the normal distribution of lynx is not correct. The presence of lynx in the area is likely, especially during times of low hare levels in the highlands, as noted in the report. The wildlife surveys done in June and August would not have detected many of the predator species such as lynx, bobcat, fox, and coyote that may be in the area. Winter surveys, when tracks are evident, tend to be more useful. DNR can provide additional information to the proponent as necessary.	Text has been re-worded to describe Project area as being on "the edge of the normal distribution of lynx". Refer to Section 5.4.1.
40	Sarah MacKay - NS Department of Natural Resources	Section 5.15: Wood turtles have been found in the Skye River from its entrance to Whycocomagh Bay, and upstream to East Skye Glen. Several nest sites have been located; one was found in a gravel pit approximately 500 meters from the Skye River, near Stewartdale. Several tributaries to the Skye River run within 200 meters of the existing quarry site and proposed expansion. Although DNR agrees it is not likely that turtle are present along the watercourses located on the proponent's property, it is possible that turtle may access the quarry pits via the Skye River tributaries when looking for suitable nesting sites. The proponent should be aware that mitigating measures may be necessary if that should occur.	Text has been updated to acknowledge the potential for Wood turtles to utilize the Project area for nesting purposes, and to highlight the need for mitigation should any turtles be found on the property. Refer to Sections 5.4.1. and 5.4.2.
41	Sarah MacKay - NS Department of Natural Resources	Forest resources located on this private property are typical for the general area with no known important (considered rare or endangered) forest resource elements identified. The loss of forest resource production from the development of the quarry will be minor in this landscape.	Comment acknowledged.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
42	Sarah MacKay - NS Department of Natural Resources	It is noted from the report that a total of 26.76 ha of the total property size of 47 ha are planned for development over the 50 year life cycle of the quarry. The proponent may wish to consider proper forest management practices to assist in mitigation of the long term loss of forest resource with the development of the quarry. This could be accomplished in two separate units. The first phase would establish a forest management plan involving the planned quarry expansion area to assist the proponent in planning for maximizing forest production on this area prior to the requirement for grubbing for the expansion. DNR assumes that much of this land clearing will occur in future decades, which would allow time for increased fiber production on these areas with proper silviculture inputs. This potential increase in wood fibre on a portion of the area would help offset the future loss of this land base from forest production. A well-designed forest management plan will identify the areas where increased fiber growth (with silviculture inputs), leading to marketable products ranging potentially from logs to wood chips, is possible within the planned expansion timetable over the next 50 years.	The proponent will consider hiring a professional forester or forest technician to determine whether there would be any economic benefit from conducting silviculture treatments in affected stands and/or adjusting the timing of harvest operations to maximize product value. Also, when harvest operations do take place, all markets will be considered to ensure highest end use of harvested material.
43	Sarah MacKay - NS Department of Natural Resources	Section 5.6: DNR suggests that the discussion of geology (approximately 1/2 page) is inadequate. It appears that the consulting firm relied on two provincial scale geology maps and the accompanying notes to draw their conclusions. A challenge associated with this approach is the loss of accuracy when an area is digitally enlarged from 1:500,000 scale maps to a detailed scale. For example, the detailed map in the report indicates that the quarry is located in calcsilicate rock/marble. According to DNR staffs who have visited the site, the rock in the quarry is actually gneiss with minor amphibolite. This map discrepancy probably reflects the inherent distortions associated with digitally enlarging a regional scale map (which is not intended for this purpose). Thus the geological boundaries on the enlarged section of the map which have been reproduced can easily shift several hundred metres or more. To do this properly, especially in an area where the geology is reasonably complex, the consultant should review the original large scale maps that the 1:500,000 maps were derived from. In this case, the maps include Barr S., White, C.E. and MacDonald, A.S. (1996) and Lynch, G and Brisson, H. (1996).	It is the consultant's opinion that a ½ page to 1 page discussion of the geology is appropriate for an overview of the underlying site conditions for the purpose of addressing potential environmental effects to groundwater quality or quantity effects in nearby drinking water wells. Other resources are also relied on for this high level assessment such as the Nova Scotia Well Driller's Database, Nova Scotia Pumping Test Inventory, in-house reports for information relating to depth to bedrock, type of bedrock, presence and construction of well information in the area. DNR's more recent mapping reference is acknowledged and has been included an updated discussion of the geology; however, the geological discussion in the groundwater section is not intended to describe the resource.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
44	Sarah MacKay - NS Department of Natural Resources	A more recent map by White, C.E. and Boehner, R.C. (2008) at 1:50,000 scale, and based on 1:10,000 scales mapping, may be an even better choice as a reference map. This map also shows a copper occurrence in the immediate area of the quarry. Although this is unlikely to be a problem, such mineral occurrences can, on rare occasions, be just the "tip of the iceberg" and should be flagged as a possible concern. These metallic minerals are also commonly associated with sulfides and other metals which may be considered problematic.	Comment acknowledged. The base mapping for the geology figure has been updated with this reference included as the base map.
45	Sarah MacKay - NS Department of Natural Resources	The existing quarry boundary is within a rock unit defined as calcsilicates and marble while the majority of the expansion is within a gneissic complex, a different bedrock formation. The supposed occurrence of white dolomite in the former unit has been staked for a number of years. This staking takes place over approximately 25% of the project property defined in this report. A reserve of dolomite was estimated to be 4.8 million tonnes (see Various Industrial Mineral Commodities in Nova Scotia, Economic Geology Series 92-1). Should the staking be mentioned or should there be a note regarding consultation with the Mineral Rights Holder (see Section 4.0, Public involvement)?	Comment acknowledged. The proponent plans to investigate this report of mineral "staking" and, if necessary contact any mineral rights holders. At this time however, the proponent does not believe there are any associated impediments to the planned use of their property.
46	Sarah MacKay - NS Department of Natural Resources	DNR staff are aware of at least one geological map (within NSDME (Nova Scotia Department of Mines and Energy) Memoir 7) which better defines the local geology, and there are assessment reports which describe the geology in this area. Some of the assessment work (AR2003-69, conducted for the property owner by Mercator Geological Services) would lead once to surmise that the rocks of the gneissic complex may be acid-generating (mafic composition with accompanying sulfides). Should an assessment for the potential for acid rock drainage be considered, despite the fact the company indicates that any water will be contained within the pit (refer to bullet point below)?	Comment acknowledged. The Proponent will be testing a sample from the quarry extension area for acid producing potential analysis.
47	Sarah MacKay - NS Department of Natural Resources	The report identifies Atlantic Salmon in the Indian River, and there are two Stream Buffer areas identified in Appendix G (Hydrology Study). DNR staff have reviewed historical aerial photography in the area of interest, and there would appear to be a third topographic low (also see map contours on Figure 1) running to the Southeast from the headwaters of Watercourse 2 (Westerly one). This may or may not be a seasonal stream, but it runs towards the Indian River and DNR suggests that it should be established that no drainage from potentially acid-generating rock being quarried end up in this topographical low and, ultimately, the River. Perhaps a third buffer area is required, but it may not be if the rock is proven to be non-acid generating.	Comment acknowledged. Acid producing potential testing will be carried out and consideration will be given to NDR's suggestion dependent upon the results of the testing.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
48	Sarah MacKay - NS Department of Natural Resources	There does not appear to have been any field-related geological assessment of the site. Given that this is a proposed expansion of a rock quarry, understanding the rocks should be considered as a basic component in this assessment. Issues such as the environment, water quality, and biology are strongly influenced by the geological conditions in the area. Ultimately all of these rocks (during the course of extraction) will be exposed to the weather by blasting and crushing, and spread as stone products throughout the region. Encountering problems such as acid-generating sulfides or toxic metals in unacceptable amounts could have negative impacts in the future. Based on the map of White and Boehner (2008), there is enough bedrock outcrops that can be examined to better understanding any potential problems.	No field work was conducted relating to geology of the site. This is generally not required for environmental assessment purposes. Discussion relating to acid producing potential and mineral occurrences has been updated in the report.
49	Sarah MacKay - NS Department of Natural Resources	Section 5.6.2, Water Quality Effects: Regarding the statement "Field inspection, reconnaissance, and testing of the ore is required to confirm the absence of sulfide mineralized zones and absence of acid producing potential." This may imply that fieldwork is planned for the entire property or it may refer only to the immediate area around the quarry. This should be clarified.	Comment acknowledged and text has been revised. The Proponent will complete acid producing potential analysis within the existing quarry and within the extension area as the quarry extends.
50	Sarah MacKay - NS Department of Natural Resources	From an aggregate resource perspective, DNR suggests that there should also be a component of the study addressing the assessment of the deposit itself. This is particularly important in a development proposal (with major land disturbance) that is based solely on stone extraction. What is the geotechnical evidence that the resource exists in and beyond the current quarry confines? At minimum, the test data associated with the rock in the quarry should be presented. More importantly, a geological assessment and sampling program in the undeveloped area of the property would provide important information about the quality of the deposit. Ideally, there should be drilling or trenching to properly establish the quality of the rock reserves; however, due to the cost of these activities, an alternative strategy is the collection of surface samples from outcrop (and perhaps trenches) within the property boundaries. A professional geologist would quickly be able to determine if the resource actually exists with respect to the quality and quantity that the proponent anticipates.	No geological field work is planned, or considered necessary to support the environmental assessment of this quarry extension. Discussion relating to acid producing potential and mineral occurrences has been updated in the report. The proponent is confident of the presence of commercially viable deposits of the target resource based on available information in order to take any development risks.

Table C-1 Disposition Table

Comment No.	Comment Issuer	Comment Received	Comment Response
51	Sarah MacKay - NS Department of Natural Resources	This study could be improved by conducting a proper geological evaluation of the site under the direction of a qualified geosciences professional. This information is not only important to the intent of an environmental assessment, but also would provide the proponent with valuable resource information about the property. If the proponent is interested in conducting a more detailed geological evaluation of the site, they can contact Dr. Chris White (424-2519) at DNR for advice. Dr White is a geologist who is very familiar with the geology in this area.	Comment acknowledged. Also refer to response to #50. The groundwater assessment has been completed by a Professional Geoscientist.
52	Sarah MacKay - NS Department of Natural Resources	Note that any Crown lands identified in the draft EA are administered by the Department of Tourism, Culture and Heritage and were therefore not part of DNR's review.	Comment acknowledged.

APPENDIX D
Project Information Bulletin

Alva Construction Limited
Whycocomagh Quarry Expansion Project
Project Information Sheet

Project Overview

Alva Construction Limited proposes to undertake quarry activities on lands adjacent to its existing facility at Whycocomagh Quarry, Churchview, Inverness County, Cape Breton, Nova Scotia (refer to Figure 1 on reverse). The current operation is 3.78 hectares (9.34 acres) in area. The proposed expansion will incorporate land immediately adjacent to the existing quarry to increase the total size of the operation to approximately 47 hectares (116.14 acres). Blasting, crushing and stockpiling of aggregate is proposed to take place at the expanded site. The quarried material is primarily used for local construction such as road building. 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 10 million tonnes of rock reserves within the proposed expansion area. The expanded site could therefore sustain aggregate production for as much as 50 years or more.

Proposed project activities will be consistent with current quarry operations on the existing adjacent site. 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 six to ten 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 150 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 24 hrs/day, 5 days/week, 40 weeks/year or more, depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

Environmental Assessment Process

Alva Construction 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 Jacques Whitford Stantec Limited (JWSL), on behalf of Alva Construction 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 at least one waterbody/watercourse 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

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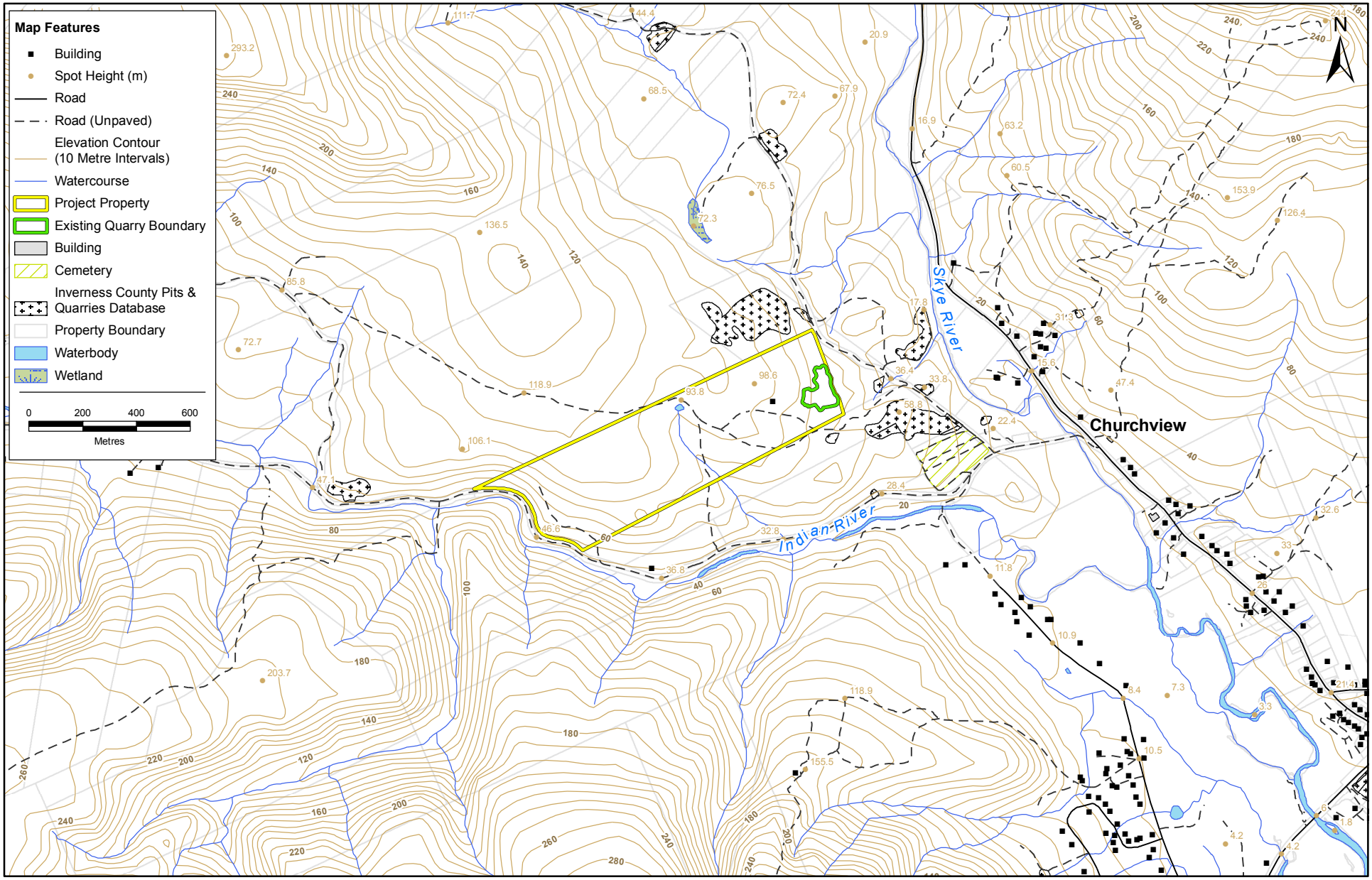

DATE: 05/05/2009	ALVA CONSTRUCTION LIMITED - WHYCOCOMAGH QUARRY	FIGURE NO: **Figure 1**
PREPARED BY: L. Kendell	**Proposed Extension Property**	
PROJECT NO.: 121510121		Stantec

APPENDIX E
AQUATIC PHOTO APPENDIX

Photo 1: WC-1 – Headwater Section) (in project area)

Photo 2: WC-1 – Headwater Section (in project area

Photo 3: WC-1 – Within Project Boundaries

Photo 4: WC-1 – Substrate within Project Boundaries

Photo 5: WC-1 – Example of steep gradient & cascade (in project area)

Photo 6: WC-1 - Upstream end of culverts under gravel road (outside project area)

Photo 7: WC-1 – Pool and vertical rock face immediately upstream of gravel road (outside project area)

Photo 8: WC-1 – Cascade over digger logs downstream of gravel road; fish survey area (outside project area)

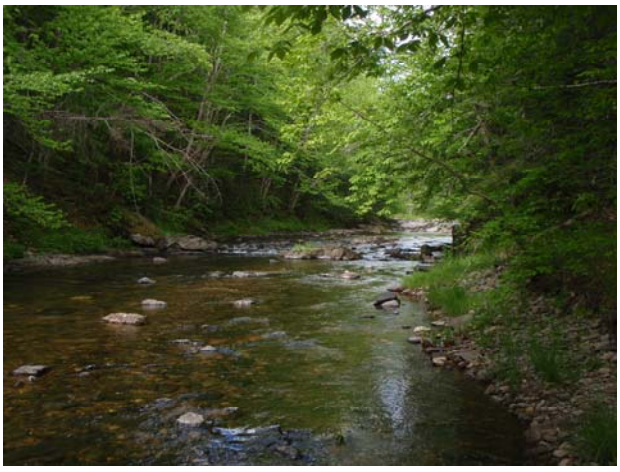

Photo 9: Indian River in vicinity of WC-1 outfall; fish survey area (outside project area)

Photo 10: Atlantic salmon caught in Indian River (Photo 9 area)

Photo 11: WC-2 – Headwater area (in project area)

Photo 12: WC-2 – Mid section, steep gradient (in project area)

Photo 13: WC-2 – Substrate (in project area)

Photo 14: WC-2 – Small cascade (in project area)

Photo 14: WC-2 meeting the gravel road ditch (outside project area)

Photo 15: WC-2 – Downstream end of culvert under gravel road, hanging and dry (upstream end buried)

APPENDIX F
Vascular Plants and Wildlife Identified in Study Area during Modelling and in the Field

F-1 Rare and Sensitive Species Modeling Results: Vascular Plants Potentially Found in the Project area

Binomial	Common Name	Preferred habitat	Season	ACCDC Rank	NSDNR Rank
Carex hystericina	Porcupine Sedge	Swamps, swales, and along brooks.	June to October	S1S2	RED
Carex tincta	Tinged Sedge	Rich soil, at edge of mixed woods in NS. Moist meadows, roadside ditches, borders and clearings in NB.	Not given for Nova Scotia	S1	RED
Elymus wiegandii	Wiegand's Wild Rye	Rich streambanks and meadows.	Flowers July and August, not readily noticeable until in bloom	S1	RED
Hypericum majus	Larger Canadian St. John's Wort	Wet or dry open soil.	July to September	S1	RED
Selaginella selaginoides	Low Spike-Moss	Moist areas bordering bog tussocks, peat bogs, and stream margins.	Produces spores in July and August. Likely identifiable when not snow covered but very easily overlooked	S2	RED
Stellaria crassifolia	Fleshy Stitchwort	Spring rills and the edges of ponds.	July and August	SH	RED
Utricularia resupinata	Northeastern Bladderwort	Ponds, lakes and river shores.	Flowers July to September, likely little noticeable or identifiable out of flower	S1	RED
Ageratina altissima	White Snakeroot	Woods, thickets.	July to October	S1	YELLOW
Alopecurus aequalis	Short-Awn Foxtail	Muddy margins of rivers and shallow ponds, and gravel margins where competitor species are few.	Summer	S2S3	YELLOW
Botrychium lanceolatum var. angustisegmentum	Lance-Leaf Grape-Fern	Rich wooded hillsides.	July and August. Can be identified until early October if sporophore is present	S2	YELLOW
Botrychium simplex	Least Grape-Fern	Usually on lakeshores or the mossy edges of streams or waterfalls although it has been reported in a wide variety of habitats.	Late May and June	S2S3	YELLOW
Campanula aparinoides	Marsh Bellflower	Meadows, ditches and river banks.	August	S3?	YELLOW
Carex tenera	Slender Sedge	Meadows, woodlands, and moist, dry openings.	Late May to August	S1S2	YELLOW
Coeloglossum viride var. virescens	Long-Bract Green Orchis	Boggy spots, damp mature woods, and fir or floodplain forests.	May to August	S2	YELLOW

F-1 Rare and Sensitive Species Modeling Results: Vascular Plants Potentially Found in the Project area

Binomial	Common Name	Preferred habitat	Season	ACCDC Rank	NSDNR Rank
Cypripedium parviflorum var. pubescens	Large Yellow Lady's-Slipper	Rich calcareous woodlands, also in drier sections of seepage fed wetlands or old beaver pond woodland.	Flowers in June. Plant identifiable from late May to October	S2	YELLOW
Epilobiumcoloratum	Purple-Leaf Willow-Herb	Low-lying ground, springy slopes and similar locations.	July and October. Seeds required for identification	S2?	YELLOW
Equisetum pratense	Meadow Horsetail	Open woods and wet meadows, usually in circumneutral soils.	Identifiable throughout the growing season	S2	YELLOW
Floerkea proserpinacoides	False Mermaid-Weed	Deciduous ravine slopes, river margins, and interval forests.	Late May to late June. Can be identified when not in flower	S2S3	YELLOW
Fraxinus nigra	Black Ash	Low ground, damp woods and swamps.	May and June. Can be identified without flowers	S3	YELLOW
Goodyera oblongifolia	Giant Rattlesnake-Plantain	Deciduous climax forest. Slopes in damp, mixed forests, and ravines.	Flowers in late summer. Identifiable earlier and into fall by it's long leaf blades with white midvein and sparse blotching	S2S3	YELLOW
Goodyera repens	Dwarf Rattlesnake-Plantain	Under conifers, growing with very few other plants.	Flowers July and August	S2S3	YELLOW
Hedeoma pulegioides	American Pennyroyal	Stony till and upland pastures, throughout northern part of NS. Near seashores occasionally.	August	S2S3	YELLOW
Hieracium robinsonii	Robinson's Hawkweed	Rock crevices and cliffs, cobble shores, and along streams.	Flowers July and August	S2	YELLOW
Hypericum dissimulatum	Disguised St. John's-Wort	On shores and damp open areas.	Not provided	S2S3	YELLOW
Impatiens pallida	Pale Jewel-Weed	Rich alluvial soils, damp thickets, and along intervals.	July and August	S2	YELLOW
Limosella australis	Mudwort	Low areas by ponds, gravel lakeshores, the muddy edges of ponds behind barrier beaches and muddy river margins.	Late June to October	S2S3	YELLOW
Megalodonta beckii	Beck Water-Marigold	Shallow, quiet waters, slow-moving streams, and ponds.	August and September	S3	YELLOW
Myriophyllum farwellii	Farwell's Water-Milfoil	Ponds and slow-moving streams.	Flowers June to September	S2	YELLOW
Piptatherum canadense	Canada Mountain-Ricegrass	Dry sandy soils.	Not provided	S2	YELLOW

F-1 Rare and Sensitive Species Modeling Results: Vascular Plants Potentially Found in the Project area

Binomial	Common Name	Preferred habitat	Season	ACCDC Rank	NSDNR Rank
Platanthera macrophylla	Large Round-Leaved Orchid	Rich old deciduous or mixed woods.	August	S2	YELLOW
Polygala sanguinea	Field Milkwort	Poor or acidic fields, damp slopes, and open woods or bush.	Late June to October	S2S3	YELLOW
Potamogeton obtusifolius	Blunt-Leaf Pondweed	Ponds, lakes, and slow-moving streams, often on a substrate of deep muck.	Flowers July to September	S2	YELLOW
Pyrola minor	Lesser Wintergreen	Characteristic of mature coniferous woods in northern Cape Breton.	Flowers in July and August	S2	YELLOW
Symphyotrichum ciliolatum	Lindley's Aster	Open fields, lawns and the edges of woods.	August and September	S2S3	YELLOW
Utricularia gibba	Humped Bladderwort	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
Zizia aurea	Common Alexanders	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites.	Flowers May and June but is identifiable until October	S1S2	YELLOW

Atlantic Canada Conservation Data Centre Species Rank Definitions	
S1	Extremely rare throughout its range in the province (typically 5 or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation.
S2	Rare throughout its range in the province (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.
S3	Uncommon throughout its range in the province, or found only in a restricted range, even if abundant at some locations. (21 to 100 occurrences).
S4	Usually widespread, fairly common throughout its range in the province, and apparently secure with many occurrences, but the Element is of long-term concern (e.g. watch list).
S5	Demonstrably widespread, abundant, and secure throughout its range in the province, and essentially ineradicable under present conditions.
S#S#	Numeric range rank: A range between two consecutive numeric ranks. Denotes uncertainty about the exact rarity of the species (*e.g.,* S1S2).
S#?	Inexact or uncertain ranking.
Nova Scotia Department of Natural Resources General Status Ranks	
red	Known to be or thought to be at risk.
Yellow	Sensitive to human activities or natural events.
Green	Not believed to be sensitive, or at risk.

Source: ACCDC 2009; NSDNR 2007

Table F-2 Population Status of Vascular Plants Recorded in Project area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Balsam Fir	*Abies balsamea*	S5	GREEN
Striped Maple	*Acer pensylvanicum*	S5	GREEN
red Maple	*Acer rubrum*	S5	GREEN
Sugar Maple	*Acer saccharum*	S5	GREEN
Mountain Maple	*Acer spicatum*	S5	GREEN
Common Yarrow	*Achillea millefolium*	S5	GREEN
red Baneberry	*Actaea rubra*	S5	GREEN
Tall Hairy Groovebur	*Agrimonia gryposepala*	S3?	GREEN
Colonial Bentgrass	*Agrostis capillaris*	SE	EXOTIC
Black Bentgrass	*Agrostis gigantea*	SE	EXOTIC
Rough Bentgrass	*Agrostis hyemalis*	S5	GREEN
Spreading Bentgrass	*Agrostis stolonifera*	S5SE	GREEN
Speckled Alder	*Alnus incana*	S5	GREEN
Serviceberry	*Amelanchier sp.*	n/a	n/a
Pearly Everlasting	*Anaphalis margaritacea*	S5	GREEN
Sweet Vernal Grass	*Anthoxanthum odoratum*	SE	EXOTIC
Bristly Sarsaparilla	*Aralia hispida*	S5	GREEN
Wild Sarsaparilla	*Aralia nudicaulis*	S5	GREEN
Lesser Burdock	*Arctium minus*	SE	EXOTIC
Whorled Aster	*Aster acuminatus*	S5	GREEN
White Panicled American-Aster	*Aster lanceolatus*	S4S5	GREEN
Farewell-Summer	*Aster lateriflorus*	S5	GREEN
New Belgium American-Aster	*Aster novi-belgii*	S5	GREEN
Swamp Aster	*Aster puniceus*	S5	GREEN
Parasol White-Top	*Aster umbellatus*	S5	GREEN
Lady-Fern	*Athyrium filix-femina*	S5	GREEN
Brachyelytrum septentrionale	*Bearded Short-Husk*	S4S5	GREEN
Yellow Birch	*Betula alleghaniensis*	S5	GREEN
Heart-Leaved Paper Birch	*Betula cordifolia*	S5	n/a
Paper Birch	*Betula papyrifera*	S5	GREEN
Gray Birch	*Betula populifolia*	S5	GREEN
Bearded Short-Husk	*Brachyelytrum erectum*	S4S5	GREEN
Hedge Bindweed	*Calystegia sepium*	S5	GREEN
Two-Leaf Toothwort	*Cardamine diphylla*	S4	GREEN
Pennsylvania Bitter-Cress	*Cardamine pensylvanica*	S5	GREEN
Black Sedge	*Carex arctata*	S5	GREEN
Bebb's Sedge	*Carex bebbii*	S1S2	RED
Brownish Sedge	*Carex brunnescens*	S5	GREEN
Hoary Sedge	*Carex canescens*	S5	GREEN
Fibrous-Root Sedge	*Carex communis*	S5	GREEN
White-Edge Sedge	*Carex debilis*	S5	GREEN
Short-Scale Sedge	*Carex deweyana*	S4	GREEN
Little Prickly Sedge	*Carex echinata*	S5	GREEN
Yellow Sedge	*Carex flava*	S5	GREEN
Graceful Sedge	*Carex gracillima*	S4S5	GREEN
Fringed Sedge	*Carex gynandra*	S5	GREEN
Bladder Sedge	*Carex intumescens*	S5	GREEN
Bristly-Stalk Sedge	*Carex leptalea*	S5	GREEN
Finely-Nerved Sedge	*Carex leptonervia*	S5	GREEN
New England Sedge	*Carex novae-angliae*	S5	GREEN
Rough Sedge	*Carex scabrata*	S5	GREEN
Pointed Broom Sedge	*Carex scoparia*	S5	GREEN

Table F-2 Population Status of Vascular Plants Recorded in Project area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Stalk-Grain Sedge	*Carex stipata*	S5	GREEN
Stalk-Grain Sedge	*Carex stipata*	S6	GREEN
Stalk-Grain Sedge	*Carex stipata*	S7	GREEN
Black Starthistle	*Centaurea nigra*	SE	EXOTIC
Oxeye Daisy	*Chrysanthemum leucanthemum*	SE	EXOTIC
Slender Wood Reedgrass	*Cinna latifolia*	S5	GREEN
Small Enchanter's Nightshade	*Circaea alpina*	S5	GREEN
Creeping Thistle	*Cirsium arvense*	SE	EXOTIC
Thistle	*Cirsium sp.*	n/a	n/a
Virginia Virgin-Bower	*Clematis virginiana*	S5	GREEN
Clinton Lily	*Clintonia borealis*	S5	GREEN
Goldthread	*Coptis trifolia*	S5	GREEN
Spotted Coralroot	*Corallorhiza maculata*	S4	GREEN
Alternate-Leaf Dogwood	*Cornus alternifolia*	S5	GREEN
Dwarf Dogwood	*Cornus canadensis*	S5	GREEN
Beaked Hazelnut	*Corylus cornuta*	S5	GREEN
Pink Lady's-Slipper	*Cypripedium acaule*	S5	GREEN
Poverty Oat-Grass	*Danthonia spicata*	S5	GREEN
Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	GREEN
Silvery Spleenwort	*Deparia acrostichoides*	S4	GREEN
Dutchman's Breeches	*Dicentra cucullaria*	S4	GREEN
Spinulose Shield Fern	*Dryopteris carthusiana*	S5	GREEN
Crested Shield-Fern	*Dryopteris cristata*	S5	GREEN
Evergreen Woodfern	*Dryopteris intermedia*	S5	GREEN
Marginal Wood-Fern	*Dryopteris marginalis*	S5	GREEN
Slender Spike-Rush	*Eleocharis tenuis*	S5	GREEN
Quackgrass	*Elymus repens*	SE	EXOTIC
Trailing Arbutus	*Epigaea repens*	S5	GREEN
Fireweed	*Epilobium angustifolium*	S5	GREEN
Hairy Willow-Herb	*Epilobium ciliatum*	S5	GREEN
Field Horsetail	*Equisetum arvense*	S5	GREEN
Woodland Horsetail	*Equisetum sylvaticum*	S5	GREEN
Daisy Fleabane	*Erigeron strigosus*	S5	GREEN
Spotted Joe-Pye Weed	*Eupatorium maculatum*	S5	GREEN
Common Boneset	*Eupatorium perfoliatum*	S5	GREEN
Spotted Spurge	*Euphorbia maculata*	SE	EXOTIC
Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	GREEN
American Beech	*Fagus grandifolia*	S5	GREEN
red Fescue	*Festuca rubra*	S5	GREEN
Virginia Strawberry	*Fragaria virginiana*	S5	GREEN
White Ash	*Fraxinus americana*	S5	GREEN
Lysimachia ciliata	*Fringed Loosestrife*	S4	GREEN
Brittle-Stem Hempnettle	*Galeopsis tetrahit*	SE	EXOTIC
Rough Bedstraw	*Galium asprellum*	S5	GREEN
Bedstaw	*Galium sp.*	n/a	n/a
Stiff Marsh Bedstraw	*Galium tinctorium*	S5	GREEN
Large-Leaved Avens	*Geum macrophyllum*	S5	GREEN
Purple Avens	*Geum rivale*	S5	GREEN
Avens	*Geum sp.*	n/a	n/a
Canada Manna-Grass	*Glyceria canadensis*	S5	GREEN
American Mannagrass	*Glyceria grandis*	S4S5	GREEN
Fowl Manna-Grass	*Glyceria striata*	S5	GREEN

Table F-2 Population Status of Vascular Plants Recorded in Project area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Northern Oak Fern	*Gymnocarpium dryopteris*	S5	GREEN
Meadow Hawkweed	*Hieracium caespitosum*	SE	EXOTIC
Common Hawkweed	*Hieracium lachenalii*	SE	EXOTIC
Mouseear	*Hieracium pilosella*	SE	EXOTIC
Hawkweed	*Hieracium sp.*	n/a	n/a
Smoothish Hawkweed	*Hieracium x floribundum*	SE	EXOTIC
Shining Fir-Clubmoss	*Huperzia lucidula*	S5	GREEN
American Water-Pennywort	*Hydrocotyle americana*	S5	GREEN
St. John's-Wort	*Hypericum perforatum*	SE	EXOTIC
Spotted Jewel-Weed	*Impatiens capensis*	S5	GREEN
Sharp-Fruit Rush	*Juncus acuminatus*	S3S4	UNDETERMINE
Narrow-Panicled Rush	*Juncus brevicaudatus*	S5	GREEN
Soft Rush	*Juncus effusus*	S5	GREEN
Slender Rush	*Juncus tenuis*	S5	GREEN
Viola labradorica	*Labrador Violet*	S5	GREEN
Tall Blue Lettuce	*Lactuca biennis*	S5	GREEN
American Larch	*Larix laricina*	S5	GREEN
Platanthera aquiilonis	*Leafy Northern Green Orchis*	S4?	GREEN
Autumn Hawkbit	*Leontodon autumnalis*	SE	EXOTIC
Twinflower	*Linnaea borealis*	S5	GREEN
Broad-Leaved Twayblade	*Listera convallarioides*	S3	GREEN
American Fly-Honeysuckle	*Lonicera canadensis*	S5	GREEN
Marsh Seedbox	*Ludwigia palustris*	S5	GREEN
Hairy Woodrush	*Luzula acuminata*	S5	GREEN
Common Woodrush	*Luzula multiflora*	S5	GREEN
Stiff Clubmoss	*Lycopodium annotinum*	S5	GREEN
Running Pine	*Lycopodium clavatum*	S5	GREEN
Treelike Clubmoss	*Lycopodium dendroideum*	S4?	GREEN
American Bugleweed	*Lycopus americanus*	S5	GREEN
Northern Bugleweed	*Lycopus uniflorus*	S5	GREEN
Purple Loosestrife	*Lythrum salicaria*	SE	EXOTIC
Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	GREEN
Ostrich Fern	*Matteuccia struthiopteris*	S5	GREEN
Indian Cucumber-Root	*Medeola virginiana*	S5	GREEN
Corn Mint	*Mentha arvensis*	S5	GREEN
Mint	*Mentha sp.*	n/a	n/a
Muskflower	*Mimulus moschatus*	S4SE	n/a
Partridge-Berry	*Mitchella repens*	S5	GREEN
Naked Bishop's-Cap	*Mitella nuda*	S5	GREEN
One-Flower Wintergreen	*Moneses uniflora*	S5	GREEN
Indian-Pipe	*Monotropa uniflora*	S5	GREEN
Small Forget-Me-Not	*Myosotis laxa*	S5	GREEN
Slender Naiad	*Najas flexilis*	S5	GREEN
Mountain Holly	*Nemopanthus mucronata*	S5	GREEN
Northern Evening-Primrose	*Oenothera parviflora*	S4?	GREEN
Small Sundrops	*Oenothera perennis*	S5	GREEN
Sensitive Fern	*Onoclea sensibilis*	S5	GREEN
Hairy Sweet-Cicely	*Osmorhiza claytonii*	S4S5	GREEN
Cinnamon Fern	*Osmunda cinnamomea*	S5	GREEN
Interrupted Fern	*Osmunda claytoniana*	S5	GREEN
White Wood-Sorrel	*Oxalis acetosella*	S5	GREEN
Upright Yellow Wood-Sorrel	*Oxalis stricta*	S5	GREEN

Table F-2 Population Status of Vascular Plants Recorded in Project area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Panic grass	*Panicum villosissimum*	n/a	n/a
Northern Beech Fern	*Phegopteris connectilis*	S5	GREEN
Meadow Timothy	*Phleum pratense*	SE	EXOTIC
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
Nipple-Seed Plantain	*Plantago major*	SE	EXOTIC
Green-Fringe Orchis	*Platanthera lacera*	S4S5	GREEN
Small Purple-Fringe Orchis	*Platanthera psycodes*	S4	GREEN
Fowl Bluegrass	*Poa palustris*	S5	GREEN
Kentucky Bluegrass	*Poa pratensis*	S5	GREEN
Drooping Bluegrass	*Poa saltuensis*	S4S5	GREEN
Scribner Bluegrass	*Poa trivialis*	SE	EXOTIC
Arrow-Leaved Tearthumb	*Polygonum sagittatum*	S5	GREEN
Christmas Fern	*Polystichum acrostichoides*	S5	GREEN
Braun's Holly-Fern	*Polystichum braunii*	S3S4	GREEN
Large-Tooth Aspen	*Populus grandidentata*	S5	GREEN
Quaking Aspen	*Populus tremuloides*	S5	GREEN
Floating Pondweed	*Potamogeton natans*	S5	GREEN
Oakes Pondweed	*Potamogeton oakesianus*	S4S5	GREEN
English Cinquefoil	*Potentilla anglica*	SE	EXOTIC
Norwegian Cinquefoil	*Potentilla norvegica*	S5	GREEN
Cinquefoil	*Potentilla sp.*	n/a	n/a
Tall Rattlesnake-root	*Prenanthes altissima*	S4S5	GREEN
Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	GREEN
Self-Heal	*Prunella vulgaris*	S5	GREEN
Fire Cherry	*Prunus pensylvanica*	S5	GREEN
Choke Cherry	*Prunus virginiana*	S5	GREEN
Bracken Fern	*Pteridium aquilinum*	S5	GREEN
Shinleaf	*Pyrola elliptica*	S5	GREEN
American Wintergreen	*Pyrola rotundifolia var. americana ameri*	S5	GREEN
One-Side Wintergreen	*Pyrola secunda*	S5	GREEN
Pyrola	*Pyrola sp.*	n/a	n/a
Common Apple	*Pyrus malus*	SE	EXOTIC
Tall Butter-Cup	*Ranunculus acris*	SE	EXOTIC
Creeping Butter-Cup	*Ranunculus repens*	SE	EXOTIC
Little Yellow-Rattle	*Rhinanthes crista-galli*	S5	GREEN
Skunk Currant	*Ribes glandulosum*	S5	GREEN
Bristly Black Currant	*Ribes lacustre*	S5	GREEN
Shining Rose	*Rosa nitida*	S4	GREEN
Rose	*Rosa sp.*	n/a	n/a
Bramble	*Rubus alleghaniensis*	S?	UNDETERMINE
Allegheny Blackberry	*Rubus allegheniensis*	S5	GREEN
Smooth Blackberry	*Rubus canadensis*	S5	GREEN
Bristly Dewberry	*Rubus hispidus*	S5	GREEN
red Raspberry	*Rubus idaeus*	S5	GREEN
European red Raspberry	*Rubus idaeus ssp. idaeus*	SE	n/a
Dwarf red Raspberry	*Rubus pubescens*	S5	GREEN
Sheep Sorrel	*Rumex acetosella*	SE	EXOTIC
Willow	*Salix sp.*	n/a	n/a

Table F-2 Population Status of Vascular Plants Recorded in Project area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Common Elderberry	*Sambucus canadensis*	S5	n/a
red Elderberry	*Sambucus racemosa*	S5	GREEN
Black-Girdle Bulrush	*Scirpus cyperinus*	S5	GREEN
Small-Fruit Bulrush	*Scirpus microcarpus*	S5	GREEN
Mad Dog Skullcap	*Scutellaria lateriflora*	S5	GREEN
Golden Groundsel	*Senecio aureus*	S4	GREEN
Tansy Ragwort	*Senecio jacobaea*	SE	EXOTIC
Robbins Squaw-Weed	*Senecio robbinsii*	S4S5	GREEN
Solomon's-Plume	*Smilacina racemosa*	S4S5	GREEN
Climbing Nightshade	*Solanum dulcamara*	SE	EXOTIC
Black Nightshade	*Solanum nigrum*	SE	EXOTIC
Black Nightshade	*Solanum ptychanthum*	SE?	EXOTIC
Canada Goldenrod	*Solidago canadensis*	S5	GREEN
Broad-Leaved Goldenrod	*Solidago flexicaulis*	S5	GREEN
Rough-Leaf Goldenrod	*Solidago rugosa*	S5	GREEN
American Mountain-Ash	*Sorbus americana*	S5	GREEN
Northern Mountain-Ash	*Sorbus decora*	S4	GREEN
American Bur-Reed	*Sparganium americanum*	S5	GREEN
Narrow-Leaf Burreed	*Sparganium emersum*	S5	GREEN
Little Starwort	*Stellaria graminea*	SE	EXOTIC
Common Dandelion	*Taraxacum officinale*	SE	EXOTIC
Tall Meadow-Rue	*Thalictrum pubescens*	S5	GREEN
New York Fern	*Thelypteris noveboracensis*	S5	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
White Clover	*Trifolium repens*	SE	EXOTIC
Nodding Trillium	*Trillium cernuum*	S4	GREEN
Painted Trillium	*Trillium undulatum*	S5	GREEN
Eastern Hemlock	*Tsuga canadensis*	S4S5	GREEN
Colt's Foot	*Tussilago farfara*	SE	EXOTIC
Narrow-Leaved Cattail	*Typha angustifolia*	S5	GREEN
Broad-Leaf Cattail	*Typha latifolia*	S5	GREEN
American Elm	*Ulmus americana*	S4	GREEN
Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	GREEN
Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	GREEN
Gypsy-Weed	*Veronica officinalis*	S5SE	EXOTIC
Marsh-Speedwell	*Veronica scutellata*	S5	GREEN
Thyme-Leaved Speedwell	*Veronica serpyllifolia*	S5	GREEN
Alderleaf Viburnum	*Viburnum alnifolium*	S5	GREEN
Possum-Haw Viburnum	*Viburnum nudum*	S5	GREEN
Tufted Vetch	*Vicia cracca*	SE	EXOTIC
Marsh Blue Violet	*Viola cucullata*	S5	GREEN
Smooth White Violet	*Viola macloskeyi*	S5	GREEN
Violet	*Viola sp.*	n/a	n/a

Table F-3 Rare and Sensitive Species Modeling Results: Wildlife Species

Binomial	Common Name	Preferred Habitat	Likely Onsight?	ACCDC Rank	NSDNR Rank	COSEWIC Rank	NS ESA Rank
Accipiter gentilis	Northern Goshawk	Mature coniferous and mixedwood forest generally remote from human habitation.	Possible	S3B	YELLOW	Not At Risk	
Acipenser oxyrinchus	Atlantic Sturgeon	Breeds in the upper reaches of the Delaware River; Adults return to the Atlantic Ocean following spawning; the young remain in fresh water for about four years and then move to ocean waters to mature.	Unlikely	S1?	RED		
Alca torda	Razorbill	Coastal cliffs.	Unlikely	S1B,SZN	YELLOW		
Alces americanus	Moose (Mainland Population)	Woodlands providing both mature softwood cover and young hardwood browse. Also swamps, bogs and lakeshores, generally remote from human habitation.	Unlikely	S1	RED		Endangered
Asio flammeus	Short-eared Owl	Nests on the ground in open country. An open hayfield is often chosen as a nest site.	Unlikely	S1S2B	YELLOW	Special Concern	
Calidris canutus rufa	Red Knot (rufa subspecies)	Breeds in drier tundra areas, such as sparsely vegetated hillsides. Intertidal, marine habitats, especially near coastal inlets, estuaries, and bays.	Unlikely	S3M	YELLOW	Endangered	
Calidris maritima	Purple Sandpiper	Breeds along low tundra near shorelines, as well as gravel beaches along rivers. Winters along rocky coastlines and man-made jetties.	Unlikely	S2N	YELLOW		
Catharus bicknelli	Bicknell's Thrush	Regenerating clear-cuts and coastal areas with spruce-fir at low elevations	Unlikely	S1S2B	YELLOW	Vulnerable	
Charadrius melodus	Piping Plover	Coastal sand and gravel beaches.	Unlikely	S1B	RED	Endangered	Endangered
Dolichonyx oryzivorus	Bobolink	Fields with dense grass cover, particularly hay fields.	Unlikely	S3B	YELLOW		

Table F-3 Rare and Sensitive Species Modeling Results: Wildlife Species

Binomial	Common Name	Preferred Habitat	Likely Onsight?	ACCDC Rank	NSDNR Rank	COSEWIC Rank	NS ESA Rank
Euphagus carolinus	Rusty Blackbird	Boreal forest; forest wetlands, such as slowmoving streams, peat bogs, sedge meadows, marshes, swamps, beaver ponds and pasture edges.	Unlikely	S3B	YELLOW	Special Concern	
Fratercula arctica	Atlantic Puffin	During the summer, reside on rocky cliffs of the North Atlantic and northern Europe. They winter far at sea on deep, icy water and are seldom seen within sight of land until March.	Unlikely	S1B	YELLOW		
Glyptemys insculpta	Wood Turtle	Found along streams and wetlands. Gravel bars, tall shrub swamps, deep pools in wetlands. May also nest in gravel pits.	Possible	S3	YELLOW	Threatened	Vulnerable
Lynx canadensis	Lynx	Live deep in coniferous forests near rocky areas, bogs and swamps.	Possible	S1	RED	Not At Risk	Endangered
Martes americana	American Marten	Large contiguous patches of mature coniferous or mixedwood forest	Possible	S1	RED		Endangered
Martes pennanti	Fisher	Large tracts of mature coniferous or mixedwood forest	Possible	S2	YELLOW		
Morone saxatilis	Striped Bass	Estuaries and coastal waters.	Unlikely	S1	RED	Threatened	
Nycticorax nycticorax	Black-crowned Night-heron	Freshwater pools, marshes, streams and estuaries.	Unlikely	S1B	YELLOW		
Pooecetes gramineus	Vesper Sparrow	Areas of low grass or shrubs such as pastures, blueberry fields and clearings. Most frequently found in blueberry fields in Nova Scotia.	Unlikely	S2S3B	YELLOW		
Salmo salar	Atlantic Salmon	Landlocked or anadromous population.	Unlikely	S2	RED	Endangered	
Sialia sialis	Eastern Bluebird	Open woodlands, clearings, farmlands, parks, orchards, gardens, fields, along roadsides on utility wires and fences.	Unlikely	S2S3B	YELLOW	Not At Risk	

Table F-3 Rare and Sensitive Species Modeling Results: Wildlife Species

Binomial	Common Name	Preferred Habitat	Likely Onsight?	ACCDC Rank	NSDNR Rank	COSEWIC Rank	NS ESA Rank
Sorex gaspensis	Gaspé Shrew	Colchester and Cumberland Counties.	Unlikely	S2	YELLOW	Not At Risk	
Sterna dougallii	Roseate Tern	Few islands off the Atlantic coast of Nova Scotia. Found in colonies.	Unlikely	S1B	RED	Endangered	Endangered
Sterna hirundo	Common Tern	Coastal and freshwater islands, coastal beaches and salt marshes.	Unlikely	S3B	YELLOW	Not At Risk	
Sterna paradisaea	Arctic Tern	Coastal islands, beaches and salt marshes. May occasionally nest on islands in lakes.	Unlikely	S3B	YELLOW		
Atlantic Canada Conservation Data Centre Species Rank Definitions							
S1	Extremely rare throughout its range in the province (typically 5 or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation.						
S2	Rare throughout its range in the province (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.						
S3	Uncommon throughout its range in the province, or found only in a restricted range, even if abundant at some locations. (21 to 100 occurrences).						
S4	Usually widespread, fairly common throughout its range in the province, and apparently secure with many occurrences, but the Element is of long-term concern (e.g. watch list).						
S5	Demonstrably widespread, abundant, and secure throughout its range in the province, and essentially ineradicable under present conditions.						
S#S#	Numeric range rank: A range between two consecutive numeric ranks. Denotes uncertainty about the exact rarity of the species (*e.g.,* S1S2).						
S#?	Inexact or uncertain ranking.						
Nova Scotia Department of Natural Resources General Status Ranks							
RED	Known to be or thought to be at risk.						
YELLOW	Sensitive to human activities or natural events.						
GREEN	Not believed to be sensitive, or at risk.						

Source: ACCDC 2009; NSDNR 2007

APPENDIX G
Population Status and Location of Select Vascular Plants Recorded in Study Area

Table G-1 Population Status and Location of Select Vascular Plants Species

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	Westing	Northing
Bebb's Sedge	*Carex bebbii*	S1S2	RED	642370.65	5094142.18
Broad-Leaved Twayblade	*Listera convallarioides*	S3	GREEN	642125.83	5093814.72
Broad-Leaved Twayblade	*Listera convallarioides*	S3	GREEN	642131.31	5093806.69
Tall Hairy Groovebur	*Agrimonia gryposepala*	S3?	GREEN	642485.71	5094137.43
Tall Hairy Groovebur	*Agrimonia gryposepala*	S3?	GREEN	642227.21	5094061.80
Sharp-Fruit Rush	*Juncus acuminatus*	S3S4	UNDETERMINED	642377.89	5094153.10
Sharp-Fruit Rush	*Juncus acuminatus*	S3S4	UNDETERMINED	642232.38	5094050.25
Braun's Holly-Fern	*Polystichum braunii*	S3S4	GREEN	623578.48	5053396.31
Boreal Chickadee	*Poecile hudsonica*	S4	YELLOW	642520.02	5094088.75

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

Table H-1 Breeding Status and Population Status of Birds Recorded in the Project area and the Breeding Bird Atlas Square within which the Project area is Located (20PR49)

Common Name	Scientific Name	NSDNR Rank	ACCDC Rank	Breeding Status (BBA Data)	Breeding Status (Field Surveys)
Alder Flycatcher	*Empidonax alnorum*	Green	S5B	Possible	Possible
American Black Duck	*Anas rubripes*	Green	S5B	Confirmed	Not Observed
American Crow	*Corvus brachyrhynchos*	Green	S5	Confirmed	Not Observed
American Goldfinch	*Carduelis tristis*	Green	S5	Probable	Observed
American Redstart	*Setophaga ruticilla*	Green	S5B	Probable	Probable
American Robin	*Turdus migratorius*	Green	S5B	Confirmed	Confirmed
Bald Eagle	*Haliaeetus leucocephalus*	Green	S5B	Possible	Not Observed
Barred Owl	*Strix varia*	Green	S5	Possible	Not Observed
Belted Kingfisher	*Ceryle alcyon*	Green	S5B	Possible	Observed
Black-and-white Warbler	*Mniotilta varia*	Green	S5B	Probable	Possible
Blackburnian Warbler	*Dendroica fusca*	Green	S4S5B	Probable	Possible
Black-capped Chickadee	*Parus atricapillus*	Green	S5	Probable	Probable
Black-throated Green Warbler	*Dendroica virens*	Green	S5B	Probable	Possible
Blue Jay	*Cyanocitta cristata*	Green	S5	Confirmed	Possible
Blue-winged Teal	*Anas discors*	Green	S4B	Confirmed	Not Observed
Boreal Chickadee	*Poecile hudsonica*	Yellow	S4	Probable	Observed
Brown Creeper	*Certhia americana*	Green	S5	Not Observed	Possible
Canada Goose	*Branta canadensis*	Green	S4B	Confirmed	Not Observed
Cedar Waxwing	*Bombycilla cedrorum*	Green	S5B	Probable	Possible
Chestnut-sided Warbler	*Dendroica pensylvanica*	Green	S5B	Probable	Not Observed
Chipping Sparrow	*Spizella passerina*	Green	S5B	Probable	Not Observed
Common Grackle	*Quiscalus quiscula*	Green	S5B	Confirmed	Observed
Common Merganser	*Mergus merganser*	Green	S5B	Possible	Not Observed
Common Raven	*Corvus corax*	Green	S5	Possible	Observed
Common Yellowthroat	*Geothlypis trichas*	Green	S5B	Confirmed	Not Observed
Dark-eyed Junco	*Junco hyemalis*	Green	S5	Probable	Possible
Downy Woodpecker	*Picoides pubescens*	Green	S5	Probable	Not Observed
Eastern Wood-Pewee	*Contopus virens*	Green	S4B	Possible	Not Observed
European Starling	*Sturnus vulgaris*	Exotic	SE	Confirmed	Not Observed
Golden-crowned Kinglet	*Regulus satrapa*	Green	S5B	Confirmed	Possible
Green-winged Teal	*Anas crecca*	Green	S5B	Confirmed	Not Observed
Hairy Woodpecker	*Picoides villosus*	Green	S5	Possible	Possible
Hermit Thrush	*Catharus guttatus*	Green	S5B	Possible	Possible
Least Flycatcher	*Empidonax minimus*	Green	S5B	Possible	Possible
Lincoln's Sparrow	*Melospiza lincolnii*	Green	S5B	Not Observed	Probable
Magnolia Warbler	*Dendroica magnolia*	Green	S5B	Confirmed	Probable
Mourning Warbler	*Oporornis philadelphia*	Green	S5B	Probable	Probable
Northern Flicker	*Colaptes auratus*	Green	S5B	Probable	Probable
Northern Harrier	*Circus cyaneus*	Green	S5B	Possible	Not Observed
Northern Parula Warbler	Parula americana	Green	S5B	Probable	Possible
Northern Waterthrush	*Seiurus noveboracensis*	Green	S5B	Possible	Not Observed
Olive-sided Flycatcher	*Contopus cooperi*	Yellow	S4B	Possible	Not Observed
Ovenbird	*Seiurus aurocapillus*	Green	S5B	Possible	Possible
Pileated Woodpecker	*Dryocopus pileatus*	Green	S5	Probable	Possible

Table H-1 Breeding Status and Population Status of Birds Recorded in the Project area and the Breeding Bird Atlas Square within which the Project area is Located (20PR49)

Common Name	Scientific Name	NSDNR Rank	ACCDC Rank	Breeding Status (BBA Data)	Breeding Status (Field Surveys)
Pine Siskin	*Carduelis pinus*	Green	S5	Probable	Not Observed
Purple Finch	*Carpodacus purpureus*	Green	S5B	Probable	Possible
red-breasted Nuthatch	*Sitta canadensis*	Green	S5	Possible	Not Observed
red-eyed Vireo	*Vireo olivaceus*	Green	S5B	Probable	Possible
red-tailed Hawk	*Buteo jamaicensis*	Green	S5B	Possible	Not Observed
red-winged Blackbird	*Agelaius phoeniceus*	Green	S5B	Confirmed	Not Observed
Ring-necked Duck	*Aythya collaris*	Green	S5B	Probable	Not Observed
Rock Pigeon	*Columba livia*	Not Assessed	SEB	Possible	Not Observed
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Green	S4B	Probable	Possible
Ruby-crowned Kinglet	*Regulus calendula*	Green	S5B	Probable	Possible
Ruby-throated Hummingbird	*Archilochus colubris*	Green	S5B	Probable	Observed
Ruffed Grouse	*Bonasa umbellus*	Green	S5	Possible	Probable
Solitary Vireo - Blue-headed Vireo	*Vireo solitarius*	Green	S5B	Probable	Possible
Song Sparrow	*Melospiza melodia*	Green	S5B	Probable	Possible
Spotted Sandpiper	*Actitis macularia*	Green	S5B	Probable	Not Observed
Swainson's Thrush	*Catharus ustulatus*	Green	S5B	Possible	Possible
Swamp sparrow	*Melospiza georgiana*	Green	S5B	Confirmed	Not Observed
Tree Swallow	*Tachycineta bicolor*	Green	S5B	Possible	Not Observed
Veery	*Catharus fuscescens*	Green	S5B	Possible	Not Observed
White-breasted Nuthatch	*Sitta carolinensis*	Green	S4	Possible	Not Observed
White-throated Sparrow	*Zonotrichia albicollis*	Green	S5B	Probable	Possible
White-winged Crossbill	*Loxia leucoptera*	Undetermined	S5	Probable	Not Observed
Wilson's Snipe	*Gallinago delicata*	Green	S5B	Possible	Not Observed
Wilson's Warbler	*Wilsonia pusilla*	Green	S4B	Possible	Not Observed
Yellow Warbler	*Dendroica petechia*	Green	S5B	Possible	Not Observed
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Green	S5B	Possible	Possible
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Green	S5B	Possible	Not Observed
Yellow-rumped Warbler	*Empidonax flaviventris*	Green	S5B	Probable	Not Observed

APPENDIX I
Plants Recorded within Wetlands

Table I-1 Vascular Plants Recorded within Wetlands of the Project Area

Common Name	Scientific Name	Wetland 1	Wetland 2	Wetland 3	Wetland 4
Balsam Fir	*Abies balsamea*		P	P	P
red Maple	*Acer rubrum*			P	P
Sugar Maple	*Acer saccharum*				P
Tall Hairy Groovebur	*Agrimonia gryposepala*	P		P	
Black Bentgrass	*Agrostis gigantea*				P
Spreading Bentgrass	*Agrostis stolonifera*		P	P	
Speckled Alder	*Alnus incana*		P	P	
Sweet Vernal Grass	*Anthoxanthum odoratum*				P
Whorled Aster	*Aster acuminatus*				P
White Panicled American-Aster	*Aster lanceolatus*	P	P	P	P
New Belgium American-Aster	*Aster novi-belgii*		P		P
Swamp Aster	*Aster puniceus*	P	P	P	
Parasol White-Top	*Aster umbellatus*		P	P	P
Lady-Fern	*Athyrium filix-femina*	P		P	P
Yellow Birch	*Betula alleghaniensis*				P
Heart-Leaved Paper Birch	*Betula cordifolia*			P	P
Paper Birch	*Betula papyrifera*		P		P
Hedge Bindweed	*Calystegia sepium*	P	P		
Bebb's Sedge	*Carex bebbii*		P		
Hoary Sedge	*Carex canescens*	P		P	
Little Prickly Sedge	*Carex echinata*		P	P	P
Yellow Sedge	*Carex flava*			P	P
Graceful Sedge	*Carex gracillima*				P
Fringed Sedge	*Carex gynandra*		P	P	P
Bladder Sedge	*Carex intumescens*			P	
Bristly-Stalk Sedge	*Carex leptalea*	P	P	P	P
Pointed Broom Sedge	*Carex scoparia*		P	P	
Stalk-Grain Sedge	*Carex stipata*	P	P	P	P
Small Enchanter's Nightshade	*Circaea alpina*	P		P	
Thistle	*Cirsium sp.*			P	P
Virginia Virgin-Bower	*Clematis virginiana*				P
Clinton Lily	*Clintonia borealis*			P	
Dwarf Dogwood	*Cornus canadensis*				P
Mountain Wood-Fern	*Dryopteris campyloptera*		P		
Spinulose Shield Fern	*Dryopteris carthusiana*	P		P	P
Crested Shield-Fern	*Dryopteris cristata*			P	P
Evergreen Woodfern	*Dryopteris intermedia*	P	P		
Slender Spike-Rush	*Eleocharis tenuis*		P	P	
Fireweed	*Epilobium angustifolium*				P
Hairy Willow-Herb	*Epilobium ciliatum*		P		
Field Horsetail	*Equisetum arvense*		P	P	
Woodland Horsetail	*Equisetum sylvaticum*			P	
Spotted Joe-Pye Weed	*Eupatorium maculatum*	P	P	P	P
Common Boneset	*Eupatorium perfoliatum*		P	P	
Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*		P	P	P
Virginia Strawberry	*Fragaria virginiana*		P	P	P
White Ash	*Fraxinus americana*			P	

Table I-1 Vascular Plants Recorded within Wetlands of the Project Area

Common Name	Scientific Name	Wetland 1	Wetland 2	Wetland 3	Wetland 4
Brittle-Stem Hempnettle	*Galeopsis tetrahit*	P			
Rough Bedstraw	*Galium asprellum*				P
Bedstaw	*Galium sp.*		P		
Stiff Marsh Bedstraw	*Galium tinctorium*	P		P	P
Avens	*Geum sp.*			P	P
American Mannagrass	*Glyceria grandis*	P			
Fowl Manna-Grass	*Glyceria striata*	P	P	P	P
American Water-Pennywort	*Hydrocotyle americana*			P	P
Spotted Jewel-Weed	*Impatiens capensis*		P	P	
Sharp-Fruit Rush	*Juncus acuminatus*		P	P	
Narrow-Panicled Rush	*Juncus brevicaudatus*		P	P	
Soft Rush	*Juncus effusus*		P	P	P
American Larch	*Larix laricina*			P	
Marsh Seedbox	*Ludwigia palustris*		P		
Common Woodrush	*Luzula multiflora*				P
American Bugleweed	*Lycopus americanus*		P	P	P
Northern Bugleweed	*Lycopus uniflorus*	P	P	P	P
Purple Loosestrife	*Lythrum salicaria*		P		
Wild Lily-of-The-Valley	*Maianthemum canadense*			P	P
Ostrich Fern	*Matteuccia struthiopteris*	P			
Corn Mint	*Mentha arvensis*	P	P		
Muskflower	*Mimulus moschatus*		P	P	
Naked Bishop's-Cap	*Mitella nuda*		P		
Small Forget-Me-Not	*Myosotis laxa*		P	P	P
Slender Naiad	*Najas flexilis*		P		
Sensitive Fern	*Onoclea sensibilis*	P	P	P	P
Hairy Sweet-Cicely	*Osmorhiza claytonii*				P
Cinnamon Fern	*Osmunda cinnamomea*			P	P
Upright Yellow Wood-Sorrel	*Oxalis stricta*		P	P	
Northern Beech Fern	*Phegopteris connectilis*			P	
White Spruce	*Picea glauca*		P	P	
Black Spruce	*Picea mariana*				P
Green-Fringe Orchis	*Platanthera lacera*			P	
Small Purple-Fringe Orchis	*Platanthera psycodes*			P	P
Kentucky Bluegrass	*Poa pratensis*			P	
Scribner Bluegrass	*Poa trivialis*	P			
Arrow-Leaved Tearthumb	*Polygonum sagittatum*	P	P	P	P
Christmas Fern	*Polystichum acrostichoides*			P	
Quaking Aspen	*Populus tremuloides*			P	
Floating Pondweed	*Potamogeton natans*		P		
English Cinquefoil	*Potentilla anglica*				P
Cinquefoil	*Potentilla sp.*		P		
Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*				P
Self-Heal	*Prunella vulgaris*			P	P
Choke Cherry	*Prunus virginiana*				P
Creeping Butter-Cup	*Ranunculus repens*	P	P	P	P

Table I-1 Vascular Plants Recorded within Wetlands of the Project Area

Common Name	Scientific Name	Wetland 1	Wetland 2	Wetland 3	Wetland 4
Bristly Black Currant	*Ribes lacustre*	P			P
Shining Rose	*Rosa nitida*		P	P	P
Rose	*Rosa sp.*			P	
Smooth Blackberry	*Rubus canadensis*	P	P		
red Raspberry	*Rubus idaeus*	P		P	P
Dwarf red Raspberry	*Rubus pubescens*		P	P	P
Willow	*Salix sp.*		P	P	
Common Elderberry	*Sambucus canadensis*	P	P		P
Black-Girdle Bulrush	*Scirpus cyperinus*				P
Small-Fruit Bulrush	*Scirpus microcarpus*		P	P	
Mad Dog Skullcap	*Scutellaria lateriflora*	P	P		
Golden Groundsel	*Senecio aureus*				P
Tansy Ragwort	*Senecio jacobaea*		P	P	
Climbing Nightshade	*Solanum dulcamara*	P	P		
Canada Goldenrod	*Solidago canadensis*	P		P	P
Rough-Leaf Goldenrod	*Solidago rugosa*	P	P	P	P
American Bur-Reed	*Sparganium americanum*		P		
Narrow-Leaf Burreed	*Sparganium emersum*		P		
Common Dandelion	*Taraxacum officinale*		P	P	
Tall Meadow-Rue	*Thalictrum pubescens*			P	
New York Fern	*Thelypteris noveboracensis*		P	P	P
Colt's Foot	*Tussilago farfara*		P		P
Narrow-Leaved Cattail	*Typha angustifolia*		P		
Broad-Leaf Cattail	*Typha latifolia*	P			
Marsh-Speedwell	*Veronica scutellata*		P		
Violet	*Viola sp.*			P	