Jacques Whitford

Engineering, Scientific, Planning and Management Consultants

3 Spectacle Lake Drive
Dartmouth NS
Canada B3B 1W8

Bus 902 468 7777
Fax 902 468 9009

www.jacqueswhitford.com

REPORT

Environmental Assessment Registration, Rhodena Rock Quarry Expansion Project

RHODENA ROCK LIMITED

PROJECT NO. SD19574.

PROJECT NO. NS19574.

REPORT TO **Rhodena Rock Limited**
PO Box 130
Port Hood, Nova Scotia
B0E 2W0

FOR **Environmental Assessment Registration Rhodena Rock Quarry Expansion Project**

March 23, 2006

Jacques Whitford
3 Spectacle Lake Drive
Dartmouth, Nova Scotia,
B3B 1W8

Phone: 902-468-7777
Fax: 902-468-9009

www.jacqueswhitford.com

Jacques Whitford

EXECUTIVE SUMMARY

Rhodena Rock Limited proposes to expand the footprint of its existing quarry at Porcupine Mountain, Guysborough County, Nova Scotia. The proposal will allow continued aggregate production (blasting, crushing and stockpiling) to supply local construction contracting needs. Quarry advancement and aggregate production at the quarry is limited by the need for additional quarry area beyond the existing permitted area. The proposed activities will take place over the next number of years (potentially as many as 40 years) involving a total of approximately 62.8 ha of land immediately adjacent to the existing quarry.

The quarry opened in 1999 and produces a variety of aggregate types. The current and anticipated average production rate is 300,000 tonnes per year, and may increase according to market demand. The current and anticipated operating schedule is 12 hrs/day, 6 days/week, or 24 hrs/day, 7 days/week, if required; on a year-round basis and weather permitting.

Proposed project activities will be consistent with current quarry operations approved by Nova Scotia Environment and Labour and in accordance with the Nova Scotia Pit and Quarry Guidelines (NSEL 1999). Aggregate production will begin with drilling and blasting, which will be conducted by a qualified blasting contractor. Blasting will take place approximately two times per year, and occasionally more frequently. After blasting, portable crushing equipment will be brought to the site to process the blasted rock as required. Various products (*i.e.*, various aggregate sizes) will be stockpiled at the quarry site until they are sold and transported to local markets via tandem trucks or tractor trailer trucks. The primary markets for the products are general construction and development projects and municipal water and sewer projects in Nova Scotia. Future markets may include provincial highway construction and maintenance projects.

Rhodena Rock Limited 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 Industrial Approval from NSEL for the quarry operation, and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (2003). Provincial guidelines to be adhered to include the Nova Scotia Pit and Quarry Guidelines (NSEL 1999).

This environmental assessment registration evaluates the potential environmental effects of the Project and identifies appropriate mitigation and monitoring to minimize these effects. The document focuses on those aspects of the environment of most concern. Components evaluated include:

- fish and fish habitat;
- rare and sensitive flora;
- wetlands;
- wildlife;
- groundwater resources;
- archaeological and heritage resources;
- air quality; and
- socio-economic environment.

Environmental effects from the quarry expansion will include the loss of terrestrial habitat within the quarry footprint. This area does not include unique habitat or rare or sensitive species; therefore, these effects are not anticipated to be significant. 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 or socio-economic effects are likely.

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1.0 PROPONENT AND PROJECT IDENTIFICATION

1.1 Proponent Information

Name of the Proponent: Rhodena Rock Limited
Postal Address: P.O. Box 130
Port Hood, NS
B0E 2W0
Tel.: (902) 945-2300
Fax: (902) 945-2087

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

Company President and/or Environmental Assessment Contact

Name: Ted vanZutphen
Official Title: Company President
Address: As above
Tel.: (902) 945-2300
Fax: (902) 945-2087

Environmental Consultant Contact

Name: Angela Swaine
Official Title: Project Manager
Address: Jacques Whitford Limited
3 Spectacle Lake Drive
Dartmouth, NS B3B 1W8
Tel.: (902) 468-7777
Fax: (902) 468-9009

Ted van Zutphen
Signature of President

March 22. 06
Date

1.2 Project Information

Name of the Undertaking: Rhodena Rock Quarry Expansion Project
Location of the Undertaking: Porcupine Mountain, Guysborough County, NS

2.0 PROJECT INFORMATION

2.1 Description of the Undertaking

Rhodena Rock Limited (Rhodena Rock, the Proponent) owns and operates Rhodena Rock Quarry, located at Porcupine Mountain, Guysborough County, Nova Scotia (Figure 2.1). An Industrial Approval (No. 99-IAE-004 – Amendment 1), pursuant to Division V of the Activities Designation Regulations, was issued by Nova Scotia Environment and Labour (NSEL) on April 20, 1999. This permit allows for construction and operation of a quarry for which the area does not exceed four hectares in area. A copy of the permit is appended to this report (Appendix A).

Rhodena Rock proposes to expand its quarry to allow for continued aggregate production (blasting, crushing and stockpiling) and intends to supply their own construction contracting needs. The Proponent owns the existing quarry lands as well as the surrounding proposed expansion land area, which will effectively allow for the expansion. The existing quarry opened in 1999 and was operated by LaFarge Canada (although Rhodena Rock was the owner). The quarry operations were taken over by Rhodena Rock in 2004.

As a result of field and desktop studies undertaken in support of this environmental registration report, the expansion area has been carefully considered so as to minimize potential environmental impacts to the wetland located southwest of the existing permitted area.

The anticipated average production rate is 300,000 tonnes per year, and may increase according to market demand. The current and anticipated operating schedule is 12 hrs/day, 6 days/week, or 24 hrs/day, 7 days/week if required; on a year-round basis and weather permitting. Estimated rock reserves in the proposed expansion area is in excess of 40 million tonnes. Quarry operations will continue to take place over the next number of years (potentially as many as 40 years) depending upon the demand for aggregate in the area.

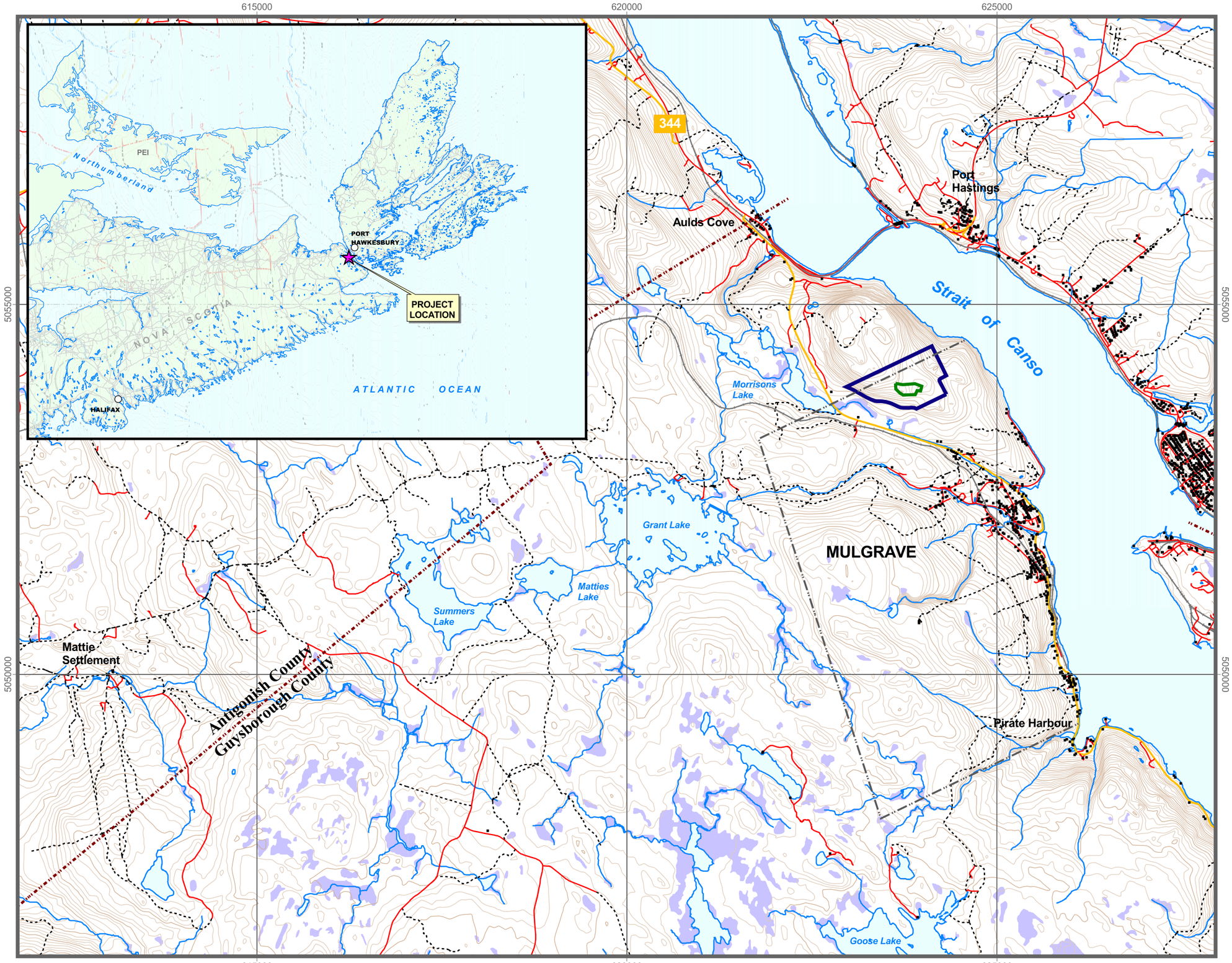
2.2 Geographical Location

The quarry is located at Porcupine Mountain, Route 344, Guysborough County, Nova Scotia (Figure 2.1). Entrance to the quarry is via a privately owned access road located off Route 344. The quarry and proposed quarry expansion area are situated on lands that have been recently clear cut (*i.e.*, within the past three to five years). The proposed expansion area supports a number of habitat types including mature second growth mixedwood and coniferous forest, immature mixedwood forest, barrens, disturbed areas, and wetlands. Generally, the proposed quarry expansion area is bound to the north, east and south by lands owned by Martin Marietta Materials Canada Limited, with an operational quarry to the northwest. A wetland and Route 344 are located southwest of the proposed quarry expansion.

Residential development in the immediate vicinity of the Project is relatively low, with the closest structure 230 m away, and approximately 15 residences/structures within 800 m. The nearest communities are Port Hastings, approximately 1.5 km away (across the Strait of Canso), Aulds Cove, approximately 2.9 km to the north, Mulgrave approximately 2.2 km to the south and Mattie Settlement approximately 11.8 km to the west (Figure 2.1).

Rhodena Rock Quarry Expansion Project

Figure 2.1
Project Location



Legend

Quarry Development
- Proposed Quarry Expansion Site
- Approved Area

Topography
- Building
- Property Boundary
- Contour
- Watercourse
- Wetlands
- Waterbody
- Land

Roads
- Bridge
- Major Highway
- Collector Highway
- Paved Road
- Unpaved Road
- Rail

N

0 500 1000 1500 2000

Meters

Map Parameters
Projection: UTM-NAD83-Z20
Scale - 1:50,000
Proposal: SD19574
Date: March 2006

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2.3 Physical Components

The existing quarry operations consist of a laydown area for the portable crushing equipment, various aggregate stockpiles, quarry floor and working face, settling pond, scale and scale house, and access road. There is no fuel storage, storage of dangerous goods, pipelines, port facility or railway associated with the existing facility and none are proposed for the quarry expansion.

Topsoil and overburden that have been striped prior to drilling and blasting are stored on site for subsequent use during site reclamation. The piles have been hydroseeded to reduce potential for erosion and sedimentation. This practice will continue throughout the development and operation of the proposed expansion area.

The laydown area is located on the quarry floor. The crushing equipment is transported to the site as required (*i.e.,* after blasting). Aggregate stockpiles are currently located at various locations within the quarry limits, as space allows. As the quarry expands and additional space on the quarry floor is created, a dedicated stockpile area will be established. Surface runoff and quarry drainage are collected on the quarry floor, which has the capacity to hold a significant quantity of water. Currently, overflow from the quarry floor drains to a settling pond located to the west of the existing operation. Two more settling pond areas will be developed with the expansion, one to the north of the quarry and one to the southeast (as indicated in Appendix B). Overflow from the existing pond is currently directed to an unnamed stream in a southward direction, while overflow from the northern pond will be directed in a northern direction, and overflow from the southeastern pond will be directed south.

The nearest residence is approximately 230 m from the boundary of the proposed quarry expansion limits. As shown in Figure 2.2, there are 15 residence/structures within 800 m. The general direction of quarry advancement will be northwest. Rock will be sampled and tested regularly to confirm the suitability of the aggregate and confirm that acid generating rock has/will not be encountered/disturbed. To date, quarry rock sampled and analyzed was not acid producing (refer to Section 5.6).

2.4 Site Preparation and Construction

Rhodena Rock purchased the property in 1999. The quarry was operated by LaFarge Canada from 1999 to 2004, when Rhodena Rock Limited took over operations. Access to the existing quarry development is along existing roads, likely constructed during earlier industrial activities. The quarry access road was upgraded in order to accommodate the truck traffic. Drainage ditches were installed along the access road to maintain drainage.

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 stabilization procedures will continue throughout the operations of the proposed expansion.

Rhodena Rock Quarry Expansion Project

Figure 2.2

Buildings & Water Supplies Within 800m

622000 623000 624000 625000

5055000 5054000 5053000

N

344

Strait of Canso

Approximate Extent of Martin Marietta Quarry

35173129

35173111

35018936

35019058

35125764

35125699

35097252

Morrisons Lake

Private Well

Private Well

McNairs Brook

Town of Mulgrave

Town of Mulgrave Municipal Water Service Limit

Map Features

- Building
- Bridge
- Collectory Highway
- Paved Road
- Unpaved Road
- Rail
- Access Road
- Watercourse
- Waterbody
- Wetland
- Property Boundaries
- Martin Marietta Quarry
- Proposed Quarry Expansion Site
- Approved Area

Surveyed Wells

- Drilled Well
- Unknown Well

0 125 250 500

Meters

Map Parameters
Datum/Projection: UTM-NAD83-Z20
Scale 1:10,000
Date: March 2006
Project No: SD19574

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Quarry drainage and surface runoff collects on the quarry floor. Overflow from the quarry floor is directed to a settling pond located to the west of the existing developed area. Additional containment capacity will be created in two other locations, as needed, as the quarry develops. There is little overflow from the settling pond as the majority of the water collected on the quarry floor and in the settling pond infiltrates into the floor and/or evaporates. Overflow from the pond is directed toward the unnamed stream that drains in a southward direction. A small sump has been excavated in the existing quarry floor, adjacent to the laydown area, to provide a water supply for dust suppression during crushing during dry periods (*i.e.*, when the quarry floor and settling pond are dry). Water is withdrawn in relatively small quantities on an as needed basis.

A number of monitoring wells will be installed within the proposed quarry expansion area. Groundwater levels will be monitored regularly to assist with quarry development and water management as well as to identify effects on groundwater levels and potential effects to other groundwater users (refer to section 5.6).

2.5 Operation and Maintenance

2.5.1 Quarry Operation Activities

The proposed Project activities will be consistent with the current quarry operations approved by NSEL (Approval No. No. 99-IAE-004 – Amendment 1) and will be in accordance with the Pit and Quarry Guidelines (NSEL 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 will occur once or twice a year, and occasionally more frequently, on a year round basis. 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. A blast design has been prepared and submitted to NSEL.

The blasted rock will be processed by portable crushing equipment transported to the quarry site as required, depending on the quantity of rock that must be processed. 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 Route 344. Since the quarry opened in 1999, the number of trucks hauling aggregates has averaged approximately five per day. The volume of trucks per day depends on market demand. If a large supply contract were awarded to the quarry (*i.e.,* a large highway construction project), average volume would likely increase for the duration of construction.

The existing quarry currently employs one permanent employee and an additional 10 during aggregate production. 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 resources. Hauling (or trucking) is typically arranged through the customers.

2.6 Effluents and Emissions

In accordance with best practices and standard NSEL requirements, runoff controls will be in place to ensure that effluent generated during operations is managed appropriately. Surface runoff at the quarry collects on the quarry floor. The quarry floor has the capacity to contain/retain a significant volume of runoff (*i.e.*, greater than 3,000 m^3). Overflow from the quarry floor drains to a settling pond constructed in the western corner of the developed area. The majority of runoff collected evaporates or infiltrates. Overflow from the settling pond drains to the northwest toward a wetland, several hundred meters from a watercourse. The existing containment/retention capacity is more than adequate for the existing facility. The containment/collection capacity of the quarry floor will increase as the quarry expands. Additional ponds will be installed, as required, in accordance with NSEL's Erosion and Sedimentation Control Handbook for Construction Sites (NSEL 1988) and the quarry's approval to operate, and in consultation with NSEL's engineers/inspectors.

A hydrological review of the Rhodena Rock Quarry and the proposed expansion was conducted by Hydro-Com Technologies Limited (refer to Appendix B). The assessment considered the proposed expansion area. The report states that a reduction in evapotranspiration and a subsequent increase in the volume of surface runoff will occur as a result of the quarry development. It was determined that, based on the proposed expansion area, the volume of annual site run off is estimated to be 810,000 m^3 (assuming the entire proposed expansion is developed).

The report concluded that the effects on the downstream flows (*i.e.*, an increase of approximately 7.0 % in Emergents Deep Marsh, 12% in Robust Deep Marsh, and 12% in Tall Shrub Swamp) and on water quality (*i.e.*, sediment loading) associated with the proposed ultimate level of quarry development can be fully mitigated using the placement of free-draining material (*i.e.*, rock/gravel) and properly sized flow retention/siltation treatment areas. Following the use of these mitigative measures, the remaining residual effects on downstream flows and water quality are expected to be minor.

Currently, overland flow drains in three directions due to two hydrologic divides. 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. In the unlikely event that overflow 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.

Dust emissions will be controlled with the application of water, obtained from the water contained in the settling pond(s) or water that is pooled on the quarry floor. To minimize generation of dust, the working areas and laydown areas will be covered with blasted rock. Stockpiled topsoil and overburden material will be seeded and covered with hay. Monitoring of airbourne particulate emissions (dust) will be conducted at the request of NSEL and in accordance with the Pit and Quarry Guidelines and the Nova Scotia Air Quality Regulations.

Combustion emissions will be generated from the operation of vehicles and equipment. Given the scope of the planned operations, these emissions will be minimal and 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. Consideration will be given to methods to reduce idling, as feasible. Ambient air monitoring will be conducted at the request of NSEL.

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 (Leq) at the property boundaries:

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

Sound monitoring will be conducted at the request of NSEL.

Solid waste generated on-site will be minimal (office and domestic refuse). All solid waste will be properly collected and stored until such time that it can be transported to a provincially approved waste disposal facility.

2.6.1 Hazardous Materials and Contingency Planning

There is no planned storage of hazardous materials or petroleum products at the quarry 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 expansion.

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

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

2.7 Decommissioning and Reclamation

Rhodena Rock will undertake a progressive reclamation program at the quarry site. The rehabilitation process at the quarry began during initial site development with the preservation of topsoil for future revegetation of the quarry. As distinct areas within the quarry become inactive, the area will be graded to a stable slope (minimum of 2:1), covered with topsoil, and seeded. At the end of the quarry operation (within six months of abandonment), rehabilitation will consist of: 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. The laydown area within the quarry, which is covered with quarried materials, will be graded, as required, and leveled to allow for future commercial, industrial, recreational, or residential land use. All areas affected by quarry activities including the setting ponds and quarry floor will be rehabilitated. Wetland creation during rehabilitation will be considered as an option for compensation for loss of wetland habitat during quarrying. A reclamation plan will be developed for the expanded site and submitted to NSEL.

3.0 SCOPE

3.1 Scope of the Undertaking

The proposed Project, as described in Section 2.0, consists of expansion of the existing quarry footprint to allow for continued quarry development and additional stockpiling. The following is a description of the spatial and temporal boundaries of the proposed Project to be considered in the assessment.

The quarry opened in 1999 and produces a variety of aggregate types. The working face is approximately 30 m (90 ft) 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). Rhodena Rock will continue to excavate from the working face.

The facilities and infrastructure associated with the existing quarry include: an access road and gate; various aggregate stockpiles; topsoil and overburden stockpiles; the quarry floor/laydown area (for portable crushing equipment); a scale and scale house; the working face; and a settling pond. Additional facilities and infrastructure associated with the proposed expansion will likely include additional aggregate stockpile areas and additional flow retention structures.

Expansion of the quarry will be initiated following approval from NSEL, as the existing developed area becomes depleted of aggregates. The proposed expansion area will cover a total of approximately 62.8 ha. Setback distances described in the Pit and Quarry Guidelines will be adhered to. The proponent previously considered a larger area for development; however, in the interest of protecting wetland habitat in the vicinity of the proposed expansion area, the expansion area was revised to exclude the wetland habitat and an appropriate (*i.e.*, 30 m) buffer southwest of the existing quarry.

The proposed operating schedule will be based on 12 hrs/day, 6 days/week, or 24 hrs/day, 7 days/week if required; year-round and weather permitting. Blasting and crushing of aggregate is expected to occur once or twice a year and occasionally more frequently, when demand for the product is required. The current and anticipated production rate is approximately 300,000 tonnes per year, and may increase with market demand. Transport of aggregates from the quarry is via tandem and tractor trailer trucks to local markets. The average number of trucks leaving the quarry daily is five.

Rhodena Rock will undertake progressive reclamation activities at the quarry. Refer to Section 2.6 for additional information related to decommissioning and abandonment activities

3.2 Purpose and Need for the Undertaking

The purpose for the Project is to allow Rhodena Rock to expand the existing quarry footprint and continue operations at their quarry at Porcupine Mountain. The quarry is currently operating under Approval No. 99-IAE-004 (Amendment), issued by NSEL on April 20, 1999. This permit is for a quarry operation of up to four hectares. A copy of the NSEL Approval is included in Appendix A. The areas regulated by this approval are near depletion.

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 expansion 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 Rhodena 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 expansion is occurring in an area that has been previously clear-cut and is already exposed to mining/quarrying activities. Expansion of the quarry will not require the construction of any new facilities (*i.e.*, roads or buildings), as the existing facilities are sufficient for the current and expanded 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 involves expansion of a quarry footprint beyond four hectares. Therefore, the 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.

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 *Species at Risk Act*, *Migratory Birds Convention Act*, the Federal Policy on Wetland Conservation, A Wildlife Policy for Canada, the Federal Water Policy, the Toxic Substances Management Policy, and the federal strategy for pollution prevention.

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 2002) was also used to determine/focus the scope of the assessment. The Proponent and their consultant met with NSEL on September 29, 2005 to discuss the location of proposed expansion, and elements and activities associated with the proposed Project, in an effort to further focus the scope of the assessment. Landowners adjacent to the quarry were also contacted (see Section 4.0) for the purpose of issues identification.

This environmental assessment evaluates the potential environmental effects of the proposed Project elements and activities, for all Project phases, with regard to each Valued Environmental Component (VEC) and Valued Socio-economic Component (VSC). By assessing potential impacts on VECs/VSCs within the study boundaries, a meaningful evaluation of project effects on relevant environmental params is achieved. Components evaluated include:

- fish and fish habitat;
- 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 November 2005, a Project Information Bulletin (Appendix C) was distributed to landowners and some local businesses within approximately 2 km of the quarry. A total of 30 bulletins were mailed out, based on the list for pre-blast surveys from the present operation. The purpose of the bulletin was to advise local residents and businesses immediately adjacent to the quarry (*i.e.*, those who are potentially most affected) of the proposed expansion and provide them with and opportunity to comment on the proposed undertaking. A letter was posted on December 16, 2005, to the Confederacy of Mainland Mi'kmaq, to encourage the submission of comments, concerns and questions regarding the Project. This consultation effort assists with issues scoping and development of appropriate mitigation for potential adverse effects.

4.2 Stakeholder Comments and Steps Taken to Address Issues

To date, no comments have been received from local stakeholders or the Confederacy of Mainland Mi'kmaq.

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

5.1 Methodology

Field studies were conducted by Jacques Whitford on June 6, 2005, and August 8, 2005, to investigate and establish the existing conditions and to determine appropriate mitigation, if necessary, to minimize environmental effects from the proposed expansion Project. These surveys consisted of: vegetation survey; wetlands survey; breeding bird survey; mammal survey; and herpetile survey. These surveys were undertaken by qualified terrestrial ecologists employed by Jacques Whitford. An assessment of potential archaeological and heritage resources was undertaken by a qualified archaeologist. A reconnaissance survey of road conditions was also conducted by a qualified transportation engineer. 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 and VSCs are likely to interact with, or be influenced by, the project. Both the temporal and spatial boundaries for the assessment vary according to the VEC. 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/VSC as well as the following:

- negative effects on the health of biota;
- loss of rare or endangered species;
- reductions in biological diversity;
- loss of critical/productive habitat;
- fragmentation of habitat or interruption of movement corridors and migration routes;
- transformation of natural landscapes;
- discharge of persistent and/or toxic chemicals;
- toxicity effects on human health;
- reductions in the capacity of renewable resources to meet the needs of present and future generations; and
- loss of current use of lands and resources for traditional purposes by Aboriginal persons.

5.2 Fish and Fish Habitat

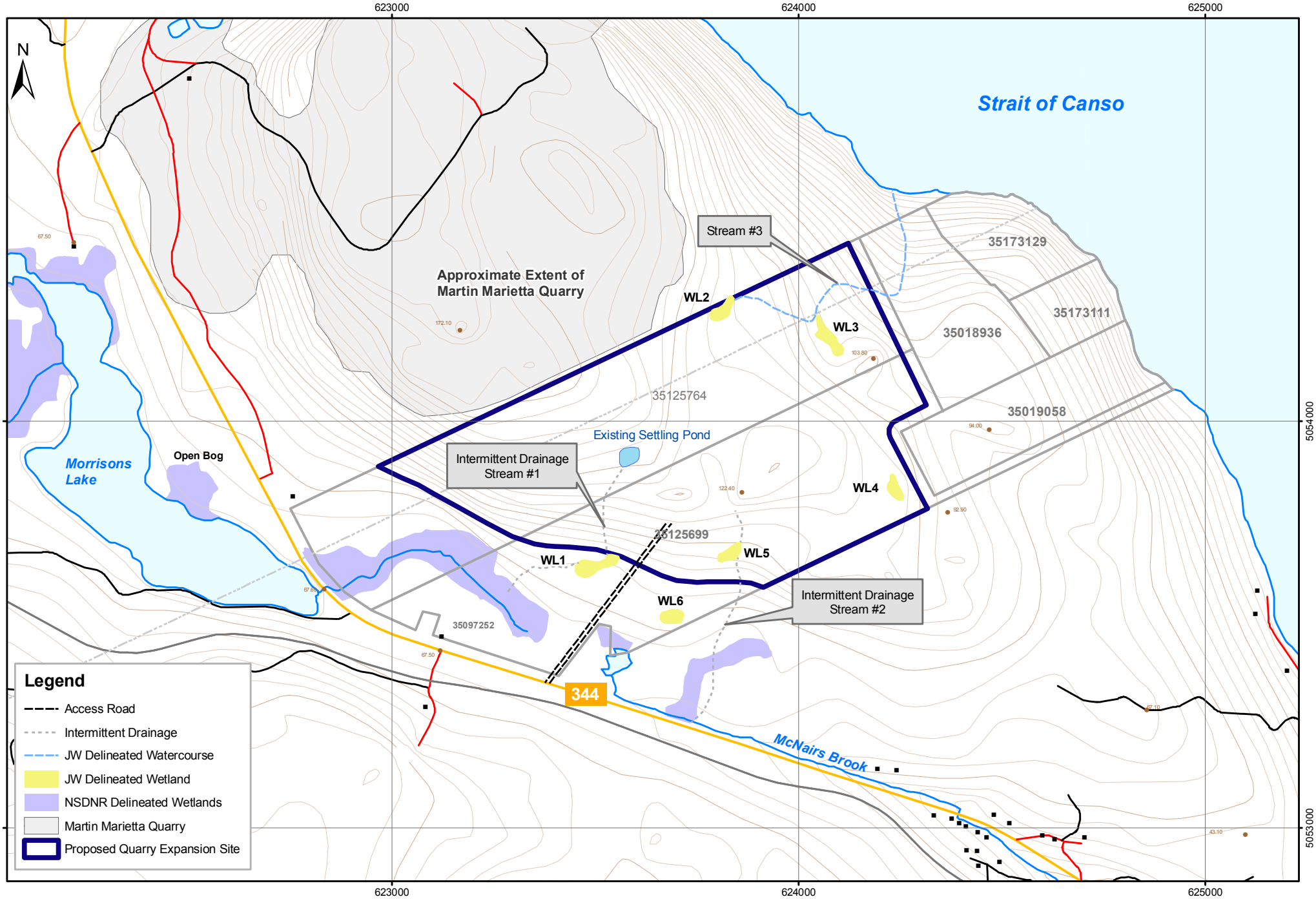
5.2.1 Description of Existing Conditions

During a review of 1:50,000 scale NTS mapping, the site location map and aerial photographs, waterbodies within and immediately adjacent to the quarry expansion site were identified. No brooks or other type of watercourse were discernible from the aerial photographs, however, three minor streams were identified during the wetland, vegetation and breeding bird surveys (Figure 5.1). One emerges from the existing quarry settling pond and heads towards Wetland 1. The second emerges near Wetland 6 and heads towards McNairs Brook. These latter two may be called intermittent drainage. The third, which may be called a brook due to its higher level of water emerges from Wetland 2, heads towards Wetland 3, and out towards the Strait of Canso.

An assessment of the brooks during the vegetation and breeding bird surveys consisted of examining the physical parameters and the biological potential of the watercourses.

Drainage towards the southern side of the property is directed via these two intermittent streams. Stream 1 originates at the settling pond in the existing quarry and proceeds down a steep slope to Wetland 1. A small amount of flow was observed in early June but no drainage was observed in early August. The channel consists largely of exposed bedrock, boulders and cobbles. The width averages approximately one metre and average depth is approximately 20 cm. A few pools and cascades are present at several locations. There is no defined stream channel through Wetland 1. The stream does not provide suitable fish habitat and none were observed during the field surveys. A representative from Fisheries and Oceans Canada visited the site in March 2006 and agreed that the stream does not constitute fish habitat.

Stream 2 originates at the eastern edge of the existing quarry and flows south to Wetland 5 and eventually enters McNairs Brook. This stream was flowing on both survey dates (early June and early August) but there was very little flow during the August survey. The portion of the stream upstream of Wetland 5 flows through very gently sloping terrain. The stream bed in this area was composed of gravel, sand and cobble derived from erosion of a steep embankment along the quarry access road. At Wetland 5, the substrate was largely obscured by iron floc that had precipitated in pools in the wetland. Downstream of Wetland 5 the stream flows along a moderately steep slope and the stream bed was composed largely of cobbles and boulders. Upstream of Wetland 5, channel width averaged approximately 2 m with an average depth of approximately 20 cm upstream. Also downstream of Wetland 5, channel width averaged approximately 1.5 m wide and average stream depth was approximately 30 cm. No fish were observed in Stream 2. The intermittent nature of the stream suggests that it does not provide suitable fish habitat. A representative from Fisheries and Oceans Canada visited the site in March 2006 and agreed that the stream does not constitute fish habitat.



Map Parameters
Datum/Projection: UTM-NAD83-Z20
Scale 1:12,000
Date: March 2006
Project No: SD19574

Figure 5.1
Wetlands and Surface Water

0 250 500 1,000
Meters

RHODENA ROCK QUARRY EXPANSION PROJECT

Jacques Whitford

Stream 3 originates in a small mixedwood treed swamp at the northern edge of the property and flows towards the north eventually draining into the Strait of Canso. The stream descends moderately steep to steep slopes and is characterized by alternating small pools, riffles and cascades. The stream channel averages approximately 1.5 m in width and average stream depth is 40 cm. The stream substrate is composed mainly of boulders, cobble and some bedrock outcrops. Stream flow was present during both the June and August surveys. Permitted activities at the adjacent Martin Marietta Quarry (Figure 5.1) will obliterate the headwaters of this stream. No fish were observed during the surveys. Given the steep slopes and presence of a number of cascades, it is unlikely that the stream provides habitat for fish. A representative from Fisheries and Oceans Canada was not able to access this stream during the March 2006 site visit. The Proponent will maintain a 30 m buffer from Stream #3 for the short term, if the stream is determined not to provide fish habitat by Fisheries and Oceans Canada, quarry operations will proceed in that area as planned. Should Fisheries and Oceans Canada determine that the stream constitutes fish habitat, the Proponent would seek HADD authorization prior to proceeding with work within 30 m of Stream #3.

The combination of stream flow and substrate did not reveal any possible fish habitat or productive capacity of suitable quality. Stream 3 drains into the Strait of Canso which does support marine fish populations.

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

Clearing, grubbing, and topsoil stripping activities can increase the potential for sediment erosion and deposition downgradient, 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 not the freshwater streams on site which do not provide fish habitat but rather for sedimentation to the marine environment via Stream 3.

Placement of free-draining material (*i.e.,* blasted rock) over the disturbed areas and the use of properly sized flow retention structures is 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 for future use during rehabilitation. Additional retention capacity on the quarry floor will be created as the quarry develops and additional settling pond(s) will be installed, as needed (see Section 2.5.2). As discussed in Appendix B, the Proponent will construct future settling ponds so as to maintain current drainage patterns to sub-watersheds. Surface runoff will be directed to the settling pond(s). Overflow from the final settling pond will be monitored and sampled in accordance with the terms and conditions of the existing Approval (and future updates) and the Pit and Quarry Guidelines to ensure suspended solids levels do not exceed the approved final effluent discharge limits.

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

5.3 Rare and Sensitive Flora

5.3.1 Description of Existing Conditions

The site was surveyed by biologists on two occasions, on June 6 and August 9, 2005. Vascular plant inventories of the property were compiled on each of the survey dates. Both the existing quarry and the proposed quarry expansion area were investigated during the surveys. The proposed expansion area supports a number of habitat types including mature second growth mixedwood and coniferous forest, immature mixedwood forest, barrens, disturbed areas and wetlands.

The central portion of the property has been disturbed as a result of existing quarrying operations. These areas support a sparse cover of ruderal plants including coltsfoot (*Tussilago farfara*), hawkweeds (*Hieracium murorum* and *H. pilosella*), sweet clover (*Melilotus alba*), and various grasses such as poverty oat-grass (*Danthonia spicata*) and rough bentgrass (*Agostis hyemalis*).

Immature mixedwood forest is found to the east of the existing quarry and along the sides of the access road. These young stands are composed mainly of red maple (*Acer rubrum*), paper birch (*Betula papyrifera*), yellow birch (*Betula allegheniensis*), balsam fir (*Abies balsamea*) and red spruce (*Picea rubens*). In some areas there is a dense growth of red raspberry (*Rubus idaeus*) in the understory.

Mature second growth mixedwood forest covers a portion of the proposed quarry expansion area. Other areas have been clear cut more recently. Most mature mixedwood stands on the property are composed of a mixture of red spruce, balsam fir, yellow birch and red maple. In richer areas, the hardwood species are more abundant and American beech (*Fagus grandiflora*) is present.

Mature conifer stands are present in more poorly drained sites such as seepage tracks. These stands are dominated by a mixture of black spruce (*Picea mariana*), red spruce, balsam fir, and some red maple.

Barrens habitat is found only on a small area of bedrock outcropping located near the western corner of the property. This area is characterized by a mosaic of patches of dense ericaceous shrub cover, exposed bedrock and small patches of stunted black spruce. The shrub dominated areas are composed mainly of late lowbush blueberry (*Vaccinium angustifolium*), sheep laurel (*Kalmia angustifolia*) and possum-haw viburnum (*Viburnum nudum*). The areas of exposed bedrock support a growth of reindeer moss lichen (*Cladonia alpestris* and *C. rangiferina*), black crowberry (*Empetrum nigrum*) and poverty oat-grass.

Six small wetlands are found on the property, four of which are located within the proposed quarry expansion area. The four wetlands located within the proposed quarry expansion area include mixedwood treed spring swamp, moss dominated basin bog, deciduous treed stream swamp and a small wetland complex composed of coniferous treed basin swamp and graminoid dominated shallow basin marsh.

The mixedwood treed spring swamp is characterized by an open tree canopy composed largely of red maple, balsam fir, white ash and black spruce that is underlain by a dense shrub understory dominated by speckled alder (*Alnus incana*).

The moss dominated basin bog has a dense carpet of sphagnum moss punctuated by scattered patches of cinnamon fern (*Osmunda cinnamomea*), white beakrush (*Rhyncospora alba*) and tawny cottongrass (*Eriophorum virginicum*). Tree and shrub cover is very sparse consisting of a few stunted black spruce and small patches of sheep laurel and northern bayberry (*Myrica pensylvanica*).

The deciduous treed stream swamp appears to have developed recently as a result of alteration of the hydrology of the area associated with quarrying. This wetland is dominated by a cover of white ash, yellow birch and white spruce (*Picea glauca*).

The coniferous treed basin swamp/graminoid dominated shallow basin marsh has also been modified by human activities. This wetland was once a peat filled basin that supported an open canopied stand of stunted black spruce and white pine. The wetland was crossed by heavy equipment when the area north of the wetland was logged. The passage of heavy equipment churned up the substrate heavily damaging the original plant community and bringing mineral soil to the surface. This resulted in the establishment of a marsh plant community dominated by soft rush (*Juncus effusus*) and cottongrass bulrush (*Scirpus cyperinus*).

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 modelling 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 2005) 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 species. 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 phenology 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 field surveys.

A total of 106 Red or Yellow-listed species have been recorded within 100 km of the Project Area. Based on the results of the habitat model, 32 Red or Yellow-listed species could potentially be present in the Project Area. Table 5.1 lists these species and the habitats present in the Project Area where they could potentially be found.

TABLE 5.1 ACCDC Vascular Plants Potentially Found in Project Area

Binomial	Common Name	NSDNR Rank	Preferred Habitat	Likely on Site	ACCDC Rank
Vaccinium boreale	Northern Blueberry	Red	Exposed headlands and barrens.	Possible	S2
Malaxis brachypoda	White Adder's-Mouth	Red	Moist woods, wet meadows, fens, bogs.	Possible	S1
Listera australis	Southern Twayblade	Red	Among the shaded sphagnum moss of bogs or damp woods.	Possible	S1
Carex tenuiflora	Sparse-Flowered Sedge	Red	Wet woods and bogs.	Possible	S1
Viola nephrophylla	Northern Bog Violet	Yellow	Cool mossy bogs, the borders of streams, and damp woods.	Possible	S2
Viburnum edule	Squashberry	Yellow	In cold woods and along streams, coniferous forest.	Possible	S2
Vaccinium uliginosum	Alpine Blueberry	Yellow	Dry or wet organic and inorganic soils, tolerant of high copper concentrations.	Possible	S2
Vaccinium caespitosum	Dwarf Blueberry	Yellow	Rocky cliffs and rock crevices. Dry or wet acidic sites.	Possible	S2

TABLE 5.1 ACCDC Vascular Plants Potentially Found in Project Area

Binomial	Common Name	NSDNR Rank	Preferred Habitat	Likely on Site	ACCDC Rank
Salix pedicellaris	Bog Willow	Yellow	Acidic bogs, and sphagnous lakeshores.	Possible	S2
Ranunculus flammula var. flammula	Greater Creeping Spearwort	Yellow	Meadows and pasture, fens, swamps, lake edges, canals and river banks.	Possible	S2
Polygala sanguinea	Field Milkwort	Yellow	Poor or acidic fields, damp slopes, and open woods or bush.	Possible	S2S3
Platanthera orbiculata	Large Roundleaf Orchid	Yellow	Areas of little herbaceous cover but thick layers of leaf mould.	Possible	S3
Ophioglossum pusillum	Adder's Tongue	Yellow	Fields, ditches, and woods in soil that is acidic and seasonally wet.	Possible	S2S3
Montia fontana	Fountain Miner's-Lettuce	Yellow	Springy or seepy slopes, wet shores and brackish spots, coastal.	Possible	S1
Megalodonta beckii	Beck Water-Marigold	Yellow	Around ponds and lakes, along streams, swamps, wet meadows, roadside ditches, marshes, bogs, and in areas of disturbed, wet soils.	Possible	S3
Lindernia dubia	Yellow-Seed False-Pimpernel	Yellow	Wet areas and the muddy edges of streams. Drained millponds and gravel pits.	Possible	S3S4
Hudsonia ericoides	Golden-Heather	Yellow	Dunes, rocks, pine barrens	Possible	S1
Goodyera oblongifolia	Giant Rattlesnake-Plantain	Yellow	Dry or moist cedar, pine, or mixed forests in deep shade with minimal vegetative competition.	Possible	S2S3
Fraxinus nigra	Black Ash	Yellow	Low-lying areas that are very wet and marshy.	Possible	S3
Eriophorum gracile	Slender Cotton-Grass	Yellow	Rare and local in wet acid bogs.	Possible	S2
Epilobium strictum	Downy Willow-Herb	Yellow	Boggy areas and wet meadows.	Possible	S3
Epilobium coloratum	Purple-Leaf Willow-Herb	Yellow	Sunny wet spots.	Possible	S2?
Eleocharis olivacea var. olivacea	Capitate Spikerush	Yellow	Peaty muck of bogs, wet sandy shores, and swales.	Possible	S2
Dryopteris fragrans var. remotiuscula	Fragrant Fern	Yellow	Substrates, slopes, ridges, cliffs (and rock screes); dry, moderately well drained; non-calcareous rocks; rock, gravel, till; with low organic content.	Possible	S2
Cypripedium parviflorum var. pubescens	Large Yellow Lady's-Slipper	Yellow	Mesic deciduous and coniferous forest, openings, thickets, prairies, meadows, fens.	Possible	S2
Cypripedium parviflorum var. makasin	Small Yellow Lady's-Slipper	Yellow	Mesic deciduous and coniferous forest, openings, thickets, prairies, meadows, fens.	Possible	S2
Campanula aparinoides	Marsh Bellflower	Yellow	Damp meadows, swamps.	Possible	S3?
Calamagrostis stricta ssp. stricta	Northern Reedgrass	Yellow	Damp woods and shaded cliffs.	Possible	S1S2

TABLE 5.1 ACCDC Vascular Plants Potentially Found in Project Area

Binomial	Common Name	NSDNR Rank	Preferred Habitat	Likely on Site	ACCDC Rank
Botrychium simplex	Least Grape-Fern	Yellow	Usually on lakeshores or the mossy edges of streams or waterfalls although it has been reported in a wide variety of habitats.	Possible	S2S3
Bidens connata	Purple-Stem Swamp Beggar-Ticks	Yellow	Ditches, pond and lake margins, sides of streams.	Possible	S3?
Anemone virginiana	Virginia Anemone	Yellow	Rocky and dry open woods.	Possible	S1S2
Alopecurus aequalis	Short-Awn Foxtail	Yellow	Wet meadows and the edges of ponds and ditches.	Possible	S2S3
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).				
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.				
Source: ACCDC 2005; NSDNR 2005					

All species of vascular plant encountered during the surveys are identified and their population statuses in Nova Scotia are determined through a review of the species status reports prepared by NSDNR (NSDNR 2005), ACCDC (ACCDC 2005), and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2005). A list of the 241 vascular plant species found on the site during the field survey is presented in Appendix D.

The ACCDC listing of rare vascular flora and fauna, classed in the S1 and S2 rarity categories and in the provincial rarity classes of Blue, Red, and Yellow, known from within one hundred km of the study site was evaluated. Only one species of conservation concern, Yellow Lady's Slipper, was found during the site surveys. This species is further discussed in Section 5.4 Wetlands. Knowledge of the habitats present on site was determined both by analysis of aerial photography, topographic and geological mapping, as well as a summer site visit in which much of the evident flora, and some of the fauna was noted. Initially the various species from a hundred kilometer radius were classed as unlikely, possible or likely given the aspects of the habitat. Many of the species classed as unlikely would in fact be nearly impossible to be present on the site.

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

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

In summary, significant Project-related effects on rare or uncommon flora are not likely to occur.

5.4 Wetlands

5.4.1 Description of Existing Conditions

Six wetlands were found within the proposed quarry expansion area. Four are located within the property expansion area and two are located just outside of the expansion area (Figure 5.1). The descriptions of each wetland are as follows.

A 10-step wetland evaluation for each wetland is presented in Appendix E.

Wetland 1

Wetland 1 is a 0.324 ha wetland complex located just outside the proposed quarry expansion area. The upper or east end of the wetland is edged by the raised and gravel slope edge of an access road that leads from Route 344 to the existing quarry area. The southwest end of the wetland borders on a small clearcut area. Both the south and north edges of the wetland are wooded, with a relatively steep slope on the north side. The wetland is fed by seepage from the surrounding upland areas and by intermittent stream flow from the north edge. This wetland presents as a mixedwood treed basin swamp.

The basin swamp plant community is characterized by a moderate tree canopy dominated by unhealthy and dying white pine (*Pinus strobus*), occupying higher hummocks in the wetland, as well as black spruce (*Picea mariana*), white ash (*Fraxinus americanus*), red maple (*Acer rubrum*), and yellow birch (*Betula alleghaniensis*). The denser, shrub class layer is composed primarily of red maple and speckled alder (*Alnus incana*), and young white ash. Young black spruce, yellow birch, blackholly (*Ilex verticillata*) and mountain holly (*Nemopanthus mucronata*), are also among the dominant shrubs. Groundcover is mostly cinnamon fern (*Osmunda cinnamomea*) and sphagnum moss (*Sphagnum sps*.), with yellow sedge (*Carex flava*), broad-leaf cattail (*Typha latifolia*), dwarf red-raspberry (*Rubus pubescens*), and golden groundsel (*Senecio aureus*) also among the dominants. Notable in this wetland is the presence of a large population of small yellow lady's slipper (*Cypripedium calceolus* var*. parviflorum*), as well as some other orchid species, and the one specimen of black snake-root (*Sanicula marlandica*); all of which suggest a moderate degree of calcium rich seepage into this wetland.

A vegetation survey was conducted in the wetland that revealed the presence of 96 species of vascular plants. The wetland is characterized by high plant species richness. None of the species encountered are considered to be rare nationally (COSEWIC 2005). Small yellow lady's-slipper is a species classed as S2 by the ACCDC and as yellow by the Province (NSDNR). A large population of over 100 stems, in numerous clumps and single plants was noted in the eastern area of this wetland, with one clump noted from the adjacent upland along the intermittent stream flowing into this wetland.

A wildlife survey conducted in the wetland revealed the presence of one species of bird, three species of mammal and three species of amphibian in the wetland. The single bird species noted in this wetland was the American Goldfinch (*Carduelis tristis*). American red squirel (*Tamiasciurus hudsonicus*), white-tailed deer (*Odocoileus virginianus*), and star-nosed mole (*Condylura cristata)* were the mammals whose presence was noted. The amphibians detected in this wetland include wood frog (*Rana sylvatica*), northern spring peeper (*Pseudacris crucifer*), and four-toed salamander (*Hemidactylium* scutatum), all of which breed or could potentially breed here despite the relative scarcity of deeper pools. A single nest site with three female four-toed salamanders was located on June 6, 2005. None of these species is considered to be rare or sensitive nationally (COSEWIC 2005),

however provincially (ACCDC 2005; NSDNR 2005) four-toed salamanders are classed as S3 by the ACCDC and as Yellow by the NSDNR. Four-toed salamanders are however apparently distributed through much of the province (records exist from Yarmouth to Northern Cape Breton) and are generally more cryptic and little recorded rather than truly rare in Nova Scotia. Four-toed salamanders seem to show up in Nova Scotia, more often than not, in suitable habitat if directed search effort for nesting females is made during the appropriate season. Suitable breeding habitat is abundant throughout most of the province.

The wetland is located in a small basin from a steep slope to the north and within a much gentler slope gradient descending to the south. The wetland receives considerable inflow from surrounding uplands as both intermittent surface flow from a small stream, and as seepage at several points. There is defined outflow, therefore the wetland would drain by subsurface flow, and thereby contribute marginally to groundwater recharge. The relatively small size and relatively small upland flow inputs suggest this wetland has a moderate influence on the regulation of surface flow in the watershed.

The wetland appears to have relatively little socio-economic value. There is no evidence to indicate that it is used for recreational, agricultural, cultural, or business purposes. 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. There is no significant evidence of direct anthropogenic disturbance of the wetland in the past. The access road along the eastern edge of the basin abuts the wetland and it is possible that past road and quarry development activity upstream on the small intermittent stream feeding into the wetland may have affected the hydrology. The risk to further effects on hydrology and thus to nutrient inputs and access to or inputs of calcium into this wetland should be minimized if the population of small yellow lady's-slipper present within it, and it's general character, is to persist. To protect this wetland, at minimum, the upland habitat to the north will be protected to the crest of the steep slope and beyond. A 30 m vegetated buffer zone will be maintained between the wetland and quarry operations. Care will be taken to neither cut off the intermittent stream flow to the wetland or see the basin become a repository of significantly increased water inflow, nutrients or sediments. This will be accomplished through the use of flow retention structures and energy dissipation measures outlined in Appendix B. In addition, a physical barrier (*e.g.*, snow fencing) will be installed prior to conducting quarrying activities near this wetland to ensure staff and machinery adhere to the buffer zone.

Wetland 2

Wetland 2 is a 0.213 ha mixedwood treed spring swamp located near the northern edge of the property. The mixedwood treed spring swamp plant community is characterized by an open tree canopy dominated by red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), white ash (*Fraxinus americana*) and black spruce (*Picea mariana*). The shrub layer is dominated by speckled alder (*Alnus incana*) along with some black holly (*Ilex verticillata*). Groundcover is mostly sphagnum moss (*Sphagnum* spp.), cinnamon fern (*Osmunda cinnamomea*), and dwarf red raspberry (*Rubus pubescens*), along with some sedge (*Carex gynandra*), three-seed sedge (*Carex trisperma*), and northern bugleweed (*Lycopus uniflorus*).

A vegetation survey was conducted in the wetland that revealed the presence of 38 species of vascular plant. The wetland is characterized by average plant species richness. None of the species encountered are considered to be rare nationally (COSEWIC 2005) or provincially (ACCDC 2005; NSDNR 2005).

Wildlife surveys conducted in the wetland revealed the presence of five species of birds including Black-capped Chickadee, Swainson's Thrush, Blue-headed Vireo, Blackburnian Warbler, and Ovenbird. Suitable nesting habitat is present in the wetland for all of these species; however, given the size of the wetland it is unlikely that they all nest in the wetland. One mammal species, American red squirrel was noted in the wetland.

None of the bird or mammal species encountered in the wetland is considered to be rare or sensitive nationally (COSEWIC 2005) or provincially (ACCDC 2005; NSDNR 2005). No herpetile species were encountered in the wetland during the field survey; however, the wetland does provide suitable breeding habitat for four-toed salamanders. Three female four-toed salamanders and their egg clutches were found in Wetland 1 so there is a high probability that they are present in this wetland as well. This species is Yellow-listed by NSDNR, however, it is believed to be cryptic rather than particularly rare.

Wetland 2 is a groundwater discharge site. It is located at the base of a long slope and is the headwaters for a small stream. This wetland would help to regulate stream flow by retaining water in the wetland substrate and releasing it slowly. Given the small size of the wetland, the storage capacity of the wetland would be very limited and the wetland would play a small role in stream flow regulation.

Although development of the quarry will result in increased peak rates of surface runoff to the stream and a reduction in low flows (*i.e.*, water will run off more quickly following additional quarry development), the placement of free-draining material over the disturbed areas and the use of properly sized flow retention structures (or holding areas along the quarry floor) is expected to fully mitigate these changes in temporal flow patterns.

The potential effects of the quarry development on downstream water quality include an increase in the total sediment loading and an increase in chemical parameters associated with the rock being quarried. It is understood that the acid generating potential of the quarried rock will be analysed and must meet environmental standards. The placement of free-draining material over all disturbed areas and the use of properly sized flow retention/siltation structures (or holding areas along the quarry floor) is expected to fully mitigate the potential increase in downstream sediment loading. As the amount of freshly exposed rock within the quarry is likely to remain relatively constant (it should be a function of the production rate, rather than the overall quarry size), the effects of the quarry on downstream water quality are expected to be relatively minor and the downstream water quality should return to background levels following the termination of active quarrying operations.

The wetland appears to have relatively little socio-economic value. There is no evidence to indicate that it is used for recreational, agricultural, cultural, or business purposes. 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. There is no evidence of anthropogenic disturbance of the wetland in the past.

Wetland 3

Wetland 3 is a 0.296 ha wetland complex located inside the eastern edge of the proposed quarry expansion area. This wetland complex is composed of a graminoid dominated shallow basin marsh, and a coniferous treed basin swamp. The wetland appears to be fed by seepage from the surrounding upland and groundwater, as well as rainfall. The end away from the outflow has numerous small pools. Many of these pools are deep and permanent enough to host northern green frog tadpoles (*Rana*

clamitans). The wetland is cut through in part by a wood road associated with forest product extraction. This track has affected part of the wetland, shifting it from what was likely total swamp formerly, to the present marsh aspect of part of the basin. This apparent shift was presumably the result of the roadway effecting damage to the former swamp vegetation, and churning up and bringing in more mineral soil to this area of the wetland. The anthropogenic influence has likely resulted in somewhat increased species diversity in this small basin wetland. This basin wetland complex has a small, perhaps at times intermittent, streamlet and seepage outflow that drains into a small perennial woodland stream only a few meters away, down a low slope.

The graminoid dominated shallow basin marsh has no tree class vegetation. Shrub class cover is very sparse consisting of some small, heart-leaved paper birch (*Betula cordifolia*) and remnant small red maple (*Acer rubrum*) as well as a few small black spruce (*Picea mariana*) and Bebb's willow (*Salix bebbiana*). The ground vegetation layer is primarily a thick cover of soft rush (*Juncus effusus*), mixed with cottongrass bulrush (*Scirpus cyperinus*), broad-leaved cattail (*Typha latifolia*), sedge (*Carex gynandra*) and sphagnum moss (*Sphagnum sp.),* with a small bit of smooth white violet (*Viola macloskeyi*).

The coniferous trees basin swamp part of Wetland 3 is distal from the outflow and quite open in terms of tree and shrub cover. It has a sparse tree class cover dominated by a few black spruce, fewer dying eastern white pine (*Pinus strobus*), and an occasional red maple. The shrub layer is somewhat less sparse in cover and is dominated by young red maple and balsam fir (*Abies balsamea*) with some black spruce and a few northern bayberry (*Myrica pensylvanica*), mostly occurring on higher hummocks. The ground vegetation outside the scattered deeper pools is thickly dominated by sphagnum mosses (*Sphagnum* spp*.)* and cinnamon fern (*Osmunda cinnamomea*), with abundant three-seed sedge (*Carex trisperma*), some dwarf red raspberry (*Rubus pubescens*), New York fern (*Thelypteris noveboracensis*) and parasol white-top aster (*Aster umbellatus*).

A vegetation survey conducted in the wetland revealed the presence of 62 species of vascular plant. This small wetland is characterized by moderate plant species richness. None of the species encountered is considered to be rare nationally (COSEWIC 2005) or provincially (ACCDC 2005, NSDNR 2005).

A wildlife survey conducted in the wetland revealed the presence of two species of birds, and three species of amphibian in the wetland. Bird species recorded in the wetland included Black-capped Chickadee (*Poecile atracapilla*) and American Goldfinch (*Carduelis tristis*). None of these species is considered to be rare or sensitive nationally (COSEWIC 2005) or provincially (ACCDC 2005; NSDNR 2005).

Amphibian species recorded in the wetland included northern green frog (*Rana clamitans)*, wood frog (*Rana sylvatica*), pickerel frog (*Rana palustris*) and yellow-spotted salamander (*Ambystoma maculatum*). Four-toed salamanders were not located in this wetland but it has potential to host them. All noted amphibian species have the potential to breed in this wetland. All the detected amphibian species are common.

Wetland 3 is located in a basin below a long slope and has apparent input from seepage and groundwater sources in addition to rainfall and surface runoff from the uplands. This wetland has seepage, and intermittent streamlet, discharge from its north end into a woodland stream channel several meters away. This would suggest that it is a groundwater discharge site rather than a groundwater recharge site. As it is a small wetland it is likely that this wetland has minor contributions to local hydrology and adjacent stream flow. Expansion of the quarry could be expected to eliminate this

small wetland as well as the upper reaches of the small woodland stream that both this wetland and Wetland 2 feed into. This stream, while perennial, did not appear to host any fish, perhaps due to the steep gradient of the stream course.

The wetland appears to have relatively little socio-economic value. There is no evidence to indicate that it is used for recreational, agricultural, cultural, or business purposes. 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. The only past anthropogenic disturbance of the wetland consists of it having been crossed by a rough wood road. The effect of this has been to alter the discharge end of the wetland from a former swamp wetland to more of a transitional marsh wetland.

Wetland 4

Wetland 4 is a 0.167 ha moss dominated basin bog located in the eastern corner of the proposed quarry expansion area. The basin bog habitat is characterized by a dense carpet of sphagnum moss, punctuated by patches of cinnamon fern, white beakrush (*Rhyncospora alba*) tawny cottongrass (*Eriophorum virginicum*), and dwarf dogwood (*Cornus canadensis*). Shrub and tree cover is sparse. Shrub cover consists of small patches of sheep laurel (*Kalmia angustifolia*), northern bayberry (*Myrica pensylvanica*) and speckled alder (*Alnus incana*). Tree cover consists of stunted red maple, heart-leaved paper birch (*Betula cordifolia*) and black spruce (*Picea mariana*).

A vegetation survey was conducted in the wetland that revealed the presence of 48 species of vascular plant. The wetland is characterized by average plant species richness. None of the species encountered is considered to be rare nationally (COSEWIC 2005) or provincially (ACCDC 2005; NSDNR 2005).

A wildlife survey conducted in the wetland revealed the presence of three mammal species and one herpetile species. No birds were encountered in the wetland. Low tree and shrub cover and the small size of the wetland limit its value as bird habitat. Mammals detected in the wetland included coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*) and a vole species. Coyote and white-tailed deer may occasionally forage in the wetland or use it as a travel route. Maritime garter snake was the only herpetile species encountered in the wetland. None of these species are considered to be rare or sensitive nationally (COSEWIC 2005) or provincially (ACCDC 2005; NSDNR 2005).

The wetland is located in a small basin situated on a gentle slope. There is a small channel located at the southeastern end which drains the wetland. The channel was dry during both the June and August field surveys. It is likely that the channel carries water only during the wettest months of the year. The presence of the channel would suggest that the wetland is a groundwater discharge site. The small size and the lack of flow during the summer months would suggest the wetland has very little influence on the regulation of surface flow in the watershed.

The wetland appears to have relatively little socio-economic value. There is no evidence to indicate that it is used for recreational, agricultural, cultural, or business purposes. 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. There is no evidence of anthropogenic disturbance of the wetland in the past.

Wetland 5

Wetland 5 is a 0.18 ha wetland complex located within the southeast corner of the proposed quarry expansion area. This wetland is a deciduous treed swamp. A small, possibly intermittent, stream feeds the wetland along with seepage from the base of the steep slope. This stream originates from the existing cleared quarry's eastern edge area and flows south, via a culvert, under a gravel road, which descends west along the steep forested slope edge. The stream is shallow and fast flowing and carries significant gravel washed down from the quarry and edge of the road berm along the slope crest. In times of heavy rainfall a spillover channel enters the wetland at a point above where the stream channel enters the wetland. In both cases a fan of gravel enters the wetland but is quickly terminated, and absorbed into the wetland when the gradient and the force of water declines at the base of the slope. The remaining narrow (<1 m), shallow (<50 cm) stream passage through the wetland has a peat and finer sand blend bottom. Scattered shallow peaty pools occur in the wetland, especially near the western edge where seepage wells up from the base of the slope.

The wetland has apparent anthropogenic origins or influence. Specifically this wetland has the aspect of either a once much smaller seepage wetland now enlarged, or a forested area that has recently been shifted to wetland conditions due to hydrological changes (increased seepage and a stream flow or increase in water coming off the extant quarry area) resulting from quarry development in the adjacent area. This deciduous treed swamp is nascent and is a blend of remnant forest vegetation and colonizing wetland species. The tree class vegetation has near 60% coverage. The dominants are white ash (*Fraxinus americanus*), yellow birch (*Betula alleghaniensis*), and white spruce (*Picea glauca*), with red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), and striped maple (*Acer pensylvanicum*). The sparse shrub layer has some young balsam fir, yellow birch, and a few small white ash. The ground vegetation is dominated approximately equally by sphagnum mosses (*Sphagnum* spp*.)* and cinnamon fern (*Osmunda cinnamomea*), then by northern beech fern (Phegopteris connectilis), New York fern (*Thelypteris noveboracensis*), and fowl manna-grass (*Glyceria striata*), with a lesser mix of three-seed sedge, wild sarsaparilla (*Aralia nudicaulis*), marsh blue violet (*Viola cucullata*), with some localized clumps of a sedge (*Carex gynandra*) and rough sedge (*Carex scabrata*).

A vegetation survey conducted in the wetland revealed the presence of 41 species of vascular plant. The wetland is characterized by average plant species richness. None of the species encountered are considered to be rare nationally (COSEWIC 2005) or provincially (ACCDC 2005; NSDNR 2005).

A wildlife survey conducted in the wetland revealed the presence of two species of birds, two species of mammal and one species of amphibian. Bird species recorded in and near the wetland included Hairy Woodpecker, and Blue-headed Vireo. Suitable nesting habitat is present in the wetland for these species. None of these species are considered to be rare or sensitive nationally (COSEWIC 2005) or provincially (ACCDC 2005; NSDNR 2005).

White-tailed deer (*Odeocoileus virginianus*) was the sinigle mammal species for which evidence was noted during the survey. This species is not considered to be rare or sensitive (COSEWIC 2005, NSDNR 2005) and is also characteristic of the surrounding terrestrial habitats.

Two amphibian species were recorded in the wetland. These included the northern green frog (*Rana clamitans)* and the northern spring peeper (*Pseudacris crucifer*). These wildlife species are common.

The wetland is located in a gently sloping semi-basin and is fed by a stream draining down a slope from the existing cleared quarry area. The wetland also receives seepage from the forested slopes base.

The stream flows out of the wetland so the wetland contributes only minor input to subsurface water. The relatively small size suggests the wetland has a minor influence on the regulation of surface flow in the watersheds.

Wetland 5 appears to have relatively little socio-economic value. There is no evidence to indicate that it is used for recreational, agricultural, cultural, or business purposes. 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. There is evidence that the wetland is in part or wholly the result of anthropogenic disturbance to the hydrology from the adjacent quarry area, is nascent in origin, and would be expected to display a shift in dominant vegetation with each passing growing season.

Wetland 6

Wetland 6 is a 0.180 ha wetland complex located at the southern end of the proposed quarry expansion area. This wetland complex is composed of fern dominated shallow basin marsh and tall shrub dominated basin swamp. The wetland is located in a small basin at the base of a long slope. The hydrology of the wetland has been modified recently, possibly as a result of human activities. The area on the northwest side of the wetland has been subjected to timber harvesting and the outflow channel of the wetland has become plugged with brush creating a dam which caused flooding. The flooding substantially altered the plant species composition of the wetland. Low areas that flooded more deeply now support fern dominated shallow basin marsh. Prior to flooding, this area would have been mixedwood treed basin swamp. The vegetation of this part of the wetland is characterized by a dense ground vegetation layer composed of a mixture of royal fern (*Osmunda regalis*), black-girdle bulrush (*Scirpus cyperinus*), sensitive fern (*Onoclea sensibilis*), and cinnamon fern (*Osmunda cinnamomea*). Shrub cover is sparse and consists largely of speckled alder, black holly (*Ilex verticillata*) and mountain holly (*Nemopanthus mucronata*). Tree cover is restricted to hummocks and consists of red maple, black spruce and yellow birch (*Betula allegheniensis*).

Tall shrub dominated basin swamp is found in areas that have not been flooded as deeply. This plant community consists of a dense tall shrub thicket dominated by black holly along with some mountain holly. Tree cover is sparse and consists mainly of red maple and black spruce. The ground vegetation layer is composed mainly of sphagnum moss, cinnamon fern and royal fern.

A vegetation survey was conducted in the wetland that revealed the presence of 28 species of vascular plant. The wetland is characterized by low plant species richness which is likely attributable to the recent changes in wetland hydrology which have eliminated many plant species. None of the species encountered are considered to be rare nationally (COSEWIC 2005) or provincially (ACCDC 2005; NSDNR 2005).

A wildlife survey conducted in the wetland revealed the presence of nine species of birds and two species of mammal. Bird species recorded during the wetland survey included Black-capped Chickadee, Ruby-crowned Kinglet, Red-breasted Nuthatch, American Robin, Swainson's Thrush, Hermit Thrush, Magnolia Warbler, Nashville Warbler, and Common Yellowthroat. Common Yellowthroat and American Robin can be expected to nest in the wetland. The other species likely nest in nearby forest habitat and forage in the wetland. American red squirrel and raccoon were the mammal species recorded in the wetland. None of these species are considered to be rare or sensitive nationally (COSEWIC 2005) or provincially (ACCDC 2005; NSDNR 2005). No herpetile species were encountered in the wetland, however, it is likely that the wetland is frequented by a variety of amphibian species including yellow-spotted salamander, northern spring peeper, pickerel frog, wood frog, and green frog.

The wetland is located at the foot of a long slope and is likely a groundwater discharge site. During wet periods, the wetland decants through a declivity between two small hillocks. There is no stream channel at this location but there is a seepage track which runs south to another wetland. The wetland's water source is supplied by both surface water and groundwater.

The wetland appears to have relatively little socio-economic value. There is no evidence to indicate that it is used for recreational, agricultural, cultural, or business purposes. 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.

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

Quarry development could result in the loss of the four wetlands located within the proposed expansion area (Wetlands 2, 3, 4 and 5). Generally, wetland habitat loss is of particular concern to provincial regulators since wetlands are recognized as productive natural areas that are transitory between terrestrial and aquatic ecosystems. Wetlands often support a large diversity and abundance of organisms and are often threatened by development activities.

The wetland evaluations (Appendix E) demonstrate that no significant habitat loss for wildlife and plant species would occur in wetlands 2, 3, 4, 5 and 6. The proponent has agreed to the proposed expansion boundaries to avoid Wetland 1 where a population of Yellow Lady's Slipper has been identified. Further modification of quarry boundaries to avoid the remaining wetlands would not be feasible without significantly affecting the proponent's opportunity to develop the resource. Rhodena Rock will work with NSDNR to develop the mitigation measures including any required wetland compensation. There are a number of options for wetland compensation. The preferred approach is for wetlands of a similar type to those lost be re-created within the same watershed. This is not always feasible however given the technical difficulty of creating certain types of wetland (*e.g.*, bogs) and other constraints to development (*e.g.*, land ownership, local hydrology). Other options include wetland creation or enhancement outside the local watershed as well as sponsorship of related wetland protection or education programs. Rhodena Rock will explore these options with NSEL and NSDNR including the potential for wetland creation as part of the quarry rehabilitation plan. Additional mitigation for wetlands outside of the Project area boundaries are included in Appendix B.

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

5.5 Wildlife

5.5.1 Description of Existing Conditions

Birds

The diversity and abundance of avian fauna is commonly associated with habitat structure rather than individual characteristics of territories such as tree species or temperature. Overall suitability of a site is determined by the complex set of interactions between atmospheric conditions, geological composition, hydrological influences, diversity and density of floral and other faunal species, *etc*.

The Maritimes Breeding Bird Atlas (MBBA) database (Erskine 1992) contains a study of bird distribution and abundance across the maritime provinces of Canada. The breeding bird atlas data is of limited usefulness because that data is recorded in 10 km X 10 km census squares, making it impossible to establish whether a particular species has been observed in close proximity to the Project area. Nevertheless, it does provide an indication as to which species may be expected in the Project area. Information on the distribution and abundance of birds in the vicinity of the Project area was supplemented with a breeding bird survey conducted on June 6, 2005.

Four MBBA squares were used to determine the approximate number of breeding birds that may be found around the Project area. The breeding status of each species was determined using the criteria used in the MBBA (Erskine 1992). “Possible” breeders are generally those birds that have been previously observed or heard singing in suitable nesting habitat. “Probable” breeders are those birds that have exhibited any of the following: courtship behaviour between a male and female; birds visiting a probable nest site; birds displaying agitated behaviour; 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 study area was reviewed to determine what habitat types were present. Habitats noted on the air photography included mature second growth deciduous, mixedwood and softwood forest, immature mixedwood forest, bog, swamp, barrens and recently disturbed areas. Examples of each habitat type were visited during the field survey. The route walked during the field survey was selected to maximize the number of habitat types visited. The field survey was conducted on June 6, 2005. The survey began at 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 vocalizations. During the survey, most birds were identified by listening to song.

The population status of each 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 2003a), Species at Risk in Nova Scotia (NSDNR 2003b), and ACCDC database (ACCDC 2005) while nationally rare species were derived from COSEWIC (2005) and *SARA*. Additional data regarding bird use of habitats in the Project area was derived from wetland surveys conducted at the site on August 9, 2005.

Birds recorded during the surveys were not limited to breeding birds only; all birds observed were identified and recorded to increase the knowledge base of avian species inhabiting or transiting the survey area.

The breeding status of each species was initially determined using the criteria used in the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). Species observed or heard singing in suitable nesting habitat were classified as possible breeders. Species exhibiting the following behaviours were classed as probable breeders:

- courtship behaviour between a male and female;
- birds visiting a probable nest site;
- birds displaying agitated behaviour; and
- male and female observed together in suitable nesting habitat.

Species were confirmed as breeding if any of the following items or activities were observed:

- nest building or adults carrying nesting material;
- distraction display or injury feigning;
- recently fledged young;
- occupied nest located; and
- adult observed carrying food or fecal sac for young.

Appendix F lists all bird species from the breeding bird atlas squares within the surrounding area of the Project. Lists of provincially rare or sensitive birds were derived from the General Status of Wildlife in Nova Scotia (NSDNR 2005), Species at Risk in Nova Scotia (NSDNR 2005), and the ACCDC database (2005) while nationally rare species were derived from COSEWIC (2005) and *SARA*. Appendix F also lists NSDNR and COSEWIC rankings.

A total of 87 bird species have been recorded in the atlas squares. A total of 45 species were observed during the field surveys (see Appendix F). While none of the species observed during the field surveys were species of conservation concern, two species recorded in the atlas squares are identified as species of conservation concern that could be present within the Project area: Common Loon, and Common Tern.

Common Loons are relatively common in Nova Scotia, but are sensitive to a variety of human activities, particularly around their breeding sites. As such, this species is Yellow listed by NSDNR. Loons are sensitive to disturbance at their nest sites and their nests, which are located close to the edge of the water, and can be swamped by the wakes of motor boats or by water level fluctuations in reservoirs. Common Loons are also susceptible to ingestion of lead in fishing sinkers, accumulation of mercury in freshwater fish and loss or reduction in food supplies as a result of acidification of freshwater bodies on which they live during the breeding season. Common Loons nest on lakes and occasionally large rivers, generally on small islands where their nests are safe from predators. Adult loons along with their fledged young move to the coast in mid-September and remain in ice-free coastal waters until the lakes are ice-free in the spring. Immature birds and a few nonbreeding adults remain in coastal waters throughout the year. The Project area is located well away from any suitable loon nesting habitat. Given the distribution of suitable loon nesting habitat relative to Project area, it is unlikely that there will be a direct loss of Common Loon nesting habitat associated with the quarry expansion.

Common Terns are relatively uncommon and are considered to be sensitive to human activities and natural events by NSDNR (Yellow listed). Common Tern populations in Nova Scotia are adversely affected by disturbance of nesting colonies, predation of eggs and young by gulls and loss of prime nesting sites to gulls, which typically begin nesting earlier than terns. Common Terns nest on coastal islands, sand spits, beaches and occasionally in salt marshes. There is a low probability for Common Terns to nest in the vicinity of the Project area due to a lack of suitable nesting sites. Common Terns are not likely to travel near the Project area, and it is not critical habitat for this species.

Mammals

Information regarding the presence of rare mammals and sensitive mammal habitat within the study area was derived from field surveys and a review of Nova Scotia significant habitat mapping data base (NSDNR 2005). Field surveys were conducted concurrently with vegetation and breeding bird surveys in June and August of 2005. The field surveys provide a good indication of the presence of large

mammal species in the study area. Knowledge of the distribution of small mammals in the study 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 study area is characterized by moderate habitat diversity. Most of the area has been harvested within the past five years. Remnants of mature softwood forest and mature mixedwood forest are found in the Project area. Small patches of immature softwood and mixedwood forest are found scattered around the property. Six small wetlands are present within the Project area. (see Section 5.4 for wetlands)

The species recorded in the study area are generally typical of woodland habitats. Evidence of species recorded during the field surveys included American Red Squirrel, White-tailed Deer, Coyote (*Canis latrans)*, Red-backed vole (*Clethrionomys gapperi*), Porcupine, Bobcat (*Lynx rufus)*, Raccoon (*Procyon lotor)*, Star-nosed mole (*Condylura cristata*) and Eastern Chipmunk (*Tamias striatus)*.

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 vicinity of the study area or critical habitat such as deer wintering areas. All of the habitats present in the study area are commonly encountered throughout the province and are unlikely to provide habitat for rare small mammal species.

Herpetiles

Information regarding amphibians and reptiles and their habitat within the study area was also derived during the field surveys. Field surveys were conducted concurrently with vegetation and bird surveys in the summer of 2005. Seven herpetile species were encountered during the surveys: Four-toed Salamander (Yellow), Green Frog, Maritime Garter Snake (*Thamnophis sirtalis pallidula)*, Northern Spring Peeper (*Pseudacris crucifer crucifer*), Red-backed Salamander (*Plethodon cinerus*), Wood Frog and Yellow-spotted Salamander (*Ambystoma maculatum)*.

The Four-toed Salamander is listed as Yellow by NSDNR and S2/S3 by ACCDC, and is considered to be sensitive to disturbance. Local herpetologists generally believe that the Four-toed Salamander is more abundant and widespread than existing records indicate. The lack of records is likely attributable to the cryptic nature of this species. Four-toed Salamanders are rarely found away from cover. During the breeding season females nest in sphagnum moss hummocks; during the rest of the year this species is present under stones, logs and other cover in forest habitats. They emerge from cover only at night to forage. A recent study of the distribution of the four-toed salamander in Nova Scotia supports the contention that this species is not as rare as previously thought and is widely distributed (JWEL 2000). The study found four-toed salamanders in more than half of the sites searched and increased the number of recorded nesting sites in Nova Scotia from 20 to 45. Critical habitat requirements for this species are sphagnum moss in which to lay eggs and a semi-permanent or permanent, soft bottomed pond or slow flowing stream adjacent to the sphagnum moss in which the hatched larvae can develop. Given the minimal distribution of suitable habitat relative to Project area, it is unlikely that there will be a direct loss of Four-toed Salamander habitat associated with the quarry expansion.

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

None of the bird species potentially found in the Project area are listed under the NS *Endangered Species Act*, considered to be rare in Nova Scotia (Erskine 1992), or particularly sensitive to anthropogenic activities (NSDNR 2005). Migratory birds are protected under the *Migratory Birds Convention Act*. It is illegal to kill migratory bird species not listed as game birds (and outside of

established hunting seasons) or destroy their eggs or young. Other bird species not protected under the federal *Act* such as raptors are protected under the provincial *Wildlife Act*.

In order to avoid contravening these regulations, clearing and grubbing of areas to be used as quarry sites will be conducted outside of the breeding season for most bird species (April 1 to August 1) so that the eggs and flightless young of birds are not inadvertently destroyed.

No critical areas for mammals such as deer wintering areas or critical herpetile habitats are known to exist in the study area. The species recorded in the study area are generally typical of woodland habitats. The field survey and a review of existing records (NSDNR 2005) did not reveal the presence of any rare mammal or herpetile species in the vicinity of the study area. The habitats present in the study area are commonly encountered throughout the province and are unlikely to provide habitat for rare small mammal species.

In summary, assuming recommended mitigative measures are applied (*i.e.*, clearing outside bird breeding season), significant Project-related effects on wildlife are not likely to occur.

5.6 Groundwater Resources

5.6.1 Description of Existing Conditions

Groundwater, an integral component of the hydrologic cycle, originates from percolation of rain, snowmelt, or surface water into the ground. This infiltrating water fills voids between individual grains in unconsolidated materials and fills fractures developed in consolidated materials. The upper surface of the saturated zone is called the water table. The water 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 to dug or drilled wells can vary greatly, depending on the hydraulic properties of overburden or bedrock aquifers. An aquifer is a 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 total population of Nova Scotia, and to almost all of the unserviced rural residences.

Spatial boundaries for the assessment of groundwater resources are based on a combination of aquifer hydraulic properties, expected groundwater flow directions, and the distance between the proposed quarry expansion and wells that may be affected by quarry activities. For example, the 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 water 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 proposed Project will develop the quarry to approximately 30 m deep.

Project-related contamination (*e.g.,* accidental petroleum hydrocarbon spills from machinery or blasting chemicals (*i.e.,* nitrate and fuel oil)) could theoretically leave a quarry that is not excavated below the water table, and could potentially affect well water quality down gradient of the quarry; most potential hazards should however be contained within the quarry dewatering system. Acid rock drainage (ARD) is also a potential issue if a mineralized zone is encountered.

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 is expected to be minimal beyond about 200 m.

Blasting effects are conservatively considered for drilled wells within 800 m of the proposed quarry expansion (*i.e.,* the minimum distance from structures allowed for blasting specified by the Pit and Quarry Guidelines). Potential effects of accidental spills and ARD are considered for all wells hydraulically downgradient of the proposed quarry expansion. The extent of the area potentially affected is dependent on surface drainage and surficial geology and can generally extend 200 m in sand and gravel, and up to 50 m in till.

The following discussion of the local groundwater resources and hydrogeology is based on a desktop study and a “windshield” survey, but does not include any water well inspection, groundwater sampling and analysis, or groundwater depth measurements.

The Project area is irregular in shape and is approximately 670 m wide (north-northwest/south-southeast) and 1240 m long (east-northeast/west-southwest) at its longest points. The topography of the Project Area consists of a ridge which extends northwestward up the southeast side of Porcupine Mountain. Elevations on the site range from approximately 60 to 155 m above sea level.

The surficial geology consists of a thin veneer of brown, loose, cobbly sand glacial till (Figure 5.2). In general, the till contains more than 90% local clasts formed from the local bedrock (Stea and Fowler 1979). Bedrock underlying the site consists mainly of Late Neoproterozoic aged granitoid rock and metavolcanic/metasedimentary rocks of the Cape Porcupine Complex. The rock units are generally separated by either steep or thrust faults (White *et. al.* 2000). In addition, the southwest portion of the site is underlain by a smaller area of Early Carboniferous aged sandstone, conglomerate, shale and arkose of the Horton Group (Donohoe *et. al*. 2005).

The proposed quarry site is situated on a watershed divide between the Strait of Canso on the east, and McNair’s Brook on the west. Due to its location, the site is expected to lie within a groundwater recharge area, and an inference of the regional groundwater flow direction has been made based on topography. Because of the location of the ridge, surface water runoff (*i.e.,* apparent shallow groundwater flow direction) radiates out from the ridge to the southwest, southeast and northeast depending on the specific area of the site. Eventually, groundwater is expected to discharge into streams and wetlands feeding Morrisons Lake and McNairs Brook, and the Strait of Canso or directly into the Lake or Strait.

Rhodena Rock Quarry Expansion Project

Figure 5.2

Surficial and Bedrock Geology

622000 623000 624000 625000

5055000 5054000 5053000

N

344

Strait of Canso

Approximate Extent of Martin Marietta Quarry

35173129

35173141

35018936

35019058

35125764

35125699

35097252

Morrisons Lake

McNairs Brook

Town of Mulgrave

Map Features
- Building
- Bridge
- Collectory Highway
- Paved Road
- Unpaved Road
- Rail
- Access Road
- Watercourse
- Waterbody
- Wetland
- Property Boundaries
- Martin Marietta Quarry
- Proposed Quarry Expansion Site
- Approved Area

Fault Type
- Steep
- Thrust

Surficial Geology

QUATERNARY
- Silty Till Plain
- Thin Veneer of Till Overlying Bedrock

Bedrock Geology

CARBONIFEROUS
- Horton Group Sedimentary Rocks

NEOPROTEROZOIC
- Alkali-Feldspar Granite/Monzogranite/Syenite
- Metavolcanic Rocks
- Metasedimentary Rocks

0 125 250 500
Meters

Map Parameters
Datum/Projection: UTM-NAD83-Z20
Scale 1:10,000
Date: March 14, 2006
Project No: SD19574

Jacques Whitford

Reference:
White, C.E., Barr, S.M., Ketchum, J.W.F., and Ethier, M. 2000: Geology of the Cape Porcupine Complex (NTS 11F/11), Guysborough County, Nova Scotia; Minerals and Energy Branch Report of Activities 2000; Report ME2001-1; p.83-93

Stern R.R., Conley, H., Brown, Y. 1992: Surficial Geology of the Province of Nova Scotia, Nova Scotia Department of Natural Resources Mines and Energy Branch, Map 92-93

Water supply for residences located along Highway 344 north of the Town of Mulgrave serviced boundary (shown on Figure 2.2) are derived primarily from privately owned drilled or dug wells. The Town of Mulgrave municipal water supply is derived from surface water reservoirs located approximately 2.5 km southwest of the Project area.

The location of the water wells servicing residential homes located nearest the Project area (*i.e.,* within 800 m) were determined during a windshield survey conducted on October 6, 2005 (Figure 2.2). The closest residential well is located approximately 300 m southwest of the proposed project. A review of available NSEL well records provided information on two of the five water wells in the area, and this information indicated that the two wells were drilled for Lewis England and Ron Spencer. The Spencer well was constructed in shale and granite while the geology for the England well was not specified, and is assumed to be constructed in Horton Group bedrock.

The well construction details for these two drilled wells are summarized in Table 5.2. The wells average 33.5 m in depth, have an average 6.4 m of casing, and yield in the range of 1.5 to 3.0 igpm, with an average value of 2.2 igpm. Depth to the water table ranges from 2.4 m to 3.0 m below grade. The average (2.7 m) water table depths suggest that the groundwater table may be intercepted during quarrying operations.

TABLE 5.2 Summary of Domestic Water Wells Records for Mulgrave

	Well Depth (m)	Casing Length (m)	Estimated Yield (igpm)	Water Depth (m)	Overburden Thickness (m)
Minimum	29.6	6.1	1.5	2.4	1.2
Maximum	37.5	6.7	3.0	3.0	4.0
Average	33.5	6.4	2.2	2.7	2.6
Median	-	-	-	-	-
Number	2	2	2	2	2
Note: Information was obtained from the Well Log Database including wells constructed between 1940 and 2004.					

In addition to wells in the area, two small streams are located southwest and south of the Project area: an unnamed stream which flows into Morrisons Lake and McNairs Brook which flows southeast past the study area, and eventually flows into the Strait of Canso. These streams may be partially fed from groundwater springs that may occur near the base of the mountain.

Water Quality

The water quality from wells constructed in Horton Group and granite bedrock is expected to be good, with most parameters meeting the Canadian Drinking Water Guidelines (Health Canada 2004). The Strait of Canso Environment Committee Water Resources inventory (SCEC 1975) suggests that Horton Group aquifers should provide a relatively good groundwater quality with low to moderate degree of dissolved solids and alkalinity, and a tendency towards hardness. Iron and manganese in excess of respective aesthetic values are possible issues. The crystalline bedrock of the Granite and metamorphic bedrock is expected to yield good to excellent water chemistry, with a low degree of hardness and total dissolved solids (TDS) (SCEC 1975). Rare occurrences of arsenic, uranium, radon gas, iron and manganese are possible under some hydrogeological conditions, or in the presence of mineralized zones.

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

The potential environmental effects on surrounding groundwater resources from a quarry operation include: water table lowering close to the high wall, depressurization of downgradient springs, temporary siltation of nearby wells due to intermittent blasting or heavy equipment operation, decrease in well yield due to water level lowering or interception of recharging fractures, and possible water quality deterioration at down-gradient wells from accidental releases of deleterious substances such as petroleum hydrocarbons or acidic drainage production within the quarry area. Potential impacts to domestic water wells are a function of distance, 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

If the quarry encounters increased groundwater seepage as it expands, water will collect within the existing settling pond and sump. Depending on the floor elevation and the resulting amount of groundwater encountered, dewatering of the proposed quarry expansion may be required.

If the rock quarry mines below the water table there maybe some localised groundwater table lowering. This is only expected to be significant up to 50 m from the Project as the degree of water level decline at a domestic well or spring fed stream would be proportional to the distance from the edge of the excavation, decreasing exponentially with distance. No known residential wells or streams exist within 50 m of the proposed operation, and therefore water level lowering leading to decreased well yield (temporary or permanent) to the existing groundwater wells in the area is not expected.

In steep hydrogeological terrain, there is a possibility for a quarry that is excavated into the water table to lower the piezometric head in areas up gradient of the quarry (*e.g.,* within the capture area of the quarry), thereby reducing water levels in wells and reducing flow rates in springs. This effect is difficult to predict, and may only be noticed at very shallow dug wells or spring fed wells during the extended dry season. It is also noted that extensive rock quarrying is present on the north side of Cape Porcupine (Figure 5.2). No spring-fed wells or spring-fed streams are known to be present within 800 m upgradient of this quarry (Figure 2.2).

Water Quality Effects

Changes in water quality may theoretically occur as a result of excavations in the recharge area of the wells. Potential impacts include: temporary siltation from blasting, oil and nitrate from blasting operations, lubricant compounds, and other chemical releases within the quarry area. A possible long term impact of well water quality is decreased pH or increased dissolved solids from attenuation of acidic drainage from exposed sulfide-rich bedrock. Although there is no known significant acid generation from the quarries in the area, quartz-carbonate veins containing abundant pyrite are common in the Cape Porcupine Complex and minor chalcopyrite also occurs as finely disseminated grains in the granitoid and metavolcanic units (White et. al. 2000). Possible evidence of ARD was noted in a stream downgradient of the current quarry where iron is precipitating into a stream. ARD is not the only stimulus to potentially cause iron precipitation, however, because of the geology in the area, further assessment for ARD should be completed as localized ARD is possible within mineralized zones or along faults in the area.

Mitigation of Effects

Due to distance, significant impacts on groundwater supplies are not anticipated due to natural attenuation primarily by dilution and dispersion along the groundwater pathways. Mitigation of short-term turbidity impacts caused by blasting vibration 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, the proponent will replace or repair any water supply well found to be adversely affected by their quarry operation to the satisfaction of the owner.

Since ARD may be a concern on the site, further assessment of the site will be completed to determine if ARD is a likely problem. This assessment will include testing the general chemistry of the water in the stream downgradient of the site (i.e. location of the iron precipitation), testing the general chemistry of any water running directly off the current quarry site, as well as the installation of monitoring wells and testing of groundwater for general chemistry on site. In addition, rock cores of bedrock obtained during the drilling for the monitoring wells and currently exposed bedrock on the quarry face will be tested for sulphur content. Depending on the results of these preliminary tests, further testing or additional precautions may be recommended to deal with potential ARD. At a minimum, while the quarry is in operation, procedures will be in place that if a mineralized zone is encountered then production in the specific area will cease until it can be properly assessed for ARD potential. Depending on the results of the assessment, additional precautions/procedures may be implemented to address ARD and/or production in a specific area may be suspended.

Monitoring

It is recommended that groundwater monitoring wells be installed in the proposed quarry expansion area at locations between the quarry and identified domestic wells and the quarry and identified streams. A minimum of one well should also be installed in each of the different bedrock units on the site to address potential ARD concerns. These wells should be drilled to a depth similar to the identified wells along Highway 344, and/or to at least 15 m below the existing groundwater table, and can be used for monitoring seasonal and mine-related groundwater levels and chemistry (including ARD) on a regular basis. These wells could also be used to monitor the elevation of the groundwater table across the proposed area of expansion. In addition, runoff from the quarry will be periodically measured for pH and other water quality parameters to further address potential ARD concerns.

In summary, significant Project-related effects on groundwater resources are not likely to occur if ARD is not a problem. A groundwater monitoring program will be developed and implemented to allow for the collection of site specific groundwater data (*i.e*., depth and chemistry) and to monitor for ARD. In addition, a preliminary testing of bedrock in the area will be tested for sulphur and surface water flowing off the site and surface water in a downgradient stream with be tested for general chemistry to address the potential for ARD concerns. Details of the monitoring program (*i.e.,* monitoring parameters and frequency) will be developed in consultation with NSEL.

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 (the time before the arrival of non-Aboriginal peoples) 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.

The assessment of heritage resource potential within the study area incorporated sources that included archaeological site records at the Nova Scotia Museum and archival resources. There are no recorded archaeological sites within or adjacent to the study area (Nova Scotia Museum Archaeological Sites Database; S. Powell, pers. comm.).

Background research was conducted using the records at the Public Archives of Nova Scotia as well as those available on the Internet. Maps consulted included those by A.F. Church (1876) and Fletcher (1899). The historical aerial photographs in the NSDNR library were also examined.

Mulgrave, founded in 1800, is the closest inhabited area to the Project area. The 1876 A.F. Church map shows houses in the town of Mulgrave as well as scattered settlement along the shore road that leads north to Keaton Point. It also shows three houses on the west side of Porcupine Mountain, but there are no houses or roads shown within the Project area. The 1884 Geological Survey of Canada map is less detailed in terms of settlement, but more geographically accurate. For example, there are only three buildings shown in Mulgrave and none along the Keaton Point Road. There are no houses or roads shown within the Project area. A 1940 aerial photograph (A6810-49) indicates the Project area was covered in low, scrubby vegetation and, while there are some small tracks and paths visible, no roads or buildings can be seen.

Based on the background research, there appears to be low potential for the Project area to contain significant archaeological resources dating to the historic period. While the area was settled in the early nineteenth century, none occurred within the Project area.

The Project area is deemed to have a low potential for containing archaeological or heritage resources pertaining to First Nations peoples. There are no apparent resources within the area that would have attracted settlement during the pre-Contact period (400 to 500 years ago). It does not appear that the area around Morrisons Lake would have contained any such resources. First Nations settlement was more likely to occur on the Strait of Canso, which would have been a major transportation route, particularly in protected areas such as Mulgrave, Port Hastings, and Aulds Cove.

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

Certain activities associated with the Project (*i.e.,* grubbing, grading), 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 only low potential for identifiable human use in the pre-Contact and historic periods. No archaeological/heritage resources or areas of elevated heritage potential were identified in the Project area. It is assumed that no areas beyond the Project area will be disturbed during the development and operation of the proposed quarry expansion. As such, development and operation of the proposed quarry are not expected to have any adverse environmental effects on heritage resources.

If archeological 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. In the case of suspected human remains, the RCMP will be called. The appropriate authorities will determine further actions to be undertaken which could include avoidance and further assessment.

In summary, assuming appropriate measures are undertaken in the event archaeological or heritage resources are discovered, significant Project-related effects on these resources are not likely to occur.

5.8 Air 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.

In general, the air quality of Nova Scotia meets the desired ambient air quality criteria (NSDOE 1998). Motor vehicles, electrical power generation, pulp and paper processing and oil refining are the major local sources of air pollutants in the province. Port Hawkesbury is the only area in the province that experiences periodic exceedences in air quality.

Ambient air quality is monitored in Nova Scotia with a network of 28 sites, operated by NSEL, Environment Canada, and Nova Scotia Power Inc. (NSPI). Other industries may also monitor for air quality. Common air pollutants monitored regularly are SO_2, particulate matter (PM), CO, ground level ozone (O_3), NO_2, and H_2S. The closest NSEL monitoring site to Rhodena Quarry is located in Port Hawkesbury. In addition, since 1997, the province began continuous reporting of an air quality index for the Port Hawkesbury region. Since reporting began, air quality has been predominantly in the "Good" category (NSEL 2004).

The Rhodena Quarry is located in a rural setting with little industrial development within a distance of 5 km except for the neighboring Martin Marietta quarry. 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.

The spatial boundary for the assessment of air quality is the approximate zone of influence affected by the quarrying activities. This zone lies within close proximity of the Canso Causeway and Port Hawkesbury, Cape Breton.

The VEC spatial boundaries were set so that the effects on potential receptors (*e.g.*, residential, institutional development) were considered. The potential effects of routine air emissions from the Project are evaluated to such a distance that the concentration falls to near background level.

Temporal boundaries for the assessment of air quality have been developed in consideration of those time periods during which Project air emissions have the potential to degrade ambient air quality. In

general, emissions that could affect air quality will be relatively short-term from such operations as blasting; 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 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). Prevailing winds are from the southwest which would make the community of Port Hastings the most frequent receptor of air emissions from the Project 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 (CWS) that harmonize the regulations in all jurisdictions.

The contaminants regulated by the Province of Nova Scotia, or which are listed in *CEPA* are discussed below, indicating how the Project may contribute to their release.

Table 5.3 presents the Nova Scotia Air Quality Regulations and CEPA Ambient Air Quality Objectives. These standards can be used as comparison to ensure acceptable ambient air quality levels are being met throughout the life of the Project.

TABLE 5.3 Nova Scotia *Air Quality Regulations (Environment Act)* and *Canadian Environmental Protection Act* Ambient Air Quality Objectives

Pollutant and units (alternative units in brackets)	Averaging Time Period	Nova Scotia	Canada			
		Maximum Permissible Ground Level Concentration	Canada Wide Standards (pending)	Ambient Air Quality Objectives		
				Maximum Desirable	Maximum Acceptable	Maximum Tolerable
Nitrogen dioxide µg/m^3 (ppb)	1 hour	400 (213)	-	-	400 (213)	1000 (532)
	24 hour	-	-	-	200 (106)	300 (160)
	Annual	100 (53)	-	60 (32)	100 (53)	-
Sulphur dioxide µg/m^3 (ppb)	1 hour	900 (344)	-	450 (172)	900 (344)	-
	24 hour	300 (115)	-	150 (57)	300 (115)	800 (306)
	Annual	60 (23)	-	30 (11)	60 (23)	-
Total Suspended Particulate Matter (TSP) µg/m^3	24 hour	120	-	-	120	400
	Annual	70	-	60	70	-
PM2.5 µg/m^3	24 hour, 98th percentile averaged over 3 consecutive years	-	30 (by 2010)	-	-	-
PM2.5-10 µg/m^3		-	Under review in 2003	-	-	-

TABLE 5.3 Nova Scotia *Air Quality Regulations (Environment Act)* and *Canadian Environmental Protection Act* Ambient Air Quality Objectives

Pollutant and units (alternative units in brackets)	Averaging Time Period	Nova Scotia	Canada			
		Maximum Permissible Ground Level Concentration	Canada Wide Standards (pending)	Ambient Air Quality Objectives		
				Maximum Desirable	Maximum Acceptable	Maximum Tolerable
Carbon Monoxide mg/m^3 (ppm)	1 hour	35 (31)	-	15 (13)	35 (31)	-
	8 hour	15 (13)	-	6 (5)	15 (13)	20 (17)
Oxidants – ozone µg/m^3 (ppb)	1	160 (82)	-	100 (51)	160 (82)	300 (153)
	8 hour, based on 4th highest annual value, averaged over 3 consecutive years	-	128 {by 2010} (65)	-	-	-
	24 hour	-	-	30 (15)	50 (25)	-
	Annual	-	-	-	30 (15)	-
Hydrogen sulphide µg/m^3 (ppb)	1 hour	42 (30)	-	-	-	-
	24 hour	8 (6)	-	-	-	-

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

Quarrying activities can generate dust (*i.e.*, particulate emissions) which has the potential to be transported offsite. As per the conditions of the existing Rhodena Quarry Industrial Approval and the *Pit and Quarry Guidelines*, particulate emissions will not exceed the following limits at the site property boundaries:

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

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;
- Blasting activities;
- Conveyors;
- Crushing operations;
- Screening 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.

- Both crushing and screening are mineral extracting operations that involve 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. The reason for these emissions is often 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. Regarding unpaved roads, the force of the wheels on the road surface causes pulverization of surface material. Particles are picked up and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake following the vehicle continues to act on the road surface after the vehicle has passed.
- 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 have been made by 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 settling pond(s) with the use of a water truck. Monitoring of particulate emissions (dust) will be conducted at the request of NSEL.

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 NSEL.

Exhaust 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.

The air quality impacts of Rhodena Quarry can be controlled by standard mitigation practices and the Project is not likely to create significant adverse impacts on air quality. Significant impacts on air quality are defined as persistent exceedences of criteria provided in Table 5.3 after application of mitigative measures.

5.9 Socio-economic Environment

5.9.1 Description of the Existing Environment

Population and Employment

The quarry is located in Guysborough County, at the western boundary of Mulgrave Township and south of the summit of Cape Porcupine. The quarry is located in a rural setting with approximately 15 residences within 800 m of the quarry site. The population in the general area (*i.e.,* Guysborough County) is 9,827 (Statistics Canada 2001). The population in this area decreased by 10 % from 1996 to 2001. The employment rate in the County is 41.1 % while the unemployment rate is 22.9 % (Statistics Canada 2001). Approximately half of the experienced labour force consists of trades, transport and equipment operators and related occupations and sales and service occupations.

The Mulgrave town line runs through the quarry. The majority of the aggregates from the quarry, to date, have been sold to customers in Guysborough County, predominantly for municipal, residential and commercial developments. The closest town is Mulgrave, and the population is 904, which is a 0.9% increase since 1996 (Statistics Canada 2001). The employment rate in Mulgrave is 45.6 % while the unemployment rate is 28.7%. Approximately half of the labour force consists of trades, transport and equipment operators and related occupations and sales and service occupations.

The existing quarry currently employs one permanent employee and an additional 10 during aggregate production. Drilling and blasting activities require additional resources; these activities are sub-contracted to a professional blasting company. Hauling of materials from the quarry also involves additional resources; hauling (or trucking) is typically arranged through the customers.

Land Use

Mining

The Guysborough County Regional Development Authority (GCRDA) adopts a pro-development approach to adding value to natural resources including mineral resources in the County (GCRDA 2003). The GCRDA's visioning audit identifies the issues associated with population, business and industry in the County. Increased unemployment, loss of young people, and economic stagnation are expected to occur if the current demographic and economic trends continue in the County. The GCRDA, thus, is committed to encouraging opportunistic growth to offset the current trends and promote community well-being (GCRDA 2005). Mineral resource extraction is included in the GCRDA strategies to adding value to natural resources. The proposed quarry expansion project, therefore, is consistent with the GCRDA strategic planning and business development approaches.

Agriculture

The Rhodena Quarry Expansion Project is not located in a region where conflict with current and future agricultural practices is anticipated.

Forestry

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

Transportation

A transportation assessment and discussion of potential impacts of the quarry operation was conducted by Atlantic Road and Traffic Ltd. in support of this environmental registration. A description of the existing conditions in the area is included in the following paragraphs.

Road Descriptions

The Rhodena Quarry is located in Mulgrave adjacent to Route 344 approximately 3.7 km south of the Highway 104 intersection in Aulds Cove. This section of Route 344 was reconstructed many years ago to a reasonably high quality geometric standard including 3.7 m travel lanes and approximately 2.0 m shoulders, including about 0.6 m of paved shoulder. The posted speed limit is 90 km/h and changes to 80 km/h just south of the site entrance driveway. The southbound approach has one travel lane and the northbound approach (from Mulgrave) is two lanes wide and includes a passing lane that ends just north of the driveway. The driveway is located on a relatively flat section of roadway and has adequate sight distances for both approaches.

Traffic Volumes

Available traffic volume data have been obtained from the Department of Transportation and Public Works. Traffic volumes are reported as Annual Average Daily Traffic (AADT) volumes and provide an estimate of the average daily volume at a location that would be obtained by counting all traffic for an entire year and dividing by 365. A machine traffic count obtained in May 2005 just north of the driveway indicated that the AADT volume for 2005 was approximately 2000 vehicles per day (vpd), with average weekday volumes in May about 2300 vpd.

Collision Data

The relative 'safety' of a section of roadway is evaluated by comparing Study Area collision rates to the average collision rates for all similar roadways in the Province. The driveway to the site is about mid-point in a 6.5 km section of Route 344 for which collision rates are maintained. The average collision rate for this section of Route 344 during the five year period 1999 to 2003 was 51.8 collisions per hundred million vehicle kilometres (HMVK) which is considerably lower than the average rate of 92.8 collisions per HMVK for all similar routes in Nova Scotia. A review of collision data for the road section did not indicate any history of collisions at or near the site driveway.

Quarry Traffic

The quarry is currently producing an average of five truck loads per day. Considering the moderate hourly two-way volume on Route 344 is about 150 to 200 vehicles per hour between 7:00 AM and 7:00 PM, to date the present truck traffic volume generated by the quarry has not affected the level of performance of Route 344.

As a result of the expansion, the average dailty truck traffic volume is not expected to increase significantly above current levels. A transportation study was completed to predict effects on traffic in the case of a large local construction project whereby there may be periodic increases in truck traffic.

Recreation and Tourism

Recreational fishing and hunting are permitted in the region surrounding the Project area. However, recreational fishing records have not been found and the lakes surrounding the Project area are not included in the Provincial recreational fish stocking program. While moose hunting is not permitted in

the region surrounding the Project area, deer hunting is allowed. The Rhodena Quarry is situated in Deer Management Zone 4 and stamps allocated for this zone are set at 2,000. Zone 4 is the largest deer hunting zone and has the largest number of stamps available. (NSDNR 2005). The general open season during 2005 ran from the last Friday in October to the first Saturday in December. The bowhunting season ran from September 24 to October 27 and December 5 to December 10.

There are no designated parks within or surrounding the Project area.

Human Health

Human health related aspects and potential effects on environmental health include potential impacts on air quality (*i.e.*, particulate emissions) and safety of commuters. Air quality is addressed in Section 5.8, and Sections 5.9.1 (collision data) and 5.9.2 includes a discussion of the safety of travellers.

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

Population and Employment

The direct and indirect employment associated with operation of Rhodena Quarry may be considered a benefit, or positive effect, to the regional economy. In addition, the quarry produces valuable products that support development and infrastructure, and the growth of the region's economy.

Expansion of the Rhodena Quarry to allow for continued operation will result in an overall positive effect on the regional economy. The availability of additional 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 2004).

Another interpretation of Project-related employment effects is that they may be considered neutral. This is because the market that Rhodena Quarry is supplying is not new, the products are not new, and the demand for aggregate in Guysborough County is currently being met by existing quarries, including the existing Rhodena Quarry. Any increase in employment associated with the Project could be offset by reductions elsewhere (*i.e*., at other quarries).

Land Use

Due to the existing industrial activity onsite (*i.e.*, quarry) and the distance from residences, impacts on existing and future adjacent land uses are not expected. Quarry activities will be conducted in accordance with the Pit and Quarry Guidelines and all setback distances specified in the Guidelines will be maintained.

Quarrying activities will produce noise from equipment operation and blasting. The quarry is located within 230 m from the nearest residence/structure. The existing quarry operation has signed one agreement with the Spencer resident located within 800 m of blasting. The quarry is sheltered from the road by a tree buffer, left in place during timber harvesting activities. The potential for noise from the quarry site to have a significant effect on residents is minimal.

Blasting operations associated with the proposed expansion will be conducted in accordance with current operations at the quarry as permitted by NSEL (Approval No. 99-IAE-004), in accordance with the Pit and Quarry Guidelines (NSEL 1999) and with a frequency similar to past operations at the site. Blasting will be conducted in accordance with the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). It is understood that additional blast monitoring activities and/or reporting may be required by NSEL. A blast design has been prepared and submitted to NSEL.

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

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

Sound monitoring will be conducted at the request of NSEL.

Transportation

In general, truck traffic associated with this Project is not anticipated to increase above that of the existing operation, unless significant aggregate supply contracts were awarded (*i.e.*, a local highway construction project).

No new access roads are required for this Project. Rhodena Rock will maintain the portion of the access road to the quarry.

The transportation impacts of the proposed quarry expansion can be summarized by the following:

- The driveway is on a level and straight section of Route 344 with adequate sight distances.
- Volumes on Route 344 are moderate, including a 2005 AADT volume of about 2000 vehicles per day and two-way hourly volumes of about 150 to 200 vehicles per hour between 7:00 AM and 7:00 PM on typical May weekdays in 2005.
- Review of collision data does not indicate any history of collisions at or near the site driveway.
- Average daily and hourly truck traffic volumes projected to be generated by the Quarry are not expected to affect the level of performance of Route 344.

The transportation assessment was conducted using exaggerated traffic volumes based on 500,000 tonnes per year (of which the quarry is only expected to produce on average 300,000 tonnes of aggregate per year). Using 500,000 tonnes per year, assuming on average of 25 tonnes per load and a production rate of 40 weeks per year, the production rate would be equal to about 85 truck loads per day. Since the quarry may operate 12 hours per day, hourly truck volumes generated by this scenario would average seven loaded trucks leaving the quarry and seven empty trucks returning. Considering the moderate hourly two-way volume of Route 344 is about 150 to 200 vehicles per hour between 7:00 AM and 7:00 PM, even this exaggerated scenario is not expected to affect the traffic performance on Route 344.

In summary, the number of loaded trucks per day to and from the quarry is not anticipated to increase and should not affect the level of performance or safety of the road.

Recreation and Tourism

The existing quarry and proposed expansion 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 Rhodena Rock to pursue their activities in the area. Fishing may occur in the tributary to Morrisons Lake or in McNairs Brook but expansion and operation of the quarry are not expected to have an impact due to the distance from these potential recreation fishing locations.

Human Health

Human health related issues are discussed in Section 5.8 Air Quality and Sections 5.9.1 and 5.9.2 Transportation. 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 are not likely to occur. Continued operation of the quarry will result in economic benefits, including employment and ongoing business opportunities.

5.10 Other Undertakings in the Area

5.10.1 Description of the Existing Environment

There is one other quarry operation licensed to operate on property immediately adjacent to Rhodena Quarry. The Martin Marietta Materials Canada Ltd.'s Porcupine Mountain Quarry at Auld's Cove extracts around 3.8 Mt/y, with an expansion proposed of 4.35 Mt/y (Panagapko 2004). Aggregate materials extracted from the Porcupine Quarry include crushed granite, asphalt, and concrete sand. The Porcupine Quarry is located on the deep tidewater of the Strait of Canso and is able to ship aggregates on a year-round basis. The markets are primarily located in other Maritime provinces, the eastern seaboard states, Gulf Coast, and the Caribbean.

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

The proposed quarry expansion will not compete with the Porcupine Quarry in terms of trucking traffic, water withdrawal, *etc*. The Rhodena Quarry markets are primarily local while the Porcupine Quarry relies on its proximity to the Strait of Canso for national and international shipments. No new demands on local suppliers or residences for the quarry expansion are predicted. Noise and dust levels and water quality may be a concern for local residences, however, both quarries are required to operate within provincial guidelines that manage and regulate quarry operations for noise, dust, and run off water quality.

6.0 EFFECTS OF THE PROJECT ON THE ENVIRONMENT

Activities associated with the proposed quarry expansion and operation will be conducted in accordance with terms and conditions of the existing Industrial Approval for Rhodena Rocks' existing quarry operation at Porcupine Mountain, as well as future amendments to the Approval, and the Pit and Quarry Guidelines. Environmental effects of the quarry expansion will include the loss of terrestrial habitat within the proposed revised quarry expansion area. The Proponent is committed to wetland compensation for the loss of wetland habitat as a result of quarrying operations. Field surveys conducted to date indicate that this area does not include unique habitat or rare or sensitive species; therefore, these effects are not anticipated to be significant.

Groundwater monitoring wells will be constructed at various locations within the proposed revised expansion area. Depth to groundwater will be monitored on a regular basis, in consideration of seasonal variations and blasting activities (*i.e.,* before and after blasting). This data will be used to monitor groundwater elevations across the site and monitor changes in the groundwater table as the quarry develops. The data could also be used to identify a hydraulic connection between the quarry area and the watercourse to the east as well as monitor groundwater inflow to the quarry and any identifying potential water management issues.

With respect to acid production potential, rock will be sampled and analyzed regularly to confirm the quality of the aggregate and ensure that the Halifax Formation slates have not been encountered/disturbed. In addition, pH of the final effluent from the settling pond will be monitored seasonally.

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 or socio-economic effects are likely. Continued operation of the quarry will result in economic benefits, including employment and ongoing business opportunities.

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 are a number of planning, design, 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 year round, weather depending, 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 effect 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 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). Examples of other relevant federal legislation include the *Migratory Birds Convention Act* and the *Species at Risk Act*.

9.0 FUNDING

The proposed expansion will be 100 percent privately funded.

10.0 ADDITIONAL INFORMATION

No additional information is provided in support of this document.

11.0 REFERENCES

11.1 Literature Cited

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11.2 Personal Communications

Nova Scotia Museum Archaeological Sites Database; Stephen Powell, personal communication

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APPENDIX A

Registry of Joint Stocks and Industrial Approval

Jacques Whitford

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

Print | Close Window

PROFILE - RHODENA ROCK LIMITED - as of 2006-01-09 10p.m.

Company/Society Name:	RHODENA ROCK LIMITED
Registry ID:	2549778
Type:	N.S. Limited Company
Nature Of Business:	
Status:	Active
Jurisdiction:	Nova Scotia
Registered Office:	10442 HIGHWAY 19 SOUTH WEST MABOU NS B0E 1X0
Mailing Address:	
Previous Name:	2549778 NOVA SCOTIA LIMITED

PEOPLE

Name	Position	Civic Address	Mailing Address
TED VAN ZUTPHEN	Recognized Agent	9988 HIGHWAY 19 PORT HOOD NS B0E 2W0	PO BOX 130 PORT HOOD NS B0E 2W0
TED J VAN ZUTPHEN	PRESIDENT	9988 HWY 19 PORT HOOD NS B0E 2W0	
TED J VAN ZUTPHEN	Director	9988 HWY 19 PORT HOOD NS B0E 2W0	
JOHN A VAN ZUTPHEN	Director	8518 HWY 19 PORT HOOD NS B0E 2W0	
JOHN A VAN ZUTPHEN	SECRETARY	8518 HWY 19 PORT HOOD NS B0E 2W0	

ACTIVITIES

Activity	Date
Registered	1996-04-18
Incorporated	1996-04-18
Special Resolution	1996-06-19
Revoked for Non-Payment	1997-06-01
Reinstated	1998-01-20
Effective Date of Name Change	1998-01-20
Filed Name Change	1998-01-20
Annual Renewal	1998-04-28
Address Change	1998-08-05
Annual Renewal	1999-03-26
Annual Statement Filed	1999-03-26
Annual Renewal	2000-03-28
Annual Statement Filed	2000-03-28
Annual Renewal	2001-03-21
Annual Renewal	2002-05-02
Annual Statement Filed	2002-05-02
Annual Renewal	2003-04-16
Annual Renewal	2004-03-29
Annual Statement Filed	2004-03-29
Annual Renewal	2005-04-05
Annual Statement Filed	2005-04-05
Change of Directors	2005-04-22

RELATED REGISTRATIONS

There are no related registrations on file for this company.

N. S. Dept. of the Environment

P. O. BOX 603 • PORT HAWKESBURY, NOVA SCOTIA • B0E 2V0 • (902) 625-0791 • FAX (902) 625-3722

File No: 11-99-0008
App. No: 99-IAE-004
(Amendment)

April 30, 1999

Rhodena Rock Limited
P. O. Box 130
Port Hood, Inc. Co.
Nova Scotia
B0E 2W0

Attention: Mr. Ted Van Zutphen

Dear Mr. VanZutphen:

Attached is your approval under the Environment Act authorizing the operation of a quarry at Porcupine Mountain, Guysborough County, Nova Scotia.

This approval or a copy is to be kept on-site at all times. All personnel involved in the project must be made fully aware of the terms and conditions of this approval. The terms and conditions are shown on the approval and it is your responsibility to ensure that they are followed. Failure to comply with the terms and conditions is an offence.

It is your duty to advise the Department of any new and relevant information respecting any adverse effect that results or may result from the approved activity, which comes to your attention after the issuance of the approval. This is required under Section 60 of the Environment Act.

If you alter, extend or modify the activity beyond the description given in your approval, you should reapply because a new approval may be required.

....2

Please call at once if you have any questions about the conditions of this approval, especially those pertaining to the actual construction. You may reach me at (902) 625-0791.

Yours truly,

Don Feldman

Don Feldman
District Manager
Eastern Region

LM:dm
Enclosures

Nova Scotia

DEPARTMENT OF THE ENVIRONMENT

Industrial Approval

Pursuant to the Environment Act and Regulations made pursuant thereto, and subject to the terms and conditions contained in the approval, this approval is granted to Rhodena Rock Limited to construct and/or operate a quarry at or near Porcupine Mountain, in the County of Guysborough, in the Province of Nova Scotia.

Granted at Antigonish, in the County of Antigonish, Province of Nova Scotia, this 20th day of April, A.D. 1999.

99-IAE-004 - Amendment 1
APPROVAL NUMBER

Don Feldman
MINISTER OR PERSON DESIGNATED BY THE MINISTER

TERMS AND CONDITIONS OF APPROVAL

NOVA SCOTIA DEPARTMENT OF THE ENVIRONMENT

Project: Rhodena Rock Limited
P. O. Box 130, Port Hood, Inv. Co., N.S., B0E 2W0
Quarry, Porcupine Mountain, Guys. Co., N. S.

Approval No. 99-IAE-004 - Amendment 1

File No. 11-99-0008

Conditions:

This application is recommended for approval subject to the following terms and conditions:

1. **Scope of Approval**

This approval relates to Rhodena Rock Limited, hereafter called the "proponent" and their request to operate a quarry at Porcupine Mountain, Guysborough County, Nova Scotia.

2. **General Terms and Conditions**

a) The proponent shall conduct its' quarry in accordance with provisions of the:

i) *Environment Act*, SNS 1994-95 C. 1;
ii) Regulations pursuant to the above Act;
iii) Local municipal environmental bylaws, zoning restrictions.

b) The Minister reserves the right to modify, amend, or add terms and conditions to this Industrial Approval at any time provided that any modification, addition, or amendment is deemed necessary to ensure adequate environmental protection.

c) This Industrial Approval is not transferrable without the written permission of the Minister.

d) If the Minister determines that there has been non-compliance with any or all of the terms and conditions provided in this Approval issued pursuant to Section 56(1) of the *Environment Act*, the Minister may in accordance with Section 58 (2)(b) cancel or suspend, the approval until such time as the Minister is satisfied that all terms and conditions have been met.

e) The proponent shall notify the Nova Scotia Department of the Environment prior to any process changes or waste disposal practices not approved under authorization of this approval.

f) The proponent shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this approval.

g) The proponent shall develop the site in such a manner as to expose only the areas that are currently being used/excavated.

h) The proponent shall ensure that this approval or a copy is kept on-site at all times and that personnel directly involved in the project are made fully aware of the terms and conditions which pertain to this approval.

i) The proponent will be required to register their project under Part IV of the *Environment Act* should the area exceed 4 hectares.

j) The proponent shall submit a legal property boundary survey outlining the active area of the pit site. This survey shall be submitted within two (2) calendar months from the date of issuances of the approval.

3. **Particulate Emissions**

a) Particulate emissions shall not exceed the following limits at the site property boundaries:

Annual Geometric Mean	70ug/m^3
Daily Average (24 hrs)	120 ug/m^3

b) The generation of fugitive dust from the site will be suppressed by the application of water sprays, or the application of other suitable dust suppressants approved by the Department.

c) Site access road(s) shall be maintained to minimize dust generation. The use of waste oil is not permitted.

NOTE: Monitoring of Particulate Emissions shall be at the request of the Nova Scotia Department of the Environment District Office.*

4. **Sound Levels**

Sound levels measured at the 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 (Night)

NOTE: Monitoring shall be at the request of the Nova Scotia Department of the Environment District Office.*

5. **Surface Water**

a) The site shall be maintained to prevent siltation of the surface water which is discharged from the property boundaries into the nearest watercourse. This includes the installation of soil erosion and sedimentation control designed to meet the specifications of this Department.

b) All erosion and sedimentation control devices shall be installed prior to any excavation of material.

c) If it becomes necessary to drain the pit workings, the wastewater shall be drained to settling ponds for appropriate treatment to meet the suspended solids limits outlined in condition 5 (d).

d) The proponent shall sample and ensure the following liquid effluent levels are met:

Final Effluent Discharge Limits

Parameters	Maximum in a Grab Sample	Monthly Arithmetic Mean	Monitoring Frequency
Total suspended solids	50 mg/l	25 mg/l	weekly
pH	5-9	6-9	weekly

e) Non-compliance of the above final effluent discharge limits shall be immediately reported to the Nova Scotia Department of the Environment District Office.*

f) Monitoring stations for liquid effluent shall be determined by the Nova Scotia Department of the Environment District Office* following a final inspection of the site.

g) A summary of results of monitoring shall be submitted to the Nova Scotia Department of the Environment District Office* upon request.

h) The proponent shall secure an approval amendment to conduct washing of aggregate on site.

6. **Groundwater**

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

b) The proponent shall secure from the Minister an approval amendment prior to excavating below the watertable.

7. **Separation Distances**

a) The proponent shall maintain a 30 m (100 feet) separation distance from the excavation to the road allowance of any common or public highway.

(b) The proponent shall not locate any buildings, product stockpiles, plant or structures within 30 m (100 feet) of the boundary of the quarry property.

(c) The proponent shall maintain a 90 m (300 feet) separation distance from the working face of the quarry, any building, product stockpiles, plants or structures to the nearest offsite structure.

(d) The proponent shall maintain an 800 m (0.5 mile) separation distance from the excavation of the quarry to the nearest off-site structure.

(e) The proponent shall maintain a 30 m (100 feet) separation distance from the pit or quarry excavation and associated works from the bank top or high water mark of any surface watercourse.

(f) The proponent shall maintain a 15 m (50 feet) separation distance from the quarry excavation to any other property boundary.

8. Reclamation

a) The site shall be progressively reclaimed and rehabilitated where possible by grading, contouring and re vegetating the disturbed land.

b) The proponent shall submit a rehabilitation plan to the Nova Scotia Department of the Environment for approval by June 30, 1999.

c) The proponent shall rehabilitate the site within six (6) months of abandonment and in accordance with the approved rehabilitation plan or other terms as specified by the department.

d) The proponent shall post a security in a form acceptable to the Department in the amount of $2,000.00 an acre of active area on or before the 31st day of May 1999.

e) The Nova Scotia Department of the Environment shall release the security to the proponent after rehabilitation of the active area has been completed to the satisfaction of the Minister of the Environment.

f) The proponent shall ensure that any security posted for rehabilitation be kept valid for the term of the approval.

9. **Blasting**

a) The proponent shall have a blast design prepared by a qualified consultant and the design sent to the Nova Scotia Department of the Environment for review prior to any blasting.

b) The proponent shall conduct a pre-blast survey, including a water quality analysis for private water supplies, for all structures within 1,500 meters of the quarry. The survey shall be conducted by a person acceptable to the department and the results of this survey sent to the Nova Scotia Department of the Environment by May 3, 1999. Water quality parameters will be determined by Nova Scotia Department of the Environment staff.

c) The proponent 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) The proponent shall ensure that all blasts are monitored at the nearest structure (residential, commercial, institutional) and a second monitor to be placed 800 meters downwind of the quarry site. The proponent shall notify the local broadcast media and the local Department of Environment office three hours prior to setting off the blast charge. The following limits for blasting shall not be exceeded:

Air Blast	128 dBL
Ground Vibration	12.5 mm/sec

NOTE: All blasts are to be monitored by a person acceptable to the department and the results sent to the Nova Scotia Department of the Environment's District Office* on a monthly basis.

10. **Access Roads**

a) The proponent shall install all culverts in accordance with the Nova Scotia Watercourse Alteration Specifications (1997), and in particular, to those pertaining to culvert installations.

b) Adequate control should be implemented to control erosion and siltation from the access road construction. The proponent shall follow the guidelines outlined in the Nova Scotia Department of the Environment's "Erosion and Sedimentation Control Handbook."

11. Dispute Resolution Mechanism

The proponent shall develop a dispute resolution mechanism to deal with complaints from the public related to noise, dust, blast damage, etc. associated with the operation of the quarry.

12. Expiry Date

This approval shall expire on December 31, 2009.

Antigonish District Office*

APPENDIX B

Rhodena Rock Quarry Hydrology

Jacques Whitford

Hydro-Com Technologies
a division of R.V. Anderson Associates Limited

445 Urquhart Crescent
Fredericton New Brunswick E3B 8K4 Canada
Tel 506 455 2888 Fax 506 455 0193
Web www.hydro-com.com

December 21, 2005 Project # 05-6613

Jacques Whitford Environment Limited
3 Spectacle Lake Drive
Dartmouth, NS
B3B 1W8

Attention: Ms. Angela Swaine

Dear : Ms. Swaine

Re: Rhodena Rock Quarry Hydrology

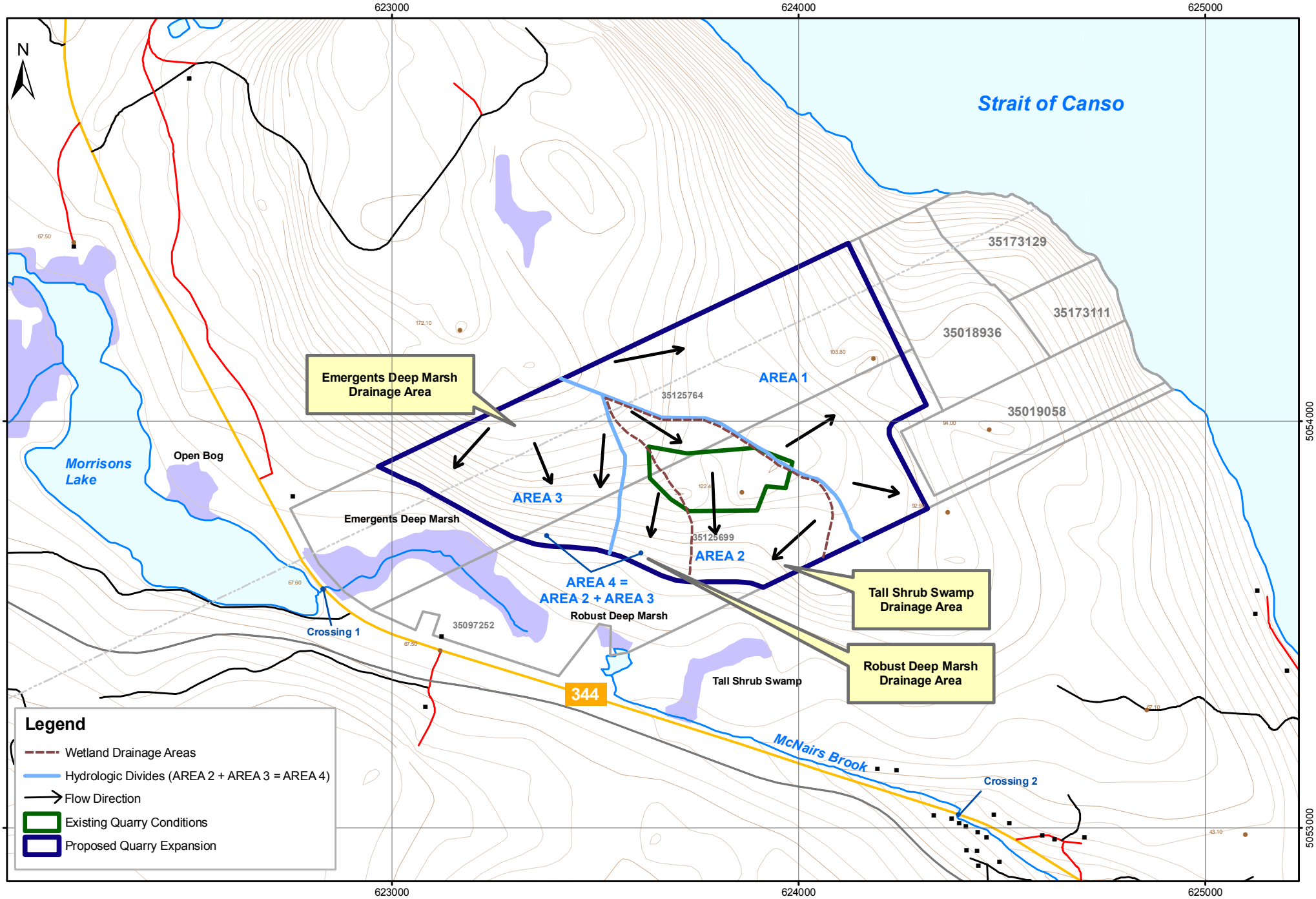
Dear Ms. Swaine:

Hydro-Com Technologies, acting at your request, has performed a review of the proposed *Rhodena Rock Quarry* expansion project. The objective of the review was to determine the hydrologic effects of this quarry expansion. This report has been prepared solely for the project described above and contains a description of our methodologies and our findings.

1. Site Description

The plan view of the existing quarry and proposed quarry expansion area is presented in Figure 1. The existing and proposed developments are located at the western boundary of the Mulgrave township approximately 0.9 km south of the summit of Cape Porcupine in Guysborough County. The proposed expansion area is bordered by Route 344 to the south and the Strait of Canso to the east.

The existing quarry (delimited in green in Figure 1) is approximately 4.0 ha in size. The proposed expansion area (delimited in blue in Figure 1) is approximately 62.8 ha in size and includes the existing quarry. The proposed expansion area is located on the eastern face of the mountain and its terrain is highly sloped (generally 10-15%). Currently, overland flow within the proposed expansion area is separated by two hydrologic divides and drains in three directions from AREAS 1, 2 & 3 as indicated in Figure 1. Flow from AREA 1 drains northeast into the Strait of Canso, flow from AREA 2 drains south toward McNairs Brook, and flow from AREA 3 drains south toward Morrisons Lake. Three wetlands are located south of the site and receive overland flow from the proposed expansion area: (i) *Emergents Deep Marsh*, (ii) *Robust Deep Marsh*, and (iii) *Tall Shrub Swamp*. Emergents Deep Marsh drains into Morrisons Lake, which is connected into a lake network discharging into the Strait of Canso north of the site. Both Robust Deep Marsh and Tall Shrub Swamp drain into McNairs Brook which flows east into the Town of Mulgrave before discharging into the Strait of Canso. Drainage infrastructure currently conveys flow under Rte 344 at two locations downstream of the proposed expansion area as shown in Figure 1 (labelled as *Crossing 1* and *Crossing 2*).



Map Parameters
Datum/Projection: UTM-NAD83-Z20
Scale 1:12,000
Date: December 2005
Project No: SD19574

Figure 1
Plan View of Site

RHODENA ROCK QUARRY EXPANSION PROJECT

Jacques Whitford

Runoff from the impacted quarry areas following excavation and landforming will be collected for treatment before being discharged. Please note that the recommendations of this study are based on the assumption that off-site runoff will be diverted around the proposed quarry expansion area.

2. Objectives

The objectives for this assignment are as follows:

1. Estimate quantities of surface runoff from the proposed quarry expansion area for the currently proposed ultimate level of quarry development;
2. Recommend the location(s) for the discharge of runoff from the site;
3. Estimate the size and design discharge capacity of the flow retention/siltation structures required for the currently proposed ultimate level of quarry development; and
4. Assess potential effects of the quarry on downstream flows and water quality for the currently proposed ultimate level of quarry development.

3. Methodology

The methodologies that were used to satisfy the above objectives were as follows:

1. The annual runoff volume from the proposed quarry expansion area was estimated using proration of mean annual flows from a nearby hydrometric station and using values from the MacLaren Atlantic Limited (1980)[1] study;
2. The recommendations for discharge location(s) from the currently proposed ultimate level of quarry development were based on minimizing the hydrological impacts on receiving wetlands and infrastructure;
3. The size and design discharge capacity of the required flow retention/siltation structures were determined using a HEC-1 runoff model and the Rational Method, and physiographic parameters of the proposed quarry expansion area;
4. The effects on downstream flows and water quality were assessed based on experience with similar developments; and
5. The hydrological attributes of the wetlands were evaluated using the relevant sections of the Nova Scotia Department of Environment Wetlands Directive (for wetlands smaller than 2.0 ha) and the North American Wetlands Conservation Council Wetland Evaluation Guide (for wetlands larger than 2.0 ha).

The following physiographic parameters were obtained from the available project mapping:

1. The size of drainage areas within the proposed quarry expansion area are presented in Table 1;
2. The wetland physiographic parameters are presented in Table 2;
3. The runoff coefficient of the proposed quarry expansion area is 0.30 for pre-development conditions and 0.65 for post-development conditions; and

[1] MacLaren Atlantic Limited. 1980. *Regional Flood Frequency Analysis for Mainland Nova Scotia Streams*. Canadan-Nova Scotia Flood Reduction Program. Figure 3.1.

4. The Soil Conservation Service (SCS) land use curve number of the proposed development areas at the ultimate development condition for average antecedent moisture conditions (AMC II) is 78.

Table 1: Physiographic parameters of drainage areas within proposed quarry expansion area

Area Designation [A]	Size (ha)
AREA 1	28.3
AREA 2	18.9
AREA 3	15.7
Total Area	62.8

[A] Please refer to Figure 1

Table 2: Physiographic parameters of wetlands receiving flow from the proposed quarry expansion area

Name	Size (ha)	Total Drainage Area (DA_1) (ha)	Drainage area within expansion (DA_2) (ha)
Emergents Deep Marsh	5.7	39.1	12.2
Robust Deep Marsh	0.3	3.85	1.86
Tall Shrub Swamp	1.5	21.8	14.0

4. Mean Annual Site Runoff

The mean annual site runoff from the proposed quarry expansion area was estimated using a number of different approaches for comparison purposes as shown in Table 3. The upper bound of the mean annual runoff volume was first calculated assuming that all precipitation contributes to runoff (using local climatic data). The lower bounds were obtained using area-based proration from a nearby hydrometric station and using mean annual runoff values for the area as reported by MacLaren Atlantic Ltd (1980). Because both of the estimation methods for the lower bounds derive mean annual runoff volumes from larger watersheds containing undeveloped areas (which help reduce overland runoff volumes), the expected mean annual runoff volume from the proposed expansion area at ultimate development conditions was estimated by increasing the lower bound value by a reasonable amount to reflect the expected hydrological conditions. The results of this analysis are presented in Table 3.

Based on historical climatic data at the Port Hastings climate station (approximately 4 km from the project site) (1971-1988), the average annual precipitation at the site is 1542.6 mm. If all of this precipitation is converted into surface runoff (which would represent an upper bound of expected average annual runoff), the annual runoff volume of runoff from the proposed quarry expansion area is estimated to be 969,000 m^3, which corresponds to a mean annual flow of 30.7 L/s.

A lower bound for the expected mean annual runoff volume was established by a drainage area based proration of flows from a nearby hydrometric station. The hydrometric station 01ER001 (1957-1995), Clam Harbour River near Birchtown with a drainage area of 45.1 km^2, was chosen

as most representative for proration purposes as its drainage area and hydrological characteristics were most similar to those at the proposed quarry site. By prorating flows from the hydrometric station, a mean annual runoff volume for the proposed quarry expansion was estimated to be 710,000 m^3, which corresponds to a mean annual flow of 22.5 L/s.

Table 3. Estimated mean annual runoff from the site based on different assessment methods.

Description	Method	Annual Flow Volume (m^3)	Mean Annual Flow (L/s)
Upper Bound	Annual Precipitation	969,000	30.7
Lower Bound	Hydrometric Station Proration	710,000	22.5
Lower Bound	MacLaren et al.	628,000	19.9
Expected Mean	Adjustment of lower bounds[a]	810,000	25.7

[a]Average of both lower bound estimates + expected increase in annual runoff.

A second approach was used to estimate the lower bound of the expected mean annual runoff at the site for comparison purposes. Based on the MacLaren Atlantic study, which presents a spatial distribution of runoff volumes throughout Nova Scotia, a mean annual runoff depth of 1,000 mm was determined as the mean annual runoff depth for the region. Using this approach, the mean annual runoff volume for the proposed quarry expansion area was computed to be 628,000 m^3 (which corresponds to a mean annual runoff flow of 19.9 L/s).

Development of the quarry will involve the removal of vegetative cover and topsoil. Clearing the land of vegetative cover will reduce interception and temporary storage of precipitation. This hydrologic change will result in less evapotranspiration and more direct runoff from the site. The average *potential* evapotranspiration rate in the region is approximately 462 mm (Dzikowski et al, 1984)[2]. Assuming that the *actual* evapotranspiration rate is reduced by 225 mm and that the annual runoff volume is increased by the same amount, the annual runoff volume is computed to be approximately 810,000 m^3 (which corresponds to a mean annual flow of 25.7 L/s) following ultimate development of the quarry expansion area.

5. Proposed location(s) and flow redistribution of discharge from proposed quarry area

To determine the most appropriate discharge locations and flow redistribution option(s) from the proposed expansion quarry area, the expected changes in mean annual runoff, peak flows and drainage dynamics into receiving water bodies (i.e. the three (3) wetlands and McNairs Brook) were considered. Mean annual runoff, peak flows and drainage dynamics are expected to vary following development as a function of flow redistribution, increased surface imperviousness and runoff detention within the proposed quarry expansion area.

Increases in mean annual runoff are not expected to greatly impact the hydraulic properties (i.e. water level and storage capacity) of wetlands and downstream watercourses. The normal water level within a wetland is most dependent on the elevation of its hydraulic control(s). Maintaining

[2] Dzikowski, P.A, G. Kirby, G. Read, W.G. Richards. 1984. *The Climate for Agriculture in Atlantic Canada.* Publication No. ACA 84-2-500. Agdex. No. 070. 19 pp.

normal water levels will help conserve normal soil moisture conditions for the riparian zone vegetation and recharge into downstream watercourses.

Decreases in mean annual runoff may affect the hydraulic properties of the three (3) wetlands (i.e. decrease in water levels) because of the reduced surface water inflow. Reduced surface water inflow will likely lead to reduced water levels in the wetlands following dry periods and high evaporation. Lower water levels can be detrimental to riparian zone vegetation as well as reduce downstream recharge rates.

Changes in drainage dynamics can impact riparian zone vegetation in wetlands depending on the location of inflow. If most inflow is relocated to the lower reaches of the wetland, the riparian zone vegetation in the upper reaches may be affected by a reduction in available water.

Large increases in peak flows can be detrimental to receiving wetlands and infrastructure, as it may lead to localized erosion within or upstream of the wetland and damage to drainage infrastructure following peak runoff events.

Three (3) development scenarios have been investigated for comparative purposes to determine the relative change in mean annual runoff, peak flows, and drainage dynamics following development. The three (3) proposed development scenarios are the following:

(A) All runoff from the southern portion of the proposed expansion area (AREA 4) shall be redirected into Emergents Deep Marsh as shown in Figure 2.

(B) Runoff in the southern portion of the proposed expansion area (AREA 4) shall be directed into Emergents Deep Marsh and Tall Shrub Swamp based on the existing hydrologic divides as shown in Figure 3.

(C) Runoff from the southern portion of the proposed expansion area (AREA 4) shall continue to be directed into Emergents Deep Marsh, Robust Deep Marsh, and Tall Shrub Swamp based on the existing wetland drainage area delineations as shown in Figure 4.

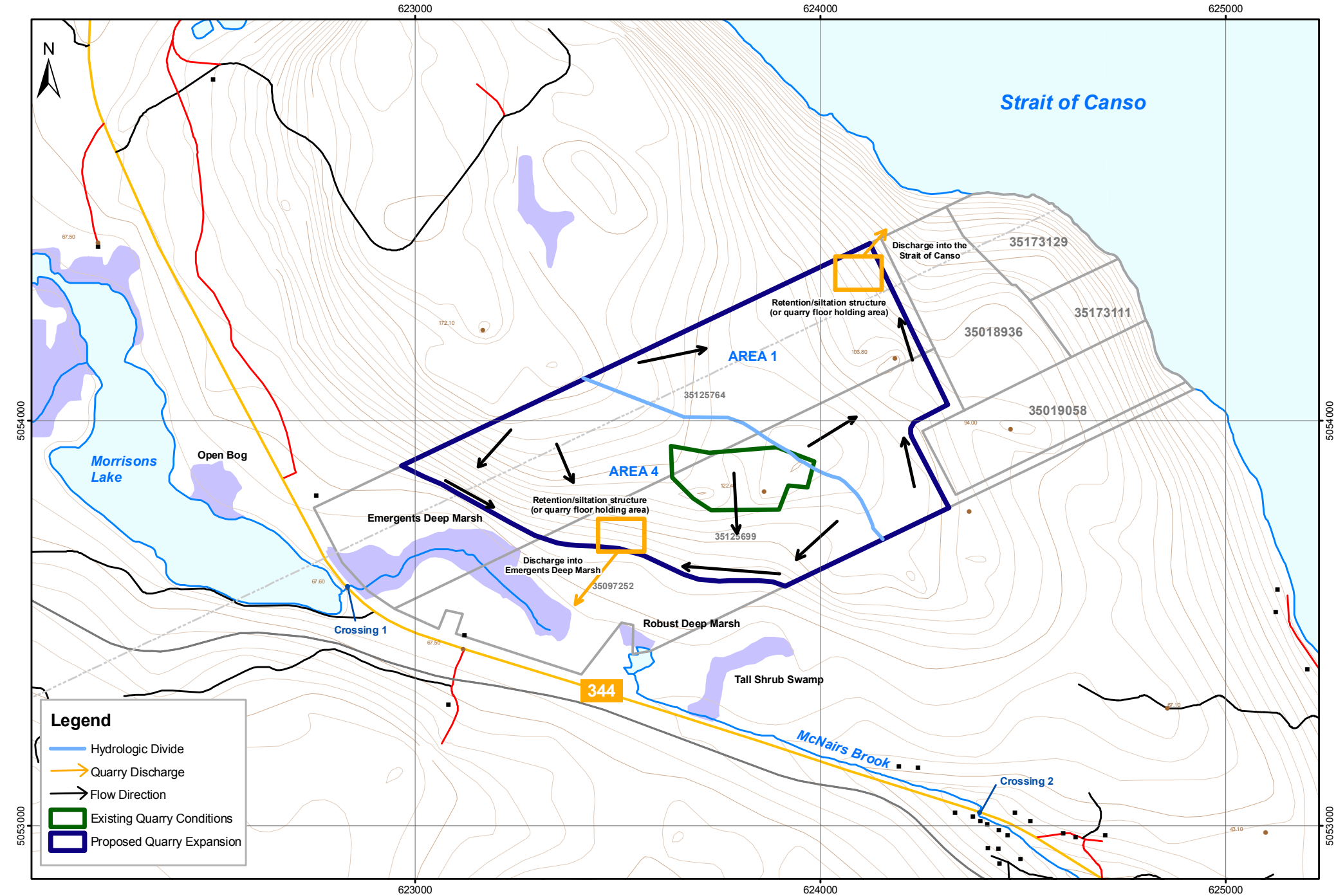
5.1 Effects on mean annual runoff

Firstly, the expected impacts on mean annual runoff for the scenarios described above were assessed. The results of this analysis are presented in Table 4.

Table 4: Expected changes in mean annual runoff volume into each wetland following different proposed development scenarios:

Scenario	Change is mean annual runoff (%)		
	Emergents Deep Marsh	Robust Deep Marsh	Tall Shrub Swamp
A	+ 57%	-57%	-59%
B	+7%	-57%	+34%
C	+7%	+12%	+12%

Based on these results, Scenario A is expected to have the most detrimental impact on Robust Deep Marsh and Tall Shrub Swamp wetlands by decreasing the mean annual runoff input. This



Map Parameters
Datum/Projection: UTM-NAD83-Z20
Scale 1:12,000
Date: December 2005
Project No: SD19574

Figure 2
Development Scenario A

0 250 500 1,000
Meters

RHODENA ROCK QUARRY EXPANSION PROJECT

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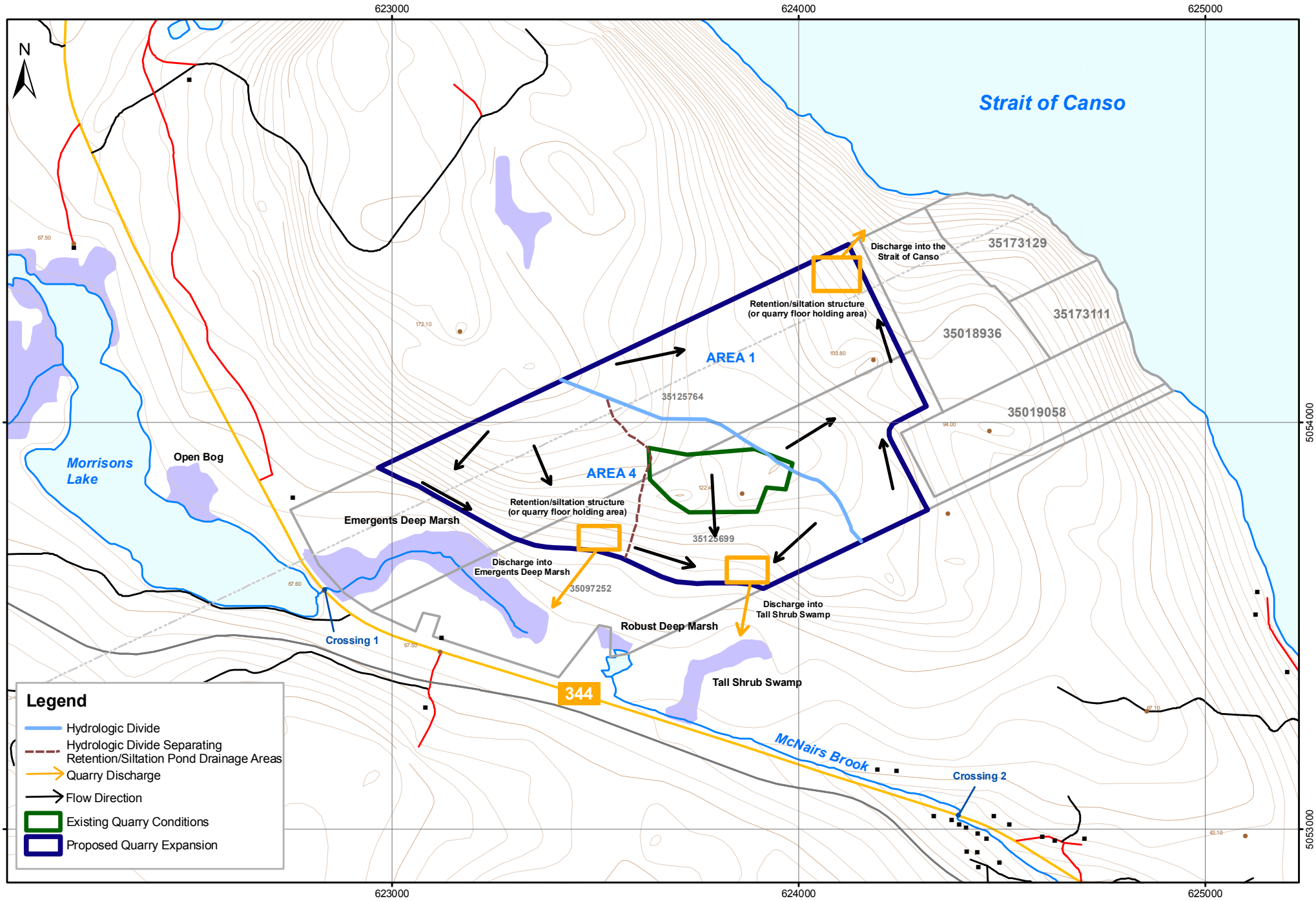

Map Parameters
Datum/Projection: UTM-NAD83-Z20
Scale 1:12,000
Date: December 2005
Project No: SD19574

Figure 3
Development Scenario B

RHODENA ROCK QUARRY EXPANSION PROJECT

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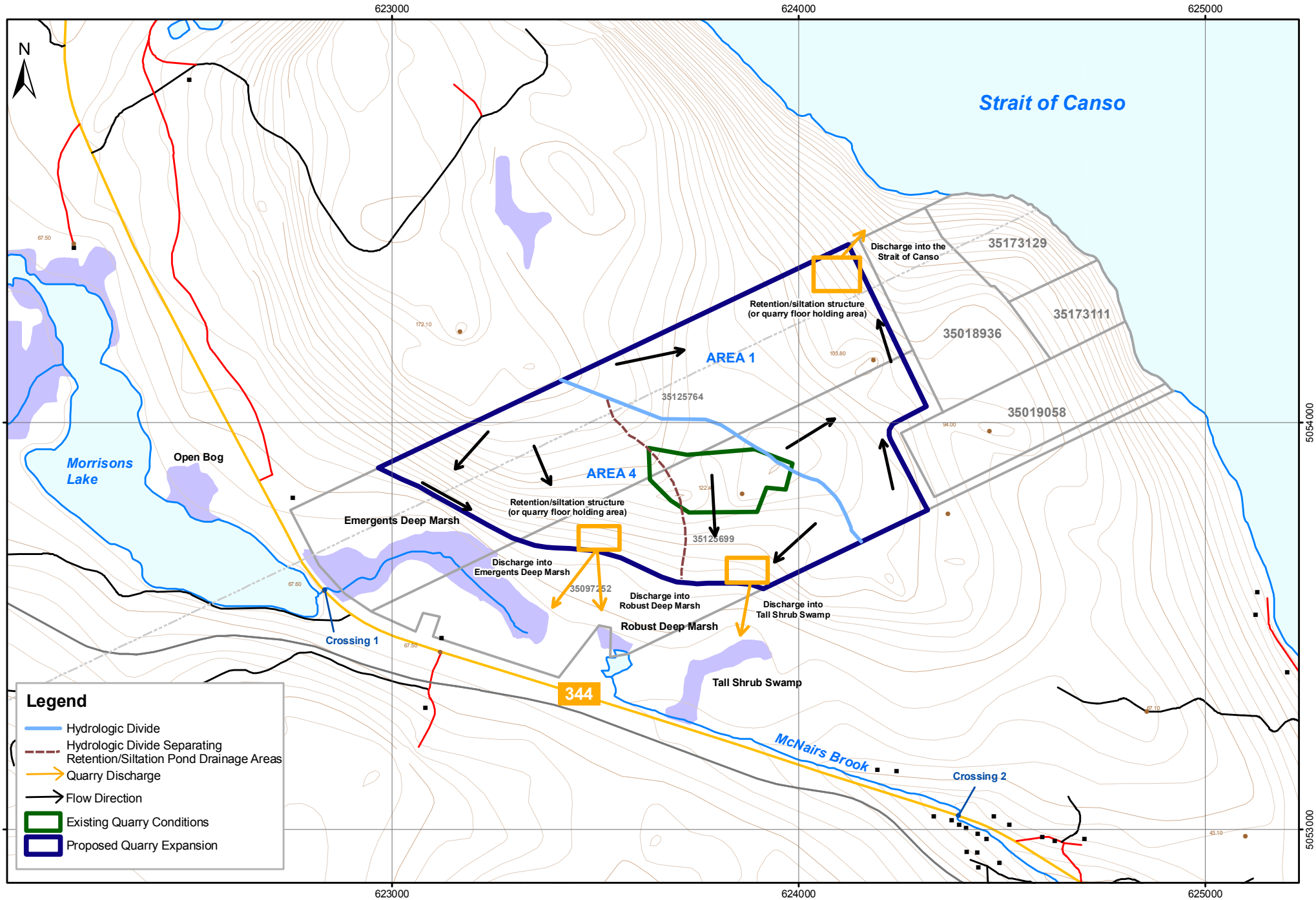


Map Parameters
Datum/Projection: UTM-NAD83-Z20
Scale 1:12,000
Date: December 2005
Project No: SD19574

Figure 4
Development Scenario C

RHODENA ROCK QUARRY EXPANSION PROJECT

Jacques Whitford

scenario could negatively impact riparian zone vegetation as well as recharge into McNairs Brook.

Scenario B is expected to minimally impact Emergents Deep Marsh and Tall Shrub Swamp, but the upper portion of McNairs Brook, upstream of the Tall Shrub Swamp outlet (including the headpond and Robust Deep Marsh), would be impacted by the reduction of inflow.

Scenario C is expected to minimally impact the vegetation and recharge value of the wetlands by conserving the mean annual runoff input into the wetlands. Flows from AREA 4 are directed into Emergents Deep Marsh, Robust Deep Marsh and Tall Shrub Swamp, which insures continuous inflow throughout the full cross-section of all three wetlands. The increases in mean annual runoff represent approximately 1.1 L/s for Emergents Deep Marsh, 0.3 L/s for Robust Deep Marsh, and 1.1 L/s for Tall Shrub Swamp.

5.2 Effects on peak runoff

Scenario C was further investigated with respect to expected increases in peak flows following ultimate development. Without retention/siltation structures, peak flows are expected to exceed pre-development levels within the proposed expansion area by 117%. Peak flow increases are a concern for McNairs Brook infrastructure (Crossing 2) due to the limited wetland storage capacity and steep channel slope approach. Greater peak flows can however be directed toward Crossing 1 due to the peak flow attenuation properties of Emergents Deep Marsh.

Based on this assessment of changes in mean annual runoff, peak flows, and drainage dynamics, Scenarios A and B are not considered appropriate due to potential decrease in wetland moisture levels. Scenario C is expected to have the least impact on the receiving water bodies and infrastructure. If peak flows toward McNairs Brook are limited to pre-development levels, they will not impact Crossing 2.

For this reason, Scenario C with peak flow attenuation toward McNairs Brook is retained for further discussion and design considerations.

6. Flow Retention/Siltation Treatment Structures

Peak design flows from the quarry expansion area at the currently proposed ultimate level of development and the retention volumes associated with the required flow retention/siltation structures were determined for Scenario C. These calculations assume that the surface runoff upstream of the development areas will be diverted around the quarry development. The peak design flows for the structure(s) represent the peak flows resulting from a 100 year return period storm event. The peak discharge flows into Robust Deep Marsh and Tall Shrub Swamp are limited to 100 year pre-development levels, while flows into Emergents Deep Marsh and the Strait of Canso are based on post-development conditions. The minimum pond volumes are equal to the runoff volume of a 6 hour duration storm event with a 25 year return period. In addition, the storage volume of structures upstream of McNairs Brook were increased to hold the expected volume difference between pre-development and post-development conditions. Note that the low lying areas of the quarry floor can provide adequate retention/siltation treatment, provided it meets the runoff volume retention requirements.

Based on the Rational Method and HEC-1 modelling, the design peak flow and retention/siltation structure volume were determined for Scenario C. The results of this computation are presented in Table 5.

Table 5: Peak design flows and retention/siltation structure volumes

Drainage Area	Receiving Water Body	Peak Design Flow (m^3/s)	Retention Structure Storage Volume (m^3)
AREA 1	Strait of Canso	5.2	6,600
AREA 4	Emergents Deep Marsh Robust Deep Marsh	4.4 0.5	6,000
	Tall Shrub Swamp	1.4	7,100

As shown in Table 5, the peak flow capacity of the hydraulic control structure from AREA 1 and upstream of Emergents Deep Marsh should be no less 5.2 m^3/s and 4.4 m^3/s, respectively. The peak flow capacity of the hydraulic control structures upstream of Robust Deep Marsh and Tall Shrub Swamp should be limited to 0.5 m^3/s and 1.4 m^3/s, respectively, to maintain pre-development flow conditions.

The runoff volume resulting from a 6 hour duration storm event with a 25 year return period was estimated to be approximately 6,600 m^3 for AREA 1, 6,000 m^3 upstream of Emergents Deep Marsh and Robust Deep Marsh, and 7,100 m^3 upstream of Tall Shrub Swamp. The proposed flow retention/siltation structure(s) (or capacity of quarry floor allowing for water accumulation between the interstices of porous media) should therefore have a volume of no less than 6,600 m^3 in AREA 1, 6,000 m^3 upstream of Emergents Deep Marsh and Robust Deep Marsh, and 7,100 m^3 upstream of Tall Shrub Swamp to accommodate site runoff at the currently proposed ultimate level of development.

7. Effects on Downstream Flows and Water Quality

The currently proposed ultimate level of quarry development is expected to reduce the amount of evapotranspiration from the quarry site and increase the volume of mean annual surface runoff. The magnitude of the above change is estimated to be approximately 141,000 m^3/year within the proposed development area. This volume increase represents approximate increases of 7%, 12% and 12% in Emergents Deep Marsh, Robust Deep Marsh and Tall Shrub Swamp, respectively. These expected increases in mean annual runoff are not expected to negatively impact wetlands or drainage infrastructure downstream.

Although the quarry development will result in a potential increase in the peak rates of surface runoff and a reduction of the low flows (i.e. water will run off more quickly following additional quarry development) from the proposed quarry area, the placement of free-draining material over the disturbed areas and the use of properly sized flow retention structures (or holding areas along the quarry floor) is expected to greatly mitigate these changes in temporal flow patterns downstream at the quarry outlets.

The potential effects of quarry development on downstream water quality include an increase in the total sediment loading and an increase in chemical parameters associated with the rock

being quarried. The placement of free-draining material over all disturbed areas and the use of properly sized flow retention/siltation structures (or holding areas along the quarry floor) is expected to fully mitigate the potential increase in downstream sediment loading. As the amount of freshly exposed rock within the quarry is likely to remain relatively constant (it should be a function of the production rate, rather than the overall quarry size), the effects of the quarry on downstream water quality are expected to be relatively minor and the downstream water quality should return to background levels following the termination of active quarrying operations.

The potential impacts associated with the concentration of flow from the quarry outlet to the receiving water bodies include potential erosion and a decrease in water treatment by local vegetation. Following development, runoff from the proposed expansion area is concentrated into a more defined drainage path between the quarry outlet and the receiving water body. More concentrated flow can lead to rill erosion if the conveyance channel is not properly stabilized. In addition, flow concentration will reduce the effectiveness of natural filtration through the riparian zone of the receiving water body. However, these negative impacts on the riparian zone vegetation and wetland water quality can be mitigated by implementing appropriate energy dissipation measures.

In summary, we believe that the effects on the downstream flows and water quality associated with the currently proposed ultimate level of quarry development can be greatly mitigated using the placement of free-draining material, properly sized flow retention/siltation structures, as well as energy dissipation measures. Following the use of these mitigative measures, the remaining residual effects on downstream flows and water quality are expected to be minor.

8. Wetland Assessment

A hydrological assessment of the three (3) wetlands located downstream of the proposed expansion area was conducted because a portion of drainage area of each wetland is located within the proposed expansion area. The hydrological attributes of the wetlands were evaluated using the relevant sections of the Nova Scotia Department of Environment Wetlands Directive (for wetlands smaller than 2.0 ha) and the North American Wetlands Conservation Council Wetland Evaluation Guide (for wetlands larger than 2.0 ha). This assessment is presented below.

Although the Robust Deep Marsh (0.3 ha) and Tall Shrub Swamp (1.5 ha) are small, together with the McNairs Brook headpond, they provide water augmentation to the upper reaches of McNairs Brook. Recharge from both wetlands is considered important to sustain baseflows in the upper reaches of McNairs Brook. The flood protection and water treatment capacity of both wetlands are expected to remain relatively unchanged in Scenario C.

The Emergents Deep Marsh is larger (5.7 ha). Because it is located upstream of the Morrisons Lake, it provides water treatment for the lake. In addition, its flow regulation and storage capacity properties will help protect infrastructure at the Route 344 crossing. The flood protection and water treatment capacity of the wetland are expected to remain unchanged following development Scenario C.

Based on this assessment, the flow regulation, flood protection and water treatment benefits of all three (3) wetlands are not expected to be impacted if development Scenario C is properly implemented.

Table 6: Wetland Assessment of *Robust Deep Marsh*

Wetland Name	Robust Deep Marsh
Wetland Size	0.3 ha
Description	Located north of the McNair Brook Headpond
Evaluation Process Used	NSDOE Wetland Directive
NSDOE Step 4: Surface Flow Regulation	Provides flow augmentation to the upper reach and the headpond of McNairs Brook
NSDOE Step 6: Water Treatment	Currently, its water treatment value is insignificant due to little upstream development. However, following quarry expansion, it may provide additional water treatment to quarry effluent draining toward McNairs Brook.

Table 7: Wetland Assessment of *Tall Shrub Swamp*

Wetland Name	Tall Shrub Swamp
Wetland Size	1.5 ha
Description	Located in the upper reach of McNairs Brook
Evaluation Process Used	NSDOE Wetland Directive
NSDOE Step 4: Surface Flow Regulation	Provides flow augmentation to the upper reach of McNairs Brook
NSDOE Step 6: Water Treatment	Currently, it may filter suspended solids from the existing quarry effluent before draining into McNairs Brook. In addition, following quarry expansion, it can provide additional water treatment to quarry effluent draining toward McNairs Brook.

Table 8: Wetland Assessment of *Emergents Deep Marsh*

Wetland Values (Emergents Deep Marsh)				
	Are Criteria Present?	**Level of Criterion Significance**	**Expected Impact of Project Upon Wetland Values**	**Describe Function (Provide Highlights Only)**
LIFE SUPPORT VALUES: <u>Hydrological Values</u> Value of the wetland in contributing to surface and groundwater stocks				
* Does the wetland contribute to recharge of regional water supply aquifers?	N	NA	NA	No regional aquifer water supply.
* Does the wetland provide flood protection benefits?	P	L	L	The proposed development is not expected to impact the wetland flood protection benefits for drainage infrastructure at Rte 344.
Does the wetland contribute to usable surface water?	P	NE	L	Following development, the wetland can provide additional water treatment before being discharged into Morrisons Lake for downstream recreational use. Currently, this criterion is ranked “negligible” as there is no upstream development.
Does the wetland provide erosion control?	N	NA	NA	Insignificant due to the relative size of the wetland compared to Morrisons Lake.
Does the wetland provide flow augmentation to users through a headwater position in the catchment basin?	N	NA	NA	Insignificant due to the relative size of the wetland compared to Morrisons Lake.
* Does the wetland reduce tidal impacts?	N	NA	NA	No tidal influence.

Key:
* = Critical Values

Are Criteria Present?
Y = Yes: confirmed presence
L = Likely: data suggests the presence but the presence is unconfirmed
P = Possibly: location and circumstance suggests presence but no data are available
N = No: not present
U = Unknown

Level of Criterion Significance:
N = National
P = Provincial
R = Regional
L = Local
NE = Negligible
NA = Not Applicable

Expected Impact of Project Upon Wetland Values:
H = High
M = Moderate
L = Low
NA = Not Applicable

Closure

We trust that this satisfies your current requirements. If you have any questions or require additional information, please contact us at your convenience.

Yours truly,

Hydro-Com Technologies

Neil McLaughlin, M.Sc.E., P.Eng. Hans Arisz, M.Sc.E., P.Eng.

APPENDIX C

Project Information Bulletin

Jacques Whitford

Rhodena Rock Limited
Rhodena Rock Quarry Expansion Project
Project Information Sheet

Project Overview

Rhodena Rock Limited proposes to expand the quarry footprint and continue quarry activities at its existing facility at Rhodena Rock Quarry, Porcupine Mountain Guysborough County, Nova Scotia (refer to Figure 1 on reverse). The proposal will allow continued aggregate production (blasting and crushing), and additional stockpiling. The quarried material is primarily used for local construction such as road building. The primary markets for the products are within Richmond County and Guysborough County. The proposed activities will take place over the next years, depending on market demand, involving approximately an additional 155 acres (62.8 ha) of land immediately adjacent to the existing quarry.

Proposed project activities will be consistent with current quarry operations approved by Nova Scotia Environment and Labour (NSEL) and in accordance with the Nova Scotia Pit and Quarry Guidelines (NSEL 1999). Aggregate production begins with drilling and blasting, which will be conducted by a licensed blasting contractor. Blasting will take place approximately two 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. The average number of trucks hauling aggregates from the quarry is 5 per day, depending on market demand. This could increase, for a short period, if a large aggregate supply contract were awarded (*i.e.*, provincial highway construction project).

The anticipated average production rate is potentially as much as 500,000 tonnes per year if a significant contract were awarded. The normal operating schedule will be based on 12 hrs/day, 6 days/week, weather permitting, although peak demand may require operations to continue for 24 hrs/day, 7 days per week, weather permitting. The proposed schedule is consistent with the current operating schedule.

Environmental Assessment Process

Rhodena Rock 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 Limited, on behalf of Rhodena Rock Limited, to fulfill these regulatory requirements. Other relevant provincial regulations include *the Activities Designation Regulations*, which requires an Industrial Approval from the Nova Scotia Department of Environment and Labour 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* (NSEL 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 the NSEL.

Environmental Document Components

The environmental registration document focuses on those aspects of the environment 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 the rare and potentially threatened and listed species, the yellow lady's slipper (*Cypripedium parviflorum*). Rhodena Rock Limited has agreed to avoid the wildflower and its critical habitat. Assuming the implementation of standard mitigative measures and government guidelines and approvals, no significant adverse environmental or socio-economic effects are considered likely.

Contacts

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

Vincent van Zutphen
Rhodena Rock Limited
(902) 945-2300

Ted van Zutphen, Vice President
Rhodena Rock Limited
(902) 945-2300

Angela Swaine, Project Manager
Jacques Whitford Environment Limited
3 Spectacle Lake Drive, Dartmouth, NS B3B 1W8
(902) 468-7777 ext. 210 (tel.); (902) 468-9009 (fax)

Figure 1
Rhodena Rock Quarry Expansion Project
Project Components

0 300 600 900 1200 Meters

1 : 5000

N

Strait

of

Canso

Open Bog

Morrisons Lake

Emergents Deep Marsh

Robust Deep Marsh

Tall Shrub Swamp

35125764

35125699

35097252

35173129

35173111

35018936

35019058

344

67.50

172.10

103.80

94.00

122.40

92.50

67.60

622000 622500 623000 623500 624000 624500 625000 625500

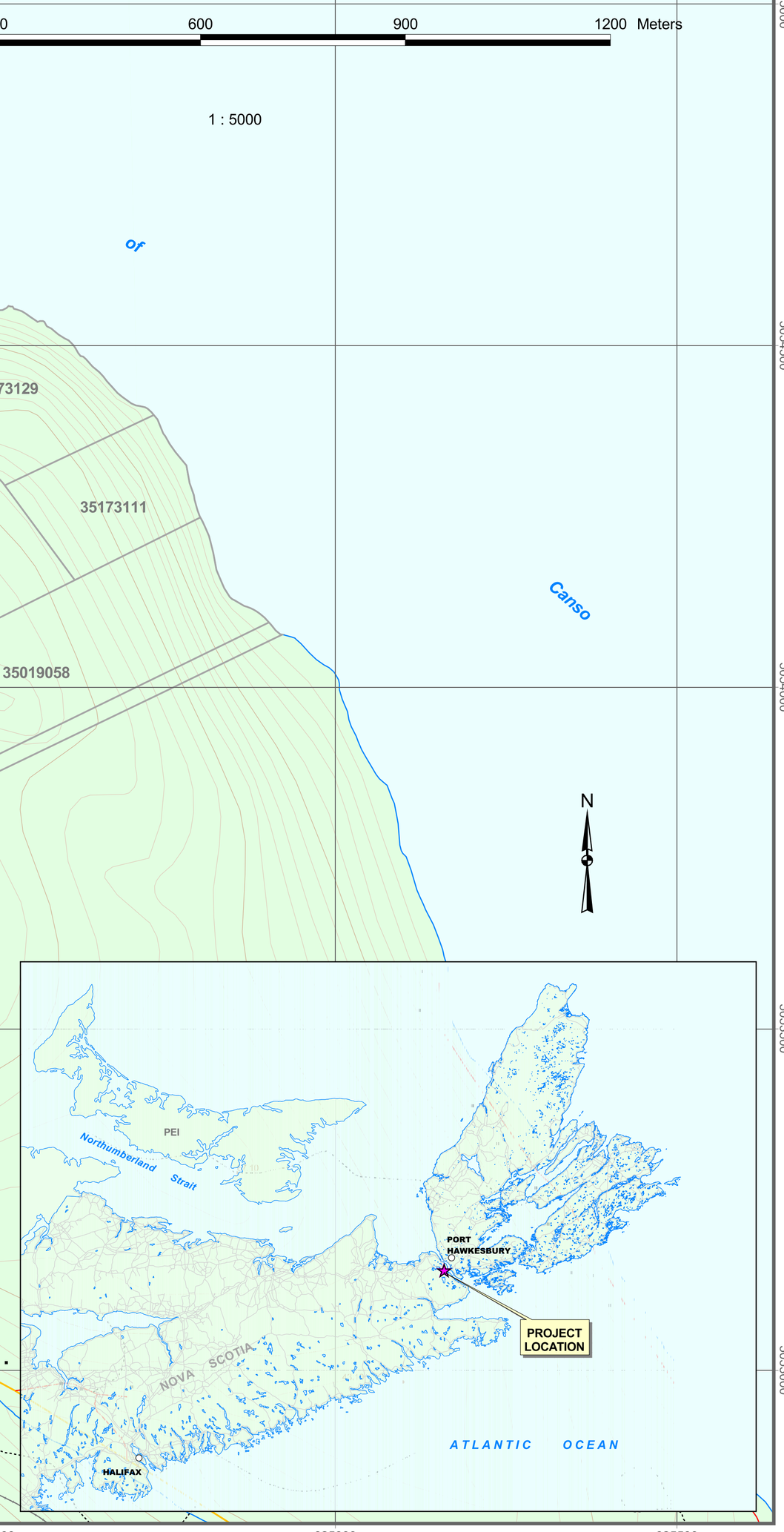
5055000 5054500 5054000 5053500 5053000

Legend

Quarry Development
- Proposed Quarry Expansion
- Existing Development

Topography
- Building
- Property Boundary
- Contour
- Watercourse
- Wetlands
- Waterbody
- Land

Roads
- Bridge
- Major Highway
- Collector Highway
- Paved Road
- Unpaved Road
- Rail



APPENDIX D

Vascular Plants Recorded in Study Area

Jacques Whitford

Appendix D

Table D.1: Table of Vascular Plants Recorded in the Study Area during the Surveys

Binomial	Common Name	S-Rank
Abies balsamea	Balsam Fir	S5
Acer pensylvanicum	Striped Maple	S5
Acer rubrum	Red Maple	S5
Acer saccharum	Sugar Maple	S5
Achillea millefolium	Common Yarrow	S5
Alnus incana	Speckled Alder	S5
Alnus viridis	Green Alder	S5
Amelanchier sp.	N/A	N/A
Anaphalis margaritacea	Pearly Everlasting	S5
Aralia hispida	Bristly Sarsaparilla	S5
Aralia nudicaulis	Wild Sarsaparilla	S5
Aronia sp.	N/A	N/A
Aster acuminatus	Whorled Aster	S5
Aster novi-belgii	New Belgium American-Aster	S5
Aster radula	Rough-Leaved Aster	S5
Aster umbellatus	Parasol White-Top	S5
Athyrium filix-femina	Lady-Fern	S5
Betula alleghaniensis	Yellow Birch	S5
Betula papyrifera	Paper Birch	S5
Betula populifolia	Gray Birch	S5
Brachyelytrum erectum	Bearded Short-Husk	S4S5
Carex brunnescens	Brownish Sedge	S5
Carex communis	Fibrous-Root Sedge	S5
Carex gracillima	Graceful Sedge	S4S5
Carex intumescens	Bladder Sedge	S5
Carex leptonervia	Finely-Nerved Sedge	S5
Carex scabrata	Rough Sedge	S5
Carex sp.1	N/A	N/A
Carex sp.2	N/A	N/A
Carex sp.3	N/A	S2S3
Carex stipata	Stalk-Grain Sedge	S5
Centaurea nigra	Black Starthistle	SE
Cerastium vulgatum	Common Mouse-Ear Chickweed	SE
Chelone glabra	White Turtlehead	S5
Chrysanthemum leucanthemum	Oxeye Daisy	SE
Chrysosplenium americanum	American Golden-Saxifrage	S5
Cinna latifolia	Slender Wood Reedgrass	S5
Circaea alpina	Small Enchanter's Nightshade	S5
Clintonia borealis	Clinton Lily	S5
Coptis trifolia	Goldthread	S5
Corallorhiza trifida	Early Coralroot	S3
Cornus canadensis	Dwarf Dogwood	S5
Cypripedium acaule	Pink Lady's-Slipper	S5

Binomial	Common Name	S-Rank
Cypripedium calceolus var. parviflorum	Small Yellow Lady's-Slipper	S2
Danthonia compressa	Flattened Oatgrass	S4
Danthonia spicata	Poverty Oat-Grass	S5
Daucus carota	Wild Carrot	SE
Dennstaedtia punctilobula	Eastern Hay-Scented Fern	S5
Deschampsia flexuosa	Crinkled Hairgrass	S5
Dianthus armeria	Deptford-Pink	SE
Drosera rotundifolia	Roundleaf Sundew	S5
Dryopteris campyloptera	Mountain Wood-Fern	S5
Dryopteris carthusiana	Spinulose Shield Fern	S5
Dryopteris cristata	Crested Shield-Fern	S5
Dryopteris intermedia	Evergreen Woodfern	S5
Dryopteris sp.	N/A	N/A
Epilobium angustifolium	Fireweed	S5
Equisetum arvense	Field Horsetail	S5
Equisetum sp.	N/A	N/A
Equisetum sylvaticum	Woodland Horsetail	S5
Euthamia graminifolia	Flat-Top Fragrant-Golden-Rod	S5
Fagus grandifolia	American Beech	S5
Fragaria virginiana	Virginia Strawberry	S5
Fraxinus americana	White Ash	S5
Galium sp.	N/A	N/A
Galium triflorum	Sweet-Scent Bedstraw	S5
Gaultheria hispidula	Creeping Snowberry	S5
Gaultheria procumbens	Teaberry	S5
Geum rivale	Purple Avens	S5
Gymnocarpium dryopteris	Northern Oak Fern	S5
Hieracium caespitosum	Meadow Hawkweed	SE
Hieracium lachenalii	Common Hawkweed	SE
Hieracium scabrum	Rough Hawkweed	S5
hieracium sp.	N/A	N/A
Huperzia lucidula	Shining Fir-Clubmoss	S5
Ilex verticillata	Black Holly	S5
Impatiens capensis	Spotted Jewel-Weed	S5
Juncus effusus	Soft Rush	S5
Juniperus communis	Ground Juniper	S5
Kalmia angustifolia	Sheep-Laurel	S5
Linnaea borealis	Twinflower	S5
Listera cordata	Heartleaf Twayblade	S4
Lonicera caerulea	Mountain Fly-Honeysuckle	S4S4
N/A	Western Honeysuckle	N/A
Lonicera canadensis	American Fly-Honeysuckle	S5
Lotus corniculatus	Birds-Foot Trefoil	SE
Lycopodium annotinum	Stiff Clubmoss	S5
Lycopodium clavatum	Running Pine	S5
Lycopodium obscurum	Tree Clubmoss	S5
Lycopodium sp.	N/A	N/A

Binomial	Common Name	S-Rank
Maianthemum canadense	Wild Lily-of-The-Valley	S5
Matteuccia struthiopteris	Ostrich Fern	S5
Medeola virginiana	Indian Cucumber-Root	S5
Medicago lupulina	Black Medic	SE
Melampyrum lineare	American Cow-Wheat	S5
Melilotus officinalis	Yellow Sweetclover	SE
Mitchella repens	Partridge-Berry	S5
Mitella nuda	Naked Bishop's-Cap	S5
Moneses uniflora	One-Flower Wintergreen	S5
Monotropa uniflora	Indian-Pipe	S5
Nemopanthus mucronata	Mountain Holly	S5
Oenothera biennis	Common Evening-Primrose	S5
Onoclea sensibilis	Sensitive Fern	S5
Osmunda cinnamomea	Cinnamon Fern	S5
Oxalis acetosella	White Wood-Sorrel	S5
Panax trifolius	Dwarf Ginseng	S3
Phegopteris connectilis	Northern Beech Fern	S5
Phleum pratense	Meadow Timothy	SE
Picea glauca	White Spruce	S5
Picea rubens	Red Spruce	S5
Pinus strobus	Eastern White Pine	S5
Plantago lanceolata	English Plantain	SE
Plantago major	Nipple-Seed Plantain	SE
Platanthera dilatata	Leafy White Orchis	S4S5
Platanthera huronensis	Green Orchid	SU
Platanthera sp.	N/A	N/A
Poa pratensis	Kentucky Bluegrass	S5
Polygonum cilinode	Fringed Black Bindweed	S5
Polygonum cuspidatum	Japanese Knotweed	SE
Polypodium appalachianum	Appalachian Polypody	S3?
Polypodium virginianum	Rock Polypody	S5
Polystichum acrostichoides	Christmas Fern	S5
Populus grandidentata	Large-Tooth Aspen	S5
Populus tremuloides	Quaking Aspen	S5
Potentilla palustris	Marsh Cinquefoil	S5
Prenanthes altissima	Tall Rattlesnake-root	S4S5
Prenanthes sp.	N/A	N/A
Prenanthes trifoliolata	Three-Leaved Rattlesnake-root	S5
Prunella vulgaris	Self-Heal	S5
Prunus pensylvanica	Fire Cherry	S5
Pteridium aquilinum	Bracken Fern	S5
Pyrola chlorantha	Greenish-Flowered Wintergreen	S4
Ranunculus repens	Creeping Butter-Cup	SE
Rosa multiflora	Rambler Rose	SE
Rosa nitida	Shining Rose	S4
Rubus alleghaniensis	a bramble	S?
Rubus canadensis	Smooth Blackberry	S5

Binomial	Common Name	S-Rank
Rubus idaeus	Red Raspberry	S5
Rubus pubescens	Dwarf Red Raspberry	S5
Rumex crispus	Curly Dock	SE
Salix sp.	N/A	N/A
Sambucus racemosa	Red Elderberry	S5
Sanicula marilandica	Black Snake-Root	S4
Scirpus sp.	N/A	N/A
Scutellaria galericulata	Hooded Skullcap	S5
Senecio aureus	Golden Groundsel	S4
Senecio jacobaea	Tansy Ragwort	SE
Senecio robbinsii	Robbins Squaw-Weed	S4S5
Smilacina trifolia	Three-Leaf Solomon's-Plume	S4S5
Solanum dulcamara	Climbing Nightshade	SE
Solidago canadensis	Canada Goldenrod	S5
Solidago flexicaulis	Broad-Leaved Goldenrod	S5
Solidago puberula	Downy Goldenrod	S5
Solidago rugosa	Rough-Leaf Goldenrod	S5
Solidago uliginosa	Bog Goldenrod	S5
Sorbus americana	American Mountain-Ash	S5
Sparganium sp.	N/A	N/A
Spiraea alba	Narrow-Leaved Meadow-Sweet	S5
Streptopus amplexifolius	Clasping Twisted-Stalk	S4S5
Streptopus roseus	Rosy Twistedstalk	S5
Taraxacum officinale	Common Dandelion	SE
Taxus canadensis	Canadian Yew	S5
Thalictrum pubescens	Tall Meadow-Rue	S5
Thelypteris palustris	Marsh Fern	S5
Trientalis borealis	Northern Starflower	S5
Trifolium pratense	Red Clover	SE
Trillium erectum	Ill-Scent Trillium	S3
Trillium undulatum	Painted Trillium	S5
Tussilago farfara	Colt's Foot	SE
Typha latifolia	Broad-Leaf Cattail	S5
Vaccinium angustifolium	Late Lowbush Blueberry	S5
Vaccinium myrtilloides	Velvetleaf Blueberry	S5
Vaccinium oxycoccos	Small Cranberry	S5
Veronica officinalis	Gypsy-Weed	S5SE
Viburnum alnifolium	Alderleaf Viburnum	S5
Viola blanda	Smooth White Violet	S5
Viola cucullata	Marsh Blue Violet	S5
Viola macloskeyi	Smooth White Violet	S5
Viola sororia	Woolly Blue Violet	S5
Osmunda claytoniana	Interrupted Fern	S5
Viburnum nudum	Possum-Haw Viburnum	S5
Eupatorium maculatum	Spotted Joe-Pye Weed	S5
Carex gynandra	A Sedge	S5
Carex trisperma	Three-Seed Sedge	S5

Binomial	Common Name	S-Rank
Thelypteris noveboracensis	New York Fern	S5
Aster lateriflorus	Farewell-Summer	S5
Platanthera psycodes	Small Purple-Fringe Orchis	S4
Lycopus uniflorus	Northern Bugleweed	S5
Carex echinata	Little Prickly Sedge	S5
Corylus cornuta	Beaked Hazelnut	S5
Salix pyrifolia	Balsam Willow	S5
Bromus ciliatus	Fringed Brome	S4S5
Aster puniceus	Swamp Aster	S5
Carex flava	Yellow Sedge	S5
Polygonum sagittatum	Arrow-Leaved Tearthumb	S5
Hamamelis virginiana	American Witch-Hazel	S5
Picea mariana	Black Spruce	S5
Calamagrostis canadensis	Blue-Joint Reedgrass	S5
Salix humilis	Prairie Willow	S5
Betula cordifolia	Heart-Leaved Paper Birch	S5
Myrica pensylvanica	Northern Bayberry	S5
Solidago gigantea	Smooth Goldenrod	S5
Salix bebbiana	Bebb's Willow	S5
Agrostis hyemalis	Rough Bentgrass	S5
Larix laricina	American Larch	S5
Cornus sericea	Silky Dogwood	S5
Eriophorum virginicum	Tawny Cotton-Grass	S5
Scirpus cyperinus	Black-Girdle Bulrush	S5
Glyceria striata	Fowl Manna-Grass	S5
Cirsium arvense	Creeping Thistle	SE
Carex leptalea	Bristly-Stalk Sedge	S5
Rosa virginiana	Virginia Rose	S5
Rubus setosus	Small Bristleberry	S4?
Fragaria vesca	Woodland Strawberry	S4
Epilobium ciliatum	Hairy Willow-Herb	S5
Poa palustris	Fowl Bluegrass	S5
Juncus brevicaudatus	Narrow-Panicled Rush	S5
Epilobium leptophyllum	Linear-Leaved Willow-Herb	S5
Juncus canadensis	Canada Rush	S5
Erechtites hieraciifolia	Fireweed	S5
Iris versicolor	Blueflag	S5
Carex papercula var. irrigua	A Sedge	S5
Platanthera clavellata	Small Green Woodland Orchid	S5
Malaxis unifolia	Green Adder's-Mouth	S4S5
Galium tinctorium	Stiff Marsh Bedstraw	S5
Sparganium emersum	Narrow-Leaf Burreed	S5
Rhynchospora alba	White Beakrush	S5
Utricularia cornuta	Horned Bladderwort	S5
Aronia melanocarpa	Black Chokeberry	S5
Vaccinium macrocarpon	Large Cranberry	S5
Empetrum nigrum	Black Crowberry	S5

Binomial	Common Name	S-Rank
Kalmia polifolia	Pale Laurel	S5
Epilobium palustre	Marsh Willow-Herb	S5
Rumex sp.	N/A	N/A
Solidago sp.	N/A	N/A
Glyceria grandis	American Mannagrass	S4S5
Sparganium americanum	American Bur-Reed	S5
Osmunda regalis	Royal Fern	S5
Galium palustre	Marsh Bedstraw	S5
Lycopus americanus	American Bugleweed	S5
Carex pseudocyperus	Cyperus-Like Sedge	S4S5
Scutellaria lateriflora	Mad Dog Skullcap	S5

APPENDIX E

Wetland Evaluations

Jacques Whitford

Appendix E: Wetland Evaluation

The amount of each wetland habitat potentially disturbed by the Project is less than 2 ha and thus is subjected to the ten-step wetland evaluation process described in the Nova Scotia Department of Environment Wetland Directive (NSDNR 1995). In the following tables each of the questions associated with the ten steps is addressed. Steps 1 and 2 are further described herein.

Table E.1a: Ten-step evaluations for wetlands 1 to 3

Wetland 1 to 3	**Wetland 1**	**Wetland 2**	**Wetland 3**	
Nova Scotia Wetlands Directive Step	**Mixedwood treed basin swamp**	**Mixedwood treed spring swamp**	**Graminoid dominated shallow basin marsh**	**Coniferous treed basin swamp**
1: Wildlife Habitat Potential	Does not appear on wetland atlas mapping, and no Golet score has been assigned to it. Wildlife observed included the Star-nosed Mole, White-tailed Deer, Wood Frog, Northern Spring Peeper, American Goldfinch. Due to small size and lack of diverse habitats, this wetland has lower potential for wildlife habitat.	Does not appear on wetland atlas mapping, and no Golet score has been assigned to it. Wildlife observed included the American Red Squirrel and Black-capped Chickadee. Due to small size and lack of diverse habitats, this wetland has lower potential for wildlife habitat.	Does not appear on wetland atlas mapping, and no Golet score has been assigned to it. Wildlife observed included the American Red Squirrel, American Goldfinch, and Black-capped Chickadee. Due to small size and lack of diverse habitats, this wetland has lower potential for wildlife habitat.	
2: Rare and Endangered Species	The Yellow Lady's-slipper is the only rare species identified in Table E.2, with an S2 rank by ACCDC and Yellow by NSDNR. (ACCDC 2005, NSDNR	None of the species identified in Table E.2 are considered to be rare in Nova Scotia (ACCDC 2005; NSDNR 2005), or Canada (COSEWIC 2005). None of the wildlife species recorded	None of the species identified in Table E.2 are considered to be rare in Nova Scotia (ACCDC 2005; NSDNR 2005), or Canada (COSEWIC 2005). None of the wildlife species recorded are considered to be rare nationally (COSEWIC 2005) or provincially (ACCDC 2005, NSDNR 2005).	

Wetland 1 to 3	Wetland 1	Wetland 2	Wetland 3	
Nova Scotia Wetlands Directive Step	**Mixedwood treed basin swamp**	**Mixedwood treed spring swamp**	**Graminoid dominated shallow basin marsh**	**Coniferous treed basin swamp**
	2005). None of the wildlife species recorded are considered to be rare nationally (COSEWIC 2005) or provincially (ACCDC 2005, NSDNR 2005).	are considered to be rare nationally (COSEWIC 2005) or provincially (ACCDC 2005, NSDNR 2005). There is, however, potential habitat for four-toed salamanders.		
3: Groundwater Recharge Potential	The wetlands may function as groundwater recharge sites. They receive both surface water and groundwater inputs from a portion of the watershed; however, there is no evident surface water outflow suggesting that water is lost from the wetland through evapotranspiration and groundwater flow. Two wells are located within approximately 800 metres. Given the size of the wetlands and their location relative to inhabited areas it is not expected to play a significant role in the replenishment of local water supplies.			
4: Surface Flow Regulation	The wetlands may play a minute role in surface water flow regulation by capturing flood surface waters from the surrounding watershed and temporarily storing it or diverting some into groundwater flow. The wetlands currently have no visible outflow, and thus they would not likely play a significant role in general surface flow regulation.			
5: Agricultural Use	The wetlands are not used for agricultural production nor do they have any agricultural potential due to their small size.			
6: Water Treatment	The wetlands are not an obvious source or sink of water treatment for the surrounding areas. The direction of surface flow is away from the wetland areas suggesting the water may arrive from rainfall and dissipate through either percolation or evaporation (Appendix H). There does not appear to be any effluent source or other artificial or natural input into the wetlands.			
7: Peat Development Potential	The wetlands are too small to provide potential for commercial peat extraction and the peat present in the wetlands would have a high wood content reducing its value as horticultural peat.			
8: Issues Addressed	All issues have been addressed.			
9: Additional Concerns	There are no additional concerns.			
10: Significance	Expansion of the quarry will result in the loss of the rare species the Yellow Lady's-slipper. The proponent has	This wetland provides minimal wetland functions including the probable groundwater infiltration site and surface water flow	This wetland provides minimal wetland functions including the probable ground water infiltration site and surface water flow control. Expansion of the quarry will result in the loss of wetland habitat. Incorporating mitigative	

Wetland 1 to 3	Wetland 1	Wetland 2	Wetland 3	
Nova Scotia Wetlands Directive Step	**Mixedwood treed basin swamp**	**Mixedwood treed spring swamp**	**Graminoid dominated shallow basin marsh**	**Coniferous treed basin swamp**
	agreed to modify the Project footprint to avoid this species and its habitat.	control. Expansion of the quarry will result in the loss of wetland habitat. Incorporating mitigative compensation measures as per NSEL's guidance will minimize adverse changes to overall wetland diversity and abundance in Nova Scotia.	compensation measures as per NSEL's guidance will minimize adverse changes to overall wetland diversity and abundance in Nova Scotia.	

Table E.1b: Ten-step evaluations for wetlands 4 to 6

Wetlands 4 to 6	Wetland 4	Wetland 5	Wetland 6	
Nova Scotia Wetlands Directive Step	**Moss dominated basin bog**	**Deciduous treed stream swamp**	**Fern dominated shallow basin marsh**	**Tall shrub dominated basin swamp**
1: Wildlife Habitat Potential	Does not appear on wetland atlas mapping, and no Golet score has been assigned to it. Wildlife observed included the White-tailed Deer, Maritime Garter Snake, Coyote, and Vole. Due to small size and lack of diverse habitats, this wetland has lower potential for wildlife habitat.	Does not appear on wetland atlas mapping, and no Golet score has been assigned to it. Wildlife observed included the Hairy woodpecker, White-tailed Deer, Green Frog, and Wood Frog. Due to small size and lack of diverse habitats, this wetland has lower potential for wildlife habitat.	Does not appear on wetland atlas mapping, and no Golet score has been assigned to it. Wildlife observed included the American Red Squirrel, Black-capped Chickadee, Nashville Warbler, Ruby-crowned Kinglet, Magnolia Warbler, and Common Yellowthroat. Due to small size and lack of diverse habitats, this wetland has lower potential for wildlife habitat.	
2: Rare and		None of the species	None of the species identified in Table E.2 are	

Wetlands 4 to 6	Wetland 4	Wetland 5	Wetland 6	
Nova Scotia Wetlands Directive Step	**Moss dominated basin bog**	**Deciduous treed stream swamp**	**Fern dominated shallow basin marsh**	**Tall shrub dominated basin swamp**
Endangered Species		identified in Table E.2 are considered to be rare in Nova Scotia (ACCDC 2005; NSDNR 2005), or Canada (COSEWIC 2005). None of the wildlife species recorded are considered to be rare nationally (COSEWIC 2005) or provincially (ACCDC 2005, NSDNR 2005).	considered to be rare in Nova Scotia (ACCDC 2005; NSDNR 2005), or Canada (COSEWIC 2005). None of the wildlife species recorded are considered to be rare nationally (COSEWIC 2005) or provincially (ACCDC 2005, NSDNR 2005).	
3: Groundwater Recharge Potential	The wetlands may function as groundwater recharge sites. They receive both surface water and groundwater inputs from a portion of the watershed; however, there is no evident surface water outflow suggesting that water is lost from the wetland through evapotranspiration and groundwater flow. 2 wells are located within approximately 800 metres. Given the size of the wetlands and there location relative to inhabited areas it is not expected to play a significant role in the replenishment of local water supplies.			
4: Surface Flow Regulation	The wetlands may play a minute role in surface water flow regulation by capturing flood surface waters from the surrounding watershed and temporarily storing it or diverting some into groundwater flow. The wetlands currently have no visible outflow, and thus the wetland likely does not play a significant role in general surface flow regulation.			
5: Agricultural Use	The wetlands are not used for agricultural production nor do they have any agricultural potential due to their small size.			
6: Water Treatment	The wetlands are not an obvious source or sink of water treatment for the surrounding areas. The direction of surface flow is away from the wetland areas suggesting the water may arrive from rainfall and dissipate through either percolation or evaporation (Appendix H). There does not appear to be any effluent source or other artificial or natural input into the wetlands.			
7: Peat Development Potential	The wetlands are too small to provide potential for commercial peat extraction and the peat present in the wetlands would have a high wood content reducing its value as horticultural peat.			
8: Issues Addressed	All issues have been addressed.			
9: Additional Concerns	There are no additional concerns.			
10. Significance	This wetland provides minimal wetland functions including the	This wetland provides minimal wetland functions including the probable	This wetland provides minimal wetland functions including the	This wetland provides minimal wetland functions including the

Wetlands 4 to 6	Wetland 4	Wetland 5	Wetland 6	
Nova Scotia Wetlands Directive Step	**Moss dominated basin bog**	**Deciduous treed stream swamp**	**Fern dominated shallow basin marsh**	**Tall shrub dominated basin swamp**
	probable groundwater infiltration site and surface water flow control. Expansion of the quarry will result in the loss of wetland habitat. Incorporating mitigative compensation measures as per NSEL's guidance will minimize adverse changes to overall wetland diversity and abundance in Nova Scotia.	ground water infiltration site and surface water flow control. Expansion of the quarry will result in the loss of wetland habitat. Incorporating mitigative compensation measures as per NSEL's guidance will minimize adverse changes to overall wetland diversity and abundance in Nova Scotia.	probable groundwater infiltration site and surface water flow control. Expansion of the quarry will result in the loss of wetland habitat. Incorporating mitigative compensation measures as per NSEL's guidance will minimize adverse changes to overall wetland diversity and abundance in Nova Scotia.	probable ground water infiltration site and surface water flow control. Expansion of the quarry will result in the loss of wetland habitat. Incorporating mitigative compensation measures as per NSEL's guidance will minimize adverse changes to overall wetland diversity and abundance in Nova Scotia.

Step 1: Evaluate Wildlife Habitat Potential

During the initial field surveys, all species of bird, mammal, reptile and amphibian detected within and immediately adjacent to the wetland were recorded. Wildlife species were detected on the basis of visual sightings, vocalizations, tracks, feces, skeletal remains, and distinctive signs such as claw marks or dens.

The wetland was surveyed for birds, mammals and herpetiles. The wetlands did not contain any pools which suggests that they do not provide valuable habitat for waterfowl or semi-aquatic mammals such as muskrat (*Ondatra zibethicus*) and beaver (*Castor canadensis*), or breeding habitat for amphibians. Additionally, the wetlands do not provide suitable habitat for fish. Overall, the wetlands are considered to have relatively low value as wildlife habitat due to their small size and lack of diverse habitats.

Step 2. Evaluate for Rare and Endangered Species

A vegetation survey was conducted on June 6 and August 8, 2005, to determine if any rare vascular plant species were present. A total of 150 species of vascular plant were encountered during the wetland surveys (Table below E.2).

Table E.2 Vascular Plants Found in Wetlands

Bionomial	Common Name	ACCDC Rank	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5	Wetland 6
Abies balsamea	Balsam Fir	S5	√	√	√	√	√	√
Acer pensylvanicum	Striped Maple	S5	√	√	√	√	√	
Acer rubrum	Red Maple	S5	√	√	√	√	√	√
Acer saccharum	Sugar Maple	S5	√				√	
Agrostis hyemalis	Rough Bentgrass	S5	√				√	√
Alnus incana	Speckled Alder	S5	√	√		√		
Amelanchier sp.	(blank)	NA	√		√	√		√
Anaphalis margaritacea	Pearly Everlasting	S5			√			
Aralia nudicaulis	Wild Sarsaparilla	S5	√	√	√	√	√	
Aronia melanocarpa	Black Chokeberry	S5				√		
Aster acuminatus	Whorled Aster	S5	√	√	√	√	√	
Aster lateriflorus	Farewell-Summer	S5	√	√			√	
Aster puniceus	Swamp Aster	S5	√					
Aster radula	Rough-Leaved Aster	S5		√	√	√		
Aster umbellatus	Parasol White-Top	S5	√		√	√	√	
Athyrium filix-femina	Lady-Fern	S5	√				√	
Betula alleghaniensis	Yellow Birch	S5	√	√	√	√	√	√
Betula cordifolia	Heart-Leaved Paper Birch	S5	√		√	√		
Betula populifolia	Gray Birch	S5				√		
Brachyelytrum erectum	Bearded Short-Husk	S4S5	√				√	
Bromus ciliatus	Fringed Brome	S4S5	√					
Calamagrostis canadensis	Blue-Joint Reedgrass	S5	√			√		√
Carex echinata	Little Prickly Sedge	S5	√		√			
Carex flava	Yellow Sedge	S5	√					
Carex gynandra	A Sedge	S5	√	√	√		√	
Carex intumescens	Bladder Sedge	S5		√			√	
Carex leptalea	Bristly-Stalk	S5	√		√			

Bionomial	Common Name	ACCDC Rank	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5	Wetland 6
	Sedge							
Carex papercula var. irrigua	A Sedge	S5			√			
Carex pseudocyperus	Cyperus-Like Sedge	S4S5						√
Carex scabrata	Rough Sedge	S5			√		√	
Carex stipata	Stalk-Grain Sedge	S5		√	√			
Carex trisperma	Three-Seed Sedge	S5	√	√	√	√	√	
Centaurea nigra	Black Starthistle	SE	√					
Chelone glabra	White Turtlehead	S5	√				√	√
Chrysosplenium americanum	American Golden-Saxifrage	S5		√				
Circaea alpina	Small Enchanter's Nightshade	S5		√				
Cirsium arvense	Creeping Thistle	SE	√					
Clintonia borealis	Clinton Lily	S5	√			√		
Coptis trifolia	Goldthread	S5		√	√			
Cornus canadensis	Dwarf Dogwood	S5	√	√	√	√		
Cornus sericea	Silky Dogwood	S5	√					
Corylus cornuta	Beaked Hazelnut	S5	√					
Cypripedium calceolus var. parviflorum	Small Yellow Lady's-Slipper	S2	√					
Drosera rotundifolia	Roundleaf Sundew	S5			√	√		
Dryopteris campyloptera	Mountain Wood-Fern	S5					√	
Dryopteris cristata	Crested Shield-Fern	S5	√					
Empetrum nigrum	Black Crowberry	S5				√		
Epilobium ciliatum	Hairy Willow-Herb	S5			√		√	√
Epilobium leptophyllum	Linear-Leaved Willow-Herb	S5			√	√		√
Epilobium palustre	Marsh Willow-Herb	S5				√		
Equisetum arvense	Field Horsetail	S5	√					
Equisetum sylvaticum	Woodland Horsetail	S5		√				
Erechtites	Fireweed	S5			√			

Bionomial	Common Name	ACCDC Rank	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5	Wetland 6
hieraciifolia								
Eriophorum virginicum	Tawny Cotton-Grass	S5	√		√	√		
Eupatorium maculatum	Spotted Joe-Pye Weed	S5	√					
Euthamia graminifolia	Flat-Top Fragrant-Golden-Rod	S5	√				√	
Fagus grandifolia	American Beech	S5					√	
Fragaria vesca	Woodland Strawberry	S4		√				
Fragaria virginiana	Virginia Strawberry	S5	√	√	√			
Fraxinus americana	White Ash	S5	√	√			√	
Galium palustre	Marsh Bedstraw	S5						√
Galium tinctorium	Stiff Marsh Bedstraw	S5			√			√
Gaultheria hispidula	Creeping Snowberry	S5	√	√	√	√	√	
Gaultheria procumbens	Teaberry	S5	√					
Geum rivale	Purple Avens	S5	√					
Glyceria grandis	American Mannagrass	S4S5					√	
Glyceria striata	Fowl Manna-Grass	S5	√		√		√	√
Hamamelis virginiana	American Witch-Hazel	S5	√					
Ilex verticillata	Black Holly	S5	√	√		√		√
Impatiens capensis	Spotted Jewel-Weed	S5					√	
Iris versicolor	Blueflag	S5			√			
Juncus brevicaudatus	Narrow-Panicled Rush	S5			√			
Juncus canadensis	Canada Rush	S5			√	√		
Juncus effusus	Soft Rush	S5	√		√	√		
Kalmia angustifolia	Sheep-Laurel	S5	√		√	√		√
Kalmia polifolia	Pale Laurel	S5				√		
Larix laricina	American Larch	S5	√					
Linnaea borealis	Twinflower	S5		√		√		

Bionomial	Common Name	ACCDC Rank	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5	Wetland 6
Lonicera caerulea	Western Honeysuckle	NA	√					
Lycopus americanus	American Bugleweed	S5						√
Lycopus uniflorus	Northern Bugleweed	S5	√	√		√	√	
Maianthemum canadense	Wild Lily-of-The-Valley	S5	√					
Malaxis unifolia	Green Adder's-Mouth	S4S5			√			
Mitchella repens	Partridge-Berry	S5	√					
Mitella nuda	Naked Bishop's-Cap	S5	√	√				
Myrica pensylvanica	Northern Bayberry	S5	√		√	√		
Nemopanthus mucronata	Mountain Holly	S5	√					√
Onoclea sensibilis	Sensitive Fern	S5	√	√	√		√	√
Osmunda cinnamomea	Cinnamon Fern	S5	√	√	√	√	√	√
Osmunda claytoniana	Interrupted Fern	S5	√	√	√	√		
Osmunda regalis	Royal Fern	S5						√
Oxalis acetosella	White Wood-Sorrel	S5					√	
Phegopteris connectilis	Northern Beech Fern	S5	√	√			√	
Picea glauca	White Spruce	S5	√			√	√	
Picea mariana	Black Spruce	S5	√	√	√	√		
Pinus strobus	Eastern White Pine	S5	√		√			
Platanthera clavellata	Small Green Woodland Orchid	S5			√	√		
Platanthera dilatata	Leafy White Orchis	S4S5	√					
Platanthera psycodes	Small Purple-Fringe Orchis	S4	√	√				
Poa palustris	Fowl Bluegrass	S5			√		√	
Polygonum sagittatum	Arrow-Leaved Tearthumb	S5	√					

Bionomial	Common Name	ACCDC Rank	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5	Wetland 6
Polystichum acrostichoides	Christmas Fern	S5	√				√	
Prenanthes trifoliolata	Three-Leaved Rattlesnake-root	S5	√				√	
Prunella vulgaris	Self-Heal	S5	√	√			√	
Prunus pensylvanica	Fire Cherry	S5	√					
Pteridium aquilinum	Bracken Fern	S5				√		
Ranunculus repens	Creeping Butter-Cup	SE			√			
Rhynchospora alba	White Beakrush	S5				√		
Rosa nitida	Shining Rose	S4	√		√			
Rosa virginiana	Virginia Rose	S5	√					
Rubus canadensis	Smooth Blackberry	S5	√		√			
Rubus idaeus	Red Raspberry	S5			√			
Rubus pubescens	Dwarf Red Raspberry	S5	√	√	√			
Rubus setosus	Small Bristleberry	S4?	√					
Rumex sp.	(blank)	NA					√	
Salix bebbiana	Bebb's Willow	S5	√		√			
Salix humilis	Prairie Willow	S5	√					
Salix pyrifolia	Balsam Willow	S5	√					
Sanicula marilandica	Black Snake-Root	S4	√					
Scirpus cyperinus	Black-Girdle Bulrush	S5	√		√	√		√
Scutellaria lateriflora	Mad Dog Skullcap	S5						√
Senecio aureus	Golden Groundsel	S4	√					
Senecio robbinsii	Robbins Squaw-Weed	S4S5	√					
Solanum dulcamara	Climbing Nightshade	SE					√	√
Solidago canadensis	Canada Goldenrod	S5					√	
Solidago flexicaulis	Broad-Leaved Goldenrod	S5					√	
Solidago gigantea	Smooth Goldenrod	S5	√					
Solidago rugosa	Rough-Leaf Goldenrod	S5	√		√		√	
Solidago sp.	(blank)	NA					√	
Solidago uliginosa	Bog Goldenrod	S5	√			√		

Bionomial	Common Name	ACCDC Rank	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5	Wetland 6
Sorbus americana	American Mountain-Ash	S5		√	√	√		
Sparganium americanum	American Bur-Reed	S5						√
Sparganium emersum	Narrow-Leaf Burreed	S5			√			
Sparganium sp.	(blank)	NA		√	√			
Spiraea alba	Narrow-Leaved Meadow-Sweet	S5	√					
Thalictrum pubescens	Tall Meadow-Rue	S5	√				√	
Thelypteris noveboracensis	New York Fern	S5	√	√	√	√	√	
Thelypteris palustris	Marsh Fern	S5	√					√
Trientalis borealis	Northern Starflower	S5					√	
Tussilago farfara	Colt's Foot	SE	√				√	
Typha latifolia	Broad-Leaf Cattail	S5	√		√		√	
Utricularia cornuta	Horned Bladderwort	S5				√		
Vaccinium angustifolium	Late Lowbush Blueberry	S5			√	√		
Vaccinium macrocarpon	Large Cranberry	S5				√		
Vaccinium myrtilloides	Velvetleaf Blueberry	S5	√					√
Vaccinium oxycoccos	Small Cranberry	S5			√	√		
Viburnum alnifolium	Alderleaf Viburnum	S5	√					
Viburnum nudum	Possum-Haw Viburnum	S5	√		√	√	√	√
Viola cucullata	Marsh Blue Violet	S5	√	√	√		√	
Viola macloskeyi	Smooth White Violet	S5			√	√		√

APPENDIX F

Bird Species Recorded in Study Area

Jacques Whitford

Appendix F: Results of Breeding Bird Survey and Maritime Breeding Bird Atlas Model

Table F.1: Breeding Bird Survey

Common Name	Binomial	NSDNR
American Crow	*Corvus brachyrhynchos*	Green
American Goldfinch	*Carduelis tristis*	Green
American Robin	*Turdus migratorius*	Green
American Woodcock	*Scolopax minor*	Green
Bald Eagle	*Haliaeetus leucocephalus*	Green
Barred Owl	*Strix varia*	Green
Bay-breasted Warbler	*Dendroica castanea*	Green
Belted Kingfisher	*Ceryle alcyon*	Green
Black-and-white Warbler	*Mniotilta varia*	Green
Blackburnian Warbler	*Dendroica fusca*	Green
Black-capped Chickadee	*Parus atricapillus*	Green
Black-throated Green Warbler	*Dendroica virens*	Green
Blue Jay	*Cyanocitta cristata*	Green
Brown Creeper	*Certhia americana*	Green
Chestnut-sided Warbler	*Dendroica pensylvanica*	Green
Common Grackle	*Quiscalus quiscula*	Green
Common Raven	*Corvus corax*	Green
Common Yellowthroat	*Geothlypis trichas*	Green
Dark-eyed Junco	*Junco hyemalis*	Green
Evening Grosbeak	*Coccothraustes vespertinus*	Green
Golden-crowned Kinglet	*Regulus satrapa*	Green
Hairy Woodpecker	*Picoides villosus*	Green
Hermit Thrush	*Catharus guttatus*	Green
Least Flycatcher	*Empidonax minimus*	Green
Magnolia Warbler	*Dendroica magnolia*	Green
Mourning Warbler	*Oporornis philadelphia*	Green
Northern Flicker	*Colaptes auratus*	Green
Olive-sided Flycatcher	*Contopus borealis*	Green
Ovenbird	*Seiurus aurocapillus*	Green
Parula Warbler	*Parula americana*	Green
Purple Finch	*Carpodacus purpureus*	Green
Red-breasted Nuthatch	*Sitta canadensis*	Green
Red-eyed Vireo	*Vireo olivaceus*	Green
Red-tailed Hawk	*Buteo jamaicensis*	Green
Red-winged Blackbird	*Agelaius phoeniceus*	Green
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Green
Ruby-crowned Kinglet	*Regulus calendula*	Green
Ruby-throated Hummingbird	*Archilochus colubris*	Green
Ruffed Grouse	*Bonasa umbellus*	Green
Solitary Vireo	*Vireo solitarius*	Green
Song Sparrow	*Melospiza melodia*	Green
Swainson's Thrush	*Catharus ustulatus*	Green
White-throated Sparrow	*Zonotrichia albicollis*	Green
Winter Wren	*Troglodytes troglodytes*	Green

Table X: Maritime Breeding Bird Atlas Results

Common Name	Binomial	Likely on Site	NSDNR Rank
Alder Flycatcher	*Empidonax alnorum*	Probable	Green
American Crow	*Corvus brachyrhynchos*	Confirmed	Green
American Goldfinch	*Carduelis tristis*	Confirmed	Green
American Kestrel	*Falco sparverius*	Possible	Green
American Redstart	*Setophaga ruticilla*	Probable	Green
American Robin	*Turdus migratorius*	Confirmed	Green
American Woodcock	*Scolopax minor*	Possible	Green
Bald Eagle	*Haliaeetus leucocephalus*	Probable	Green
Barn Swallow	*Hirundo rustica*	Possible	Green
Barred Owl	*Strix varia*	Probable	Green
Bay-breasted Warbler	*Dendroica castanea*	Possible	Green
Belted Kingfisher	*Ceryle alcyon*	Probable	Green
Black-and-white Warbler	*Mniotilta varia*	Probable	Green
Blackburnian Warbler	*Dendroica fusca*	Probable	Green
Black-capped Chickadee	*Parus atricapillus*	Probable	Green
Black-throated Green Warbler	*Dendroica virens*	Confirmed	Green
Blue Jay	*Cyanocitta cristata*	Confirmed	Green
Blue-winged Teal	*Anas discors*	Possible	Green
Boreal Chickadee	*Parus hudsonicus*	Possible	Green
Brown-headed Cowbird	*Molothrus ater*	Possible	Green
Canada Warbler	*Wilsonia canadensis*	Confirmed	Green
Cape May Warbler	*Dendroica tigrina*	Possible	Green
Cedar Waxwing	*Bombycillia cedrorum*	Probable	Green
Chestnut-sided Warbler	*Dendroica pensylvanica*	Possible	Green
Chipping Sparrow	*Spizella passerina*	Possible	Green
Common Grackle	*Quiscalus quiscula*	Confirmed	Green
Common Loon	*Gavia immer*	Possible	Yellow
Common Nighthawk	*Chordeiles minor*	Probable	Green
Common Raven	*Corvus corax*	Confirmed	Green
Common Snipe	*Gallinago gallinago*	Possible	Green
Common Tern	*Sterna hirundo*	Confirmed	Yellow
Common Yellowthroat	*Geothlypis trichas*	Probable	Green
Dark-eyed Junco	*Junco hyemalis*	Confirmed	Green
Double-crested Cormorant	*Phalacrocorax auritus*	Possible	Green
Downy Woodpecker	*Picoides pubescens*	Possible	Green
Eastern Kingbird	*Tyrannus tryannus*	Probable	Green
Eastern Wood-Pewee	*Contopus virens*	Probable	Green
European Starling	*Sturnus vulgaris*	Confirmed	Introduced
Evening Grosbeak	*Coccothraustes vespertinus*	Confirmed	Green
Golden-crowned Kinglet	*Regulus satrapa*	Possible	Green
Gray Jay	*Perisoreus canadensis*	Possible	Green
Great Black-backed Gull	*Larus marinus*	Possible	Green
Great Blue Heron	*Ardea herodias*	Possible	Green
Hairy Woodpecker	*Picoides villosus*	Possible	Green
Hermit Thrush	*Catharus guttatus*	Probable	Green

Common Name	Binomial	Likely on Site	NSDNR Rank
Herring Gull	*Larus argentatus*	Possible	Green
House Sparrow	*Passer domesticus*	Confirmed	Introduced
Killdeer	*Charadrius vociferus*	Confirmed	Green
Lincoln's Sparrow	*Melospiza lincolnii*	Probable	Green
Magnolia Warbler	*Dendroica magnolia*	Probable	Green
Mourning Dove	*Zenaida macroura*	Confirmed	Green
Mourning Warbler	*Oporornis philadelphia*	Possible	Green
Nashville Warbler	*Vermivora ruficapilla*	Possible	Green
Northern Flicker	*Colaptes auratus*	Possible	Green
Northern Harrier	*Circus cyaneus*	Possible	Green
Northern Mockingbird	*Mimus polyglottos*	Probable	Green
Northern Oriole	*Icterus galbula*	Probable	Green
Northern Parula Warbler	*Parula americana*	Possible	Green
Olive-sided Flycatcher	*Contopus borealis*	Probable	Green
Osprey	*Pandion haliaetus*	Possible	Green
Palm Warbler	*Dendroica palmarum*	Possible	Green
Pine Siskin	*Carduelis pinus*	Probable	Green
Purple Finch	*Carpodacus purpureus*	Probable	Green
Red-breasted Nuthatch	*Sitta canadensis*	Probable	Green
Red-eyed Vireo	*Vireo olivaceus*	Probable	Green
Red-winged Blackbird	*Agelaius phoeniceus*	Confirmed	Green
Ring-necked Duck	*Aythya collaris*	Possible	Green
Ring-necked Pheasant	*Phasianus colchicus*	Probable	Introduced
Rock Dove	*Columba livia*	Confirmed	Introduced
Ruby-crowned Kinglet	*Regulus calendula*	Probable	Green
Ruby-throated Hummingbird	*Archilochus colubris*	Possible	Green
Rusty Blackbird	*Euphagus carolinus*	Possible	Green
Savannah Sparrow	*Passerculus sandwichensis*	Possible	Green
Sharp-shinned Hawk	*Accipiter striatus*	Possible	Green
Solitary Vireo	*Vireo solitarius*	Possible	Green
Song Sparrow	*Melospiza melodia*	Confirmed	Green
Spotted Sandpiper	*Actitis macularia*	Probable	Green
Swainson's Thrush	*Catharus ustulatus*	Confirmed	Green
Swamp Sparrow	*Melospiza georgiana*	Possible	Green
Tennessee Warbler	*Vermivora peregrina*	Probable	Green
Tree Swallow	*Tachycineta bicolor*	Confirmed	Green
Veery	*Catharus fuscescens*	Possible	Green
White-throated Sparrow	*Zonotrichia albicollis*	Confirmed	Green
Winter Wren	*Troglodytes troglodytes*	Possible	Green
Yellow Warbler	*Dendroica petechia*	Probable	Green
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Possible	Green
Yellow-rumped Warbler	*Dendroica coronata*	Probable	Green