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Final Report: Environmental Assessment Registration for the Duncan Gillis Quarry Extension Project

Gillis Construction Cape Breton Ltd.
P.O. Box 98
Baddeck, NS B0E 1B0

File: 121510266

July 2010

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1.1 PROPONENT INFORMATION

Name of the Proponent:	Gillis Construction Cape Breton Limited
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Registry of Joint Stocks for the proponent company is included in Appendix A.

Company President and/or Environmental Assessment Contact

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Environmental Consultant Contact

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Signature June 29/2010
Date

1.2 PROJECT INFORMATION

Name of the Undertaking:	Duncan Gillis Quarry Extension Project
Location of the Undertaking:	Baddeck, Cape Breton, NS

2.0 Project Information

2.1 DESCRIPTION OF THE UNDERTAKING

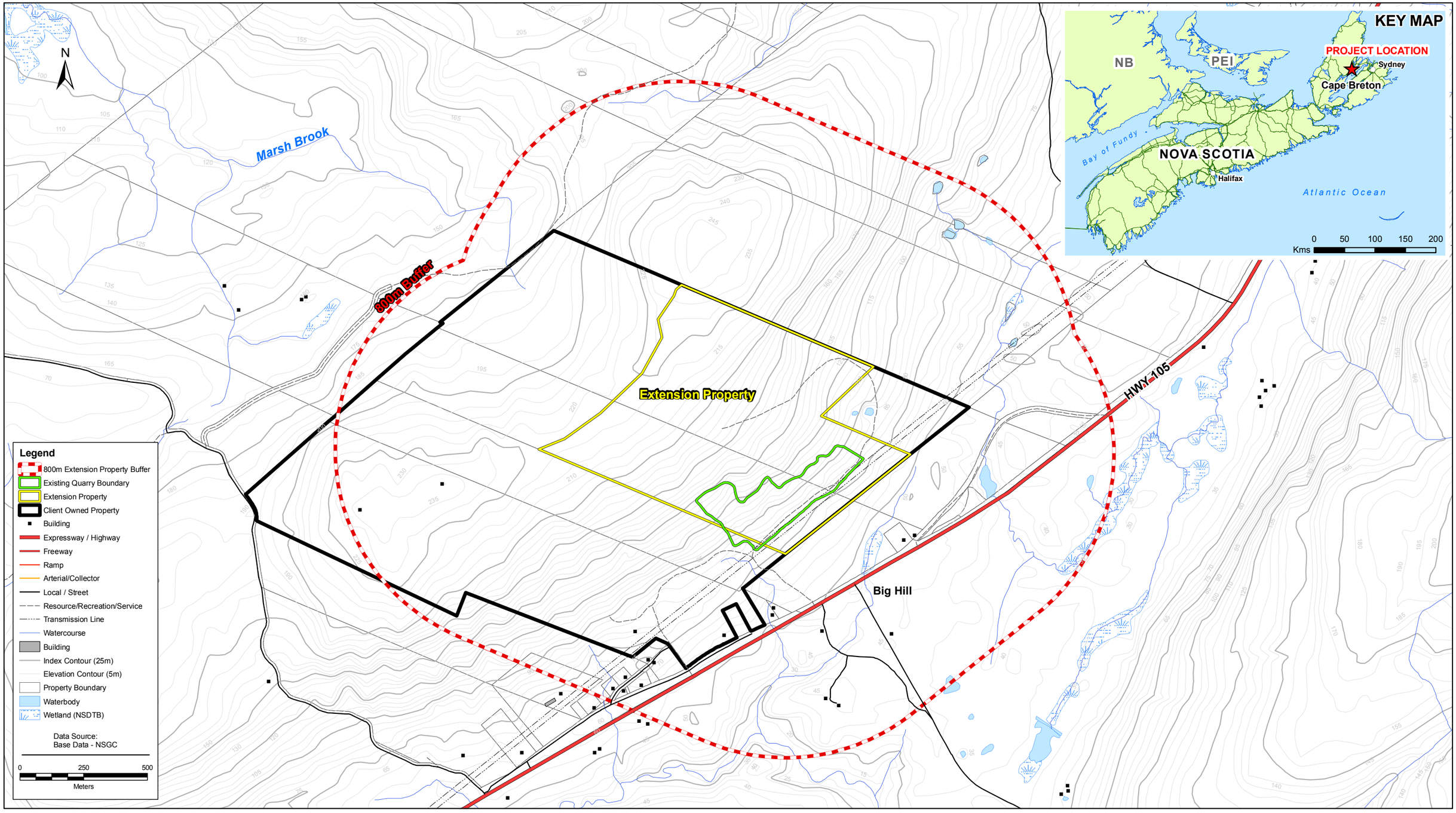
Gillis Construction Cape Breton Limited (Gillis Construction; the Proponent) owns and operates the Duncan Gillis Quarry, located in Baddeck, Cape Breton, Nova Scotia (Figure 1). The quarry property is in the Municipality of the County of Victoria. The existing quarry is currently operated in accordance with the Nova Scotia Pit and Quarry Guidelines (NSE 1999). In addition to this Environmental Assessment Registration, the Proponent will also apply for a Part V approval (Industrial Approval) under the Nova Scotia *Environment Act*. This permitting is being conducted in part to satisfy a request from Nova Scotia Transportation and Infrastructure Renewal (TIR), a key customer of Gillis Construction.

Gillis Construction proposes to extend the quarry site to occupy 77 ha of land, in total, to allow for continued aggregate production (blasting, crushing, and stockpiling) and will supply quartzite to local gravel markets and highway construction projects. The Proponent purchased the quarry in 1969. However, blasting was not conducted on site until 1983, when TIR changed the highway asphalt spec. The total disturbed area to date of approximately 7 ha.

The anticipated average production rate is approximately 200,000 tonnes per year; with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting; the current and anticipated operating schedule is 12 hrs/day, five days/week, 44 weeks/year or more, depending on the demand for aggregates. Depending on market demand, the proposed quarry operations will take place over an extended period of time until the material is exhausted. The originally proposed Project extension area was scaled back to minimize overlap with the village of Baddeck's surface water supply area.

2.2 GEOGRAPHIC LOCATION

Duncan Gillis Quarry is in the community of Baddeck, Cape Breton, Nova Scotia (Figure 1). It is located along the Trans Canada Highway, and is accessed via a private road that branches off from the Highway. The quarry and proposed quarry extension area are situated on lands that are owned by the Proponent. The surrounding lands are mostly undeveloped.



AUTHOR: G. Mesheau	DATE: July 13, 2010	GILLIS CONSTRUCTION QUARRY EXTENSION	FIGURE NO.: Figure 1
APPROVED BY: G. Asche	SCALE: 1:10,000	**PROJECT LOCATION**	
PROJECT NUMBER: 1056547	COORDINATE SYSTEM: UTM NAD 83 ZONE 20		Stantec

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The Project Area is situated on a large southeast-facing hill and is primarily comprised of mesic upland forest which is dissected by old logging roads. This forested slope is covered by immature mixedwood, immature hardwood, mature hardwood, and immature softwood stands (Figure 2). Forest within the eastern end of the site is currently at an early-successional stage as a result of recent clear-cutting activities. The southeastern end of the site is characterized by exposed bedrock and aggregate material due to disturbance from quarry operations.

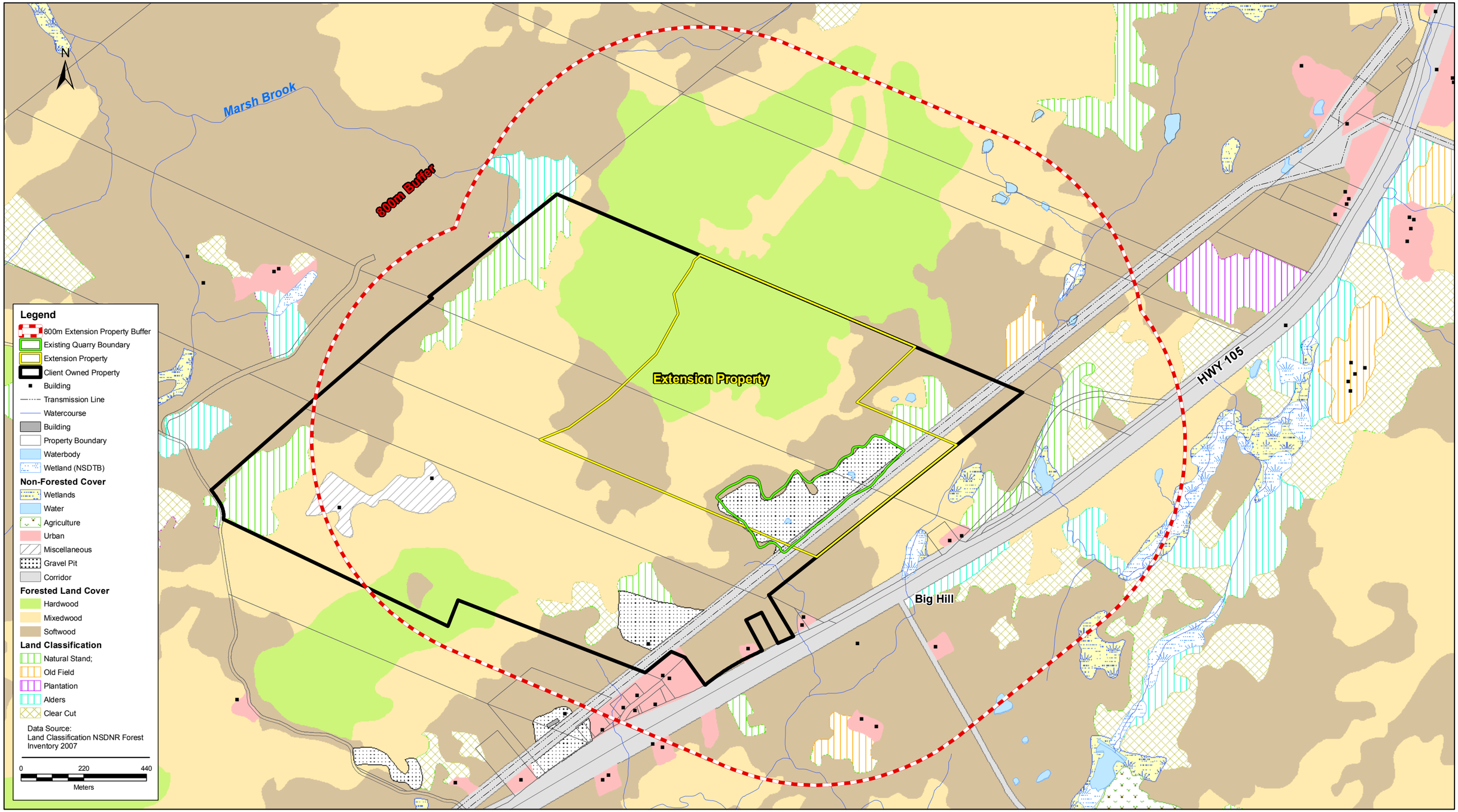
Based on available mapping and aerial photography, residential development in the immediate vicinity of the existing Duncan Gillis Quarry is relatively low. There are approximately 15 structures unrelated to the existing quarry within 800 m (Figure 1).

The quarry is located on land that is not zoned for any particular use because it falls outside of the Eastern District Planning Commission's (EDPC) designated Baddeck Plan Area for Victoria County.

2.3 PROJECT COMPONENTS

The existing quarry operations consist of a laydown area for the portable crushing equipment, screening, washing, various aggregate stockpiles, quarry floor and working face, settling pond, weight scales, and a private access road off of the Trans Canada Highway. The existing property currently does not have liquid asphalt stored on site and there are no outdoor fuel tanks. There is also no planned storage of other hazardous materials. Topsoil, grubbing material and overburden that have been stripped prior to drilling and blasting are stored on-site in an area where site run-off has been controlled.

The laydown area is located on the quarry floor. The rock is processed by portable crushing equipment that is transported to the site as required (*i.e.,* after blasting). Once the quarry is extended, portable crushing equipment is expected to be on-site two to three times a year for 3 weeks each time. Aggregate stockpiles are currently located at various locations within the quarry limits.



AUTHOR: G. Mesheau	DATE: July 13, 2010	GILLIS CONSTRUCTION QUARRY EXTENSION	FIGURE NO.: Figure 2
APPROVED BY: G. Asche	SCALE: 1:12,500	**LAND CLASSIFICATION**	
1056547	COORDINATE SYSTEM: UTM NAD 83 ZONE 20		Stantec

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Quarry drainage and surface runoff collection and controls will be in place for the extended quarry. Surface runoff and quarry drainage are collected on the quarry floor, which has the capacity to hold a significant quantity of water. Currently, overflow from the quarry floor and site run-off drains to a settling pond located east of the existing operation. Additional settling pond volume will be developed with the extension, as required. Details regarding the amount of additional settling pond volume required for proposed quarry operations is presented in Appendix B and will be further refined at the Industrial Approval stage. Excavation will not take place below the groundwater table.

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

2.4 SITE PREPARATION AND CONSTRUCTION

The existing quarry has been in operation for 27 years. Access to the existing quarry development is along existing roads. To minimize the potential for erosion and sedimentation, grubbing and removal of overburden has been and will continue to be conducted on an as needed basis, to accommodate drilling and blasting activities. Topsoil, grubbed material and overburden are stockpiled on site in an area where runoff has been contained. These, or similar stabilization procedures will continue throughout the operations of the proposed extension.

Quarry drainage and surface runoff collects on the quarry floor. Overflow from the quarry floor is currently directed to a settling pond located east of the existing developed area. Additional surface water management capacity will be created, 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, evaporates and/or is directed off site. Water that has pooled on the Quarry floor will be used to provide a water supply for dust suppression during crushing in dry periods.

The boundaries of the proposed expansion area were developed to minimize overlap with the village of Baddeck's surface water supply area.

2.5 OPERATION AND MAINTENANCE

The proposed Project activities will be consistent with the current quarry operations, the future Industrial Approval, and will be in accordance with the Pit and Quarry Guidelines (NSE 1999). These Guidelines apply to all pits and quarry operations in the province of Nova Scotia and provide:

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

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

The blasted rock will be processed by portable crushing equipment that will be on-site. The various aggregate products will be stockpiled in designated areas within the quarry. Material is hauled and moved within the quarry with a loader. Other equipment will likely include an excavator. Products will be transported from the quarry via tandem and tractor trailer trucks along the existing truck route.

The anticipated average production rate is approximately 200,000 tonnes per year; with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule may be 12 hrs/day, five days/week, 44 weeks/year or more, depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

The existing quarry currently employs 2 full time employees throughout the year, and this number can fluctuate by 15-20, plus truck drivers, depending on the activities taking place on site (*i.e.,* when the contractors are on site). Employment levels are expected to remain the same following site extension. Drilling and blasting activities involve additional resources; these activities are sub-contracted to a professional blasting company. Hauling of materials from the quarry also involves additional labour and equipment requirements. Hauling (or trucking) is typically arranged through the customers.

2.6 EFFLUENTS AND EMISSIONS

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

In accordance with best practices and standard NSE requirements, runoff controls will be in place to ensure that effluent generated during operations is managed appropriately. Surface runoff at the quarry collects on the quarry floor. Overflow from the quarry floor and site run-off drains to a settling pond located east of the existing operation. Additional pond volume will be installed, as required, in accordance with NSE's Erosion and Sedimentation Control Handbook

for Construction Sites (NSE 1988) and the quarry's future Approval to operate, and in consultation with NSE's engineers/inspectors. Details regarding the amount of additional settling pond volume required for proposed extended quarry operations is discussed in Appendix B and will be further refined at the Industrial Approval stage.

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

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

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

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

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

Combustion emissions will be generated from the operation of vehicles and equipment during Project activities. Given the scope of the planned operations, these emissions will be minimal, localized and similar in quantities to the operation of a small construction project using one or two pieces of heavy equipment. Emissions will be reduced through proper equipment maintenance and inspection practices to ensure efficient operation. Consideration will be given to methods to reduce truck and equipment idling, as feasible.

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

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

Sound monitoring will be conducted at the request of NSE.

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

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

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

During crushing and screening operations, the only hazardous materials anticipated on-site will be those associated with the normal operation of construction equipment. These substances include: gasoline, diesel fuel, lubricants and antifreeze liquid. No outdoor on-site storage of such materials is anticipated.

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

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

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

2.7 DECOMMISSIONING AND RECLAMATION

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

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

The preferred method for revegetation is preservation and utilization of root mats from grubbed material. This approach would provide a source of native plant species well adapted to local soil and climatic conditions and would greatly reduce the need to fertilize the reclaimed pit. If it is necessary to seed reclaimed areas where grubbings have not produced sufficient plant biomass to stabilize soils, wherever practical, native plants should be used for site reclamation. In lieu of native species, seed mixes containing naturalized species which are well established in Nova Scotia and which are not aggressive weeds in the plant communities which are present in the area should be used for reclamation.

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

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

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

3.0 Scope

3.1 SCOPE OF THE UNDERTAKING

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

3.2 PURPOSE AND NEED FOR THE UNDERTAKING

The purpose for the Project is to allow Gillis Construction to extend the existing quarry footprint and continue operations at their quarry in Baddeck. The quarry is currently operating in accordance with the Nova Scotia Pit and Quarry Guidelines (NSE1999).

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

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

3.3 PROJECT ALTERNATIVES

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

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

3.4 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

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

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, policies and guidance include the *Fisheries Act*, *Species at Risk Act, the Migratory Birds Convention Act* and Environmental Canada Guidance Related to the Environmental Assessment of Aggregate Pit Mines and Quarries in the Atlantic Provinces (2008a).

There are no known requirements for an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA) associated with the proposed quarry extension. No federal land or funding is required for the Project. There are no requirements for federal permits or authorizations under the CEAA Law List Regulation currently projected.

The scope of the environmental assessment in relation to the proposed Project has been determined by the Proponent and their consultant and is based upon the proposed Project elements and activities, the professional judgment and expert knowledge of the study team, consultations with the public and regulatory authorities on this and similar projects, and the results of field studies conducted in support of this environmental assessment. The Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia (NSEL 2008) was also used to determine/focus the scope of the assessment. The Proponent and their consultant met with NSE on January 28, 2010 to discuss the location of proposed extension, and elements and activities associated with the proposed Project, in an effort to further focus the scope of the assessment. Landowners adjacent to the quarry were also contacted (see Section 4.0) for the purpose of issues identification.

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

- Surface water resources;
- Rare and sensitive flora;
- Wetlands;

- Wildlife;
- Groundwater;
- Archaeological and heritage resources;
- Air quality; and
- Socio-economic environment.

4.0 Public Involvement

4.1 METHODS OF INVOLVEMENT

In January and February 2010, sixteen Project Information Bulletins (Appendix C) were distributed to landowners within approximately 1.0 km of the quarry, twelve of which were inside the 800 m boundary. The purpose of the bulletin was to advise local residents and businesses close to the existing quarry and proposed Project site (*i.e.,* those who are potentially most affected) and provide them with opportunity to comment on the proposed undertaking.

Information letters were also sent to the Confederacy of Mainland Mi'kmaq, the Native Council, the Mi'kmaq Rights Initiative, the Union of Nova Scotia Indians and the chief and councils of the Wagmatcook First Nation and the We'koqma'q First Nation to encourage the submission of comments, concerns, and questions regarding the Project (Appendix C). The proponent also contacted the chief and councils of the above noted local First Nations and offered to meet with them to discuss the Project and answer any questions that they may have.

4.2 STAKEHOLDER COMMENTS AND STEPS TAKEN TO ADDRESS ISSUES

To date, no comments have been received from stakeholders as a result of the Project Information Bulletin or First Nation information letters.

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

5.0 Valued Environmental Components and Effects Management

5.1 METHODOLOGY

Field studies were conducted by Stantec between October 6 – 8, 2009, to investigate and establish the existing conditions and to determine appropriate mitigation, if necessary, to manage environmental effects from the proposed extension Project. These surveys consisted of: vegetation survey; wetlands survey; mammal survey; and herpetile survey. These surveys were undertaken by a qualified terrestrial ecologist employed by Stantec. An assessment of potential archaeological and heritage resources was undertaken by a qualified archaeologist. Additional information, in support of the field studies and the assessment, was gathered through a review of: air photos; site mapping; and other information sources, such as the Nova Scotia Museum, Statistics Canada, the Nova Scotia Department of Transportation and Infrastructure Renewal, and the Nova Scotia Department of Natural Resources.

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

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

5.2 SURFACE WATER RESOURCES

Surface Water was selected as a VEC because of the potential for Project activities to interact with the freshwater environment. Key resources associated with the VEC include aquatic life, fish habitat and surface water quality, as well as potential water uses for agriculture, recreation, industry or potability. Water quantity is discussed as part of the Groundwater Resources VEC (Section 5.6). There are no watercourses located within the proposed quarry Extension Area. Marsh Brook crosses the northwest Property boundary (Figure 3). Marsh Brook feeds Peters Brook, which is currently used as the surface water source for the Village of Baddeck's drinking water supply. There are multiple small tributaries of Big Harbour Brook located outside the southeast Project property boundary. Big Harbour Brook feeds directly into Big Harbour within the Great Bras d'Or water body.

N

Marsh Brook

800m Buffer

Extension Property

HWY-105

Big Hill

Legend

- Wetland Delination POI
- 800m Extension Property Buffer
- Existing Quarry Boundary
- Extension Property
- Client Owned Property
- Building
- Transmission Line
- Watercourse
- Building
- Index Contour (25m)
- Elevation Contour (5m)
- Property Boundary

Designated Areas

- Cemetery
- Lumber Mill
- Pit

Environmentally Sensitive Areas

- Deer Wintering
- Freshwater
- Migratory Bird
- Of Concern
- Other Habitat
- Municipal Surface Water Supply
- Freshwater Wetland (NSDNR)
- Waterbody
- Wetland (NSDTB)

Data Source:
ESA - NSDNR Significant Species and Habitats Project 2007

0 220 440
Meters

AUTHOR: G. Mesheau	DATE: July 13, 2010	GILLIS CONSTRUCTION QUARRY EXTENSION	FIGURE NO.: **Figure 3**
APPROVED BY: G. Asche	SCALE: 1:12,500	**ENVIRONMENTALLY SENSITIVE AREAS**	Stantec
1056547	COORDINATE SYSTEM: UTM NAD 83 ZONE 20		

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5.2.1 Description of Existing Conditions

A desktop review of available watercourse mapping and proposed Project boundaries was completed to assess the potential for interactions between the Project Activities and the aquatic environment. The only watercourse known to cross the Property boundaries is Marsh Brook, a tributary to the Peters Brook surface water supply. Marsh Brook does not cross the proposed extension Project Area and is located upstream of the extension area. The aquatic habitat, fish resources and water quality of Marsh Brook are not discussed specifically since the watercourse does not physically interact with the proposed extension Project Area. The following discussion of the surface water resources associated with the proposed Project Area includes a presentation of findings from the desktop review.

Other Potential Users

There are no known agricultural, recreational, or industrial uses of surface water within the vicinity of the Project property boundaries. The Peters Brook Water Supply Area is adjacent to and up-gradient of the proposed Extension Area but does not overlap with it. Typically, activities on designated Protected Water Areas (PWA) are limited. However, the Peters Brook Water Supply Area is not known to be a designated PWA under the *Environment Act*. The Village of Baddeck has confirmed that it falls under the municipality's source water protection plan (Municipally of Victoria County pers. comm. March 2010). As such, the municipality protects the water supply source by managing the influences on it. The drinking water currently supplied by Peters Brook is protected using a multi-barrier source water protection approach which includes the prevention of source water contamination (Victoria County 2009).

The Village of Baddeck is currently in the process of locating a ground water source to meet their drinking water supply needs. They hope to convert to a ground water source from the currently used Peters Brook surface water supply within the next two years (Municipally of Victoria County pers. comm. March 2010). Once a ground water source is being used to supply the Village's drinking water, it is anticipated that the Peters Brook Water Supply Area will no longer fall under source water protection planning.

Surface Water Interactions

Marsh Brook, Peters Brook, and Big Harbour Brook are all located outside the proposed Extension Project Area. Marsh Brook and Peters Brook are located up-gradient of the proposed extension area; Big Harbour Brook is located downstream of the proposed extension area. Specifically, the drainage patterns within the proposed extension area are anticipated to drain east and southeast, away from the Marsh Brook and Peters Brook watershed (see Figure 4). Therefore, very little potential exists for proposed project activities to interact with these surface water resources.

Mitigation is suggested in the following sections to prevent potential down gradient effects from Project Activities on Big Harbour Brook, located outside the Project Boundaries..

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

The primary potential effects on the surface water VEC from quarry activities result from erosion and sediment control when the potential exists for drainage from the quarry site to feed into existing surface water resources. As discussed above, the potential for this interaction on the Duncan Gillis quarry site is minimal as a result of the lack of any surface water resources within the proposed extension area for quarry activities. There is the potential for erosion and sedimentation to occur whenever soil is exposed. Therefore, potential effects are discussed and mitigation is proposed that can be implemented in the event that drainage from the quarry property moves west or northwest toward Marsh Brook or south and southeast toward Big Harbour Brook at some point during Project activities.

Potential Effects

Sedimentation (increased sediment load in stream water and deposition in downstream sediments) is perhaps the most common environmental effect of quarry activities on fish and aquatic habitat, including water quality. The environmental effects of sedimentation are well studied and understood; therefore, detailed mitigation measures to protect watercourses from these effects have been developed. Sedimentation can result in physical changes to the aquatic environment, including the accumulation of fines on stream substrate. Sedimentation and siltation of surface water can also degrade surface water quality (e.g. oxygen levels, light penetration, water temperature, water chemistry such as organics and metals) leading to potential changes in primary production and food availability (Anderson *et al.* 1996 and Trow Consulting Engineers Ltd. 1996).

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

The following mitigation discussion focuses on the prevention and control of erosion and sedimentation during quarry activities. Mitigating for potential effects of erosion and sedimentation serves to protect aquatic habitat, fish resources and water quality simultaneously.

Proposed Mitigation

As specified in Nova Scotia Pit and Quarry Guidelines, no active quarry components will be located within 30 m of a watercourse without prior government approval. Natural vegetation will be maintained within this buffer. No alteration of surface water resources is anticipated to be required during the life of the quarry extension given the only surface water within the Duncan Gillis Property Boundaries is Marsh Brook, which is located outside the proposed Extension Area. However, appropriate mitigation is recommended to prevent potential effects of Project Activities on Marsh Brook and downstream in Big Harbour Brook.

In addition to provincial regulations, any alteration of surface water resources within the Duncan Gillis Property Boundaries (*e.g.*, Marsh Brook) as a result of effects from Project activities would also have to be approved by Fisheries and Oceans Canada (DFO), although this type of alteration is not expected within the life of the quarry DFO has developed the Policy for the Management of Fish Habitat (DFO 1986), which applies to all development and industrial projects in or near watercourses that could harmfully alter, disrupt, or destroy (HADD) fish habitat by chemical, physical, or biological means. The guiding principle of this policy is to achieve no net loss of the productive capacity of fish habitats. Any blasting that occurs close to the eastern and southeastern sides of the proposed project extension area (*i.e.,* closest to the Big Harbour Brook tributaries outside the Project Boundary) will also adhere to the DFO Guidelines for the use of Explosives In or Near Canadian Fisheries Waters (1998).

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

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

Based on the results of the desktop watercourse assessment and the mitigation proposed, there is very low potential for quarry activities to interact with the aquatic environment and significant Project-related effects on Marsh Brook, Peters Brook or Big Harbour Brook are not likely to occur.

Proposed Monitoring

No surface water exists downstream of the proposed Extension Area within the Duncan Gillis Property Boundaries. Big Harbour Brook exists downstream of the Project Area, outside the property boundaries. A groundwater monitoring well has been proposed for this downstream area, which will serve to detect any potential effects on groundwater from quarry activities (Section 5.6.2). Given that there is no surface water connection between the quarry site and the downstream Big Harbour Brook, a separate surface water monitoring program is not required. The quarry boundaries will not extend south or southeast toward Big Harbour Brook in the future.

The quarry has potential to progress in the northern portion of the proposed extension towards the current Peters Brook Water Supply area (which will likely take 100 years or more of quarrying to reach). If an extension towards the northern portion of the property occurs in the

future, the Proponent should engage in discussions with the Town of Baddeck to determine if the Town has switched to a groundwater sourced supply. Evaluation for a surface water monitoring program in Marsh Brook should be conducted at this time.

5.3 RARE AND SENSITIVE FLORA

5.3.1 Description of Existing Conditions

The Project Area was surveyed by Stantec botanists on October 6th – 8th, 2009. A vascular plant inventory of the site was compiled during the survey and habitat descriptions were compiled. The Project Area is situated on a large southeast-facing hill and is primarily comprised of mesic upland forest which is dissected by old logging roads. This forested slope is covered by immature mixedwood, immature hardwood, mature hardwood, and immature softwood stands. Forest within the eastern end of the site is currently at an early-successional stage as a result of recent clear-cutting activities. The southeastern end of the site is characterized by exposed bedrock and aggregate material due to disturbance from quarry operations. Vegetation within the area of the existing quarry is largely restricted to its periphery and comprised of weedy taxa. However, an abandoned portion of the quarry as well as some of the old logging roads within the dispersed throughout the forested slope are regenerating with vegetation and provide habitat for species which are tolerant of relatively open and dry environmental conditions. Wetlands are prominent on the lower slope of the hill (downslope of the existing quarry) and are primarily comprised of mixedwood treed swamps. However, a small area of tall shrub swamp, a tiny marsh dominated by herbaceous taxa, and an anthropogenic pond are also present.

Stands of immature mixedwood are abundant along the lower-mid slopes of the Project Area. Tree cover within this habitat is dominated by balsam fir (*Abies balsamea*) paper birch (*Betula papyrifera*), and lesser amounts of red maple (*Acer rubrum*). A moderate but intermittent shrub cover is primarily provided by balsam fir. The herbaceous layer is dominated by dwarf dogwood (*Cornus canadensis*) as well as a number of ferns, particularly eastern hay-scented fern (*Dennstaedtia punctilobula*), mountain wood-fern (*Dryopteris campyloptera*), and evergreen woodfern (*Dryopteris intermedia*). Red-stemmed moss (*Pleurozium schreberi*) is the most dominant moss on the forest floor but broom moss (*Dicranum spp*.), braided moss (*Hypnum spp*.), and stair-step moss (*Hylocomium splendens*) are also abundant.

The mid-upper slopes of the Project Areas are dominated by hardwood forest, the majority of which is comprised of immature stands. Tree cover within this forest type is dominated almost exclusively by American beech (*Fagus grandifolia*). American beech is also the primary component of a moderate shrub layer, although balsam fir is also abundant within this stratum. A prominent herbaceous layer is dominated by spinulose shield fern (*Dryopteris carthusiana*), but a number of other forbs as well as graminoids are also common, including fibrous-root sedge (*Carex communis*), New York fern (*Thelypteris noveboracensis*), northern starflower (*Trientalis borealis*) and indian-pipe (*Monotropa uniflora*). Whereas the forest floor is primarily covered by American beech leaves, some intermittent moss coverage is provided by hair-cap moss (*Polytrichum spp.*), broom moss, and braided moss.

Pockets of mature hardwood are present throughout the forested slope, particularly at its higher elevation. Tree cover within this forest is formed predominantly by a mixture of American beech, yellow birch (*Betula alleghaniensis*), and sugar maple (*Acer saccharum*). Moderate shrub coverage within this habitat is provided almost exclusively by American beech whereas a well-developed herbaceous layer is dominated by shining fir-clubmoss (Huperzia lucidula), mountain wood-fern, and evergreen woodfern. In addition, a number of other forbs are also common, including New York fern, whorled aster (*Oclemena acuminata*), wild lily-of-the-valley (*Maianthemum canadense*), and white wood-sorrel (*Oxalis acetosella*). Moss coverage is generally low and provided predominantly by broom moss, hair-cap moss, and red-stemmed moss.

A stand of immature softwood is present within the western end of the Project Area. Tree cover within this area is comprised almost exclusively of balsam fir. The dense overstory cover provided by this species restricts development of the understory shrub and herbaceous layers. However, some scattered herbs are present throughout this habitat, including evergreen woodfern, white wood-sorrel, northern starflower, and goldthread (*Coptis trifolia*). The forest floor has a well-developed moss layer which is predominantly formed by red-stemmed moss and stair-step moss.

The forested area within the eastern corner of the Project Area has recently (within approximately 5 years) been clear-cut and is currently in an early successional phase. The vegetative community that is found within this area is dominated by red raspberry (*Rubus idaeus*) and has an intermittent cover of regenerating tree species, particularly fire cherry (*Prunus pensylvanica*), red maple, balsam fir, and heart-leaved paper birch (*Betula cordifolia*). Although absent throughout the majority of this habitat, some scattered overstory tree coverage is provided by yellow birch, balsam fir, and red maple. A well-developed herbaceous layer is present and dominated by eastern hay-scented fern, and poverty oat-grass (*Danthonia spicata*). A number of other herbaceous taxa are also common, including flat-top fragrant-golden-rod (*Euthamia graminifolia*), soft rush (*Juncus effusus*), dwarf dogwood, and pearly everlasting (*Anaphalis margaritacea*). Moss coverage is low within the regenerating clear-cut but scattered patches of hair-cap moss are present.

The northwestern end of the existing quarry, which includes a large scree slope, is at an early successional stage following a cease of quarrying activities, and may be characterized as regenerating mixedwood. This habitat has an intermittent cover of shrubs / regenerating trees which is predominantly formed by white spruce (*Picea glauca*), paper birch, green alder (*Alnus viridis*), and balsam fir. Large amounts of this area are covered by exposed substrate or are dominated by early-successional non-vascular taxa, particularly hair-cap moss and reindeer lichen (*Cladina spp.*). Common species with the sparse herbaceous layer include virginia strawberry (*Fragaria virginiana*), downy goldenrod (*Solidago puberula*), low cudweed (*Gnaphalium uliginosum*), poverty oat-grass, eastern hay-scented fern, and ladies'-tresses (*Spiranthes lacera*).

The mixedwood treed swamps within the southeastern end of the Project Area are dominated by balsam fir and red maple, whereas scattered amounts of white ash are also common. These species also form a moderate shrub layer within the swamps, along with lesser amounts of striped maple (*Acer pensylvanicum*), serviceberry (*Amelanchier sp.*), black spruce (*Picea mariana*), and sugar maple. A prominent herbaceous layer is predominantly comprised of dwarf red raspberry (*Rubus pubescens*), cinnamon fern (*Osmunda cinnamomea*), dwarf dogwood, and rough-leaf goldenrod (*Solidago rugosa*). Many other herbaceous taxa are also common throughout this habitat however, including purple avens (*Geum rivale*) and the exotic colt's foot (*Tussilago farfara*). Peatmoss (*Sphagnum spp*.) forms a prominent carpet over the forest floor whereas shaggy-moss (*Rhytidiadelphus sp*.) is also prominent.

A pocket of tall shrub swamp is present within the largest wetland of the Project Area. This habitat is dominated by speckled alder (*Alnus incana*) coverage but a number of other species also contribute to the prevalent shrub layer, particularly balsam fir, red maple, and the subshrub red raspberry. The herbaceous layer within this habitat is comprised of a diversity of forbs and graminoids, with the rough sedge (*Carex scabrata*), cinnamon fern, broad-leaf cattail (*Typha latifolia*), rough-leaf goldenrod, and sensitive fern (*Onoclea sensibilis*) being particularly abundant. Although present, peatmoss coverage is not extensive within this habitat.

A small slope marsh is present within the transmission line corridor at the eastern end of the Project Area. The area is currently dominated by a variety of graminoids and forbs, including black sedge (*Carex nigra*), peppermint (*Mentha x piperata*), broad-leaf cattail, brownish sedge (*Carex brunnescens*), and cinnamon fern. Additionally, black starthistle (*Centaurea nigra*), which is an exotic plant common within anthropogenic habitats, is prominent within this wetland. Although of little abundance, silky dogwood (*Cornus sericea*) provides some shrub coverage within this habitat.

A settling pond has been created south of the existing quarry. Although located within a larger wetland complex, the pond is largely separated from this habitat by an upland ridge created by the mounding of the material that was excavated during its construction. The pond itself is devoid of plant cover except for a narrow fringe along its periphery. A number of graminoids are found growing within the shallow water of the pond’s edge, including broad-leaf cattail, narrow-panicled rush (*Juncus brevicaudatus*), soft rush, and blue-joint reedgrass (*Calamagrostis canadensis*). Additionally, forbs such as spotted jewel-weed (*Impatiens capensis*) are also found within this transition zone and the aquatic species nuttall pondweed (*Potamogeton epihydrus*) was found within the shallow margins of the pond. The ridge of upland habitat that surrounds the pond is comprised largely of weedy taxa such as Canada goldenrod (*Solidago canadensis*), flat-top fragrant-golden-rod (*Euthamia graminifolia*), and the exotic creeping butter-cup (*Ranunculus repens*).

Rare Vascular Plants

A rare plant modeling exercise was performed to determine the likelihood of presence of rare or sensitive plants within the Project Area. As part of the modeling exercise, all records of vascular plant species listed by the Nova Scotia Department of Natural Resources (NSDNR) as at risk (Red listed) or sensitive to human activities or natural events (Yellow listed) (NSDNR 2007a) within a radius of 100 km were compiled by means of an Atlantic Canada Conservation Data Center (ACCDC) data search. The habitat requirements of these species were compared to the range of environmental conditions within the Project Area to determine if suitable habitat was present for these taxa. Knowledge of the habitats present within the Project Area was determined through field visits. In instances where appropriate habitat was present for a particular species, that species was considered to be potentially present within the Project Area. The seasonal aspects and ease of identification of each of the species potentially present in the Project Area was also incorporated into the model in order to determine when the rare or sensitive taxa would be best identified.

A total of 167 Red or Yellow-listed vascular plant species have been recorded within 100 km of the Project Area. Based on the results of the habitat model, 57 of these could be potentially present within the Project Area, including 16 Red-listed and 41 Yellow-listed species. No provincially or federally designated “species at risk” were identified as being potentially present within the Project Area. The results of the model suggest that there is potential for all habitats in the Project Area to support rare or sensitive vascular plant species. Because many of the plants highlighted by the modeling exercise are associated with swamps, ponds, and deciduous forests, these habitats are considered to be most likely to harbour rare or sensitive taxa. Appendix D lists the species identified during the modeling exercise as being potentially present within the Project Area as well as information on their population status, habitat preference, and phenology.

All species of vascular plants encountered during the surveys were identified and their population status determined through a review of provincial and federal sources, including the general status ranks of wild species in Nova Scotia (NSDNR 2007a), S-ranks of the ACCDC (ACCDC 2009), designations by the provincial *Endangered Species A*ct (NSDNR 2007c), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2009), and Schedule 1 of the Species At Risk Act (SARA). No rare, at risk, or uncommon species were encountered during the field survey. A list of the 243 vascular plant taxa found on site during field surveys and information on their population status is provided in Appendix E.

The timing of the fall plant survey was appropriate for identifying the majority of taxa highlighted during the rare plant modeling exercise. Although many of the rare or sensitive plants would have flowered well before the timing of the survey, most are readily identified by their seeds and/or general morphological characteristics, such as leaf shape. However, the timing of the survey was not ideal for certain early-flowering forbs, such as northern bog violet (*Viola nephrophylla*) or southern twayblade (*Listera australis*) for which flowers are necessary for confident identification. In addition, many graminoid specimens were senescing at the time of

visitation, complicating the identification of their species epithet. Several rare or sensitive graminoids, such as short-awn foxtail (*Alopecurus aequalis*) and species of the genus *Carex*, were identified during the modeling exercise as being potentially present on site, but could have been overlooked due to the timing of the survey.

In addition to the vascular plants, several rare non-vascular species have been recorded within 100 km of the Project Area. Of these taxa, two lichens - boreal felt lichen (*Erioderma pedicellatum*) and frosted glass-whiskers (*Sclerophora peronella*) are considered “species at risk” by federal and / or provincially resources. Boreal felt lichen is considered “endangered” by the province of Nova Scotia, COSEWIC, as well as SARA and has been found approximately 31 km from the Project Area. This species primarily grows on the trunks and branches of balsam fir within moist and mature forest stands (Environment Canada 2007). Although the Project Area does include some balsam fir dominated forest, these stands are immature in age and unlikely to provide appropriate environmental conditions for the boreal felt lichen. Frosted glass-whiskers is listed as a species of “special concern” by COSEWIC and SARA, and has been recorded approximately 33 km from the Project Area. Records of this species within Nova Scotia have been found growing on the exposed heartwood of living red maple trees in old-growth northern hardwood stands (COSEWIC 2005). Although the Project Area does support some mature hardwood in its western end, red maple is not a dominant component of this habitat. In summary, the Project Area is unlikely to provide habitat for either of these two rare lichens but inventories of non-vascular taxa were not completed during the site visit.

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

The Project has the potential to influence the populations of plant species through direct habitat loss or indirect changes in habitat conditions, such as altered hydrological regimes. However, no federally or provincially designated “species at risk” or rare or sensitive plants, as identified by NSDNR or the ACCDC, were identified within the Project Area. Because it is not expected that Project activities will cause a significant adverse effect on any populations of rare or sensitive taxa, no specific mitigative measures are recommended.

The fall plant survey was appropriate for identifying the majority of taxa highlighted during the rare plant modeling exercise. However, an additional plant survey will be conducted in the spring / early summer of 2010 to target those species which are more readily identified early in the growing season. If any rare or sensitive species are encountered during this survey, effects of Project activities on their local populations will be assessed and mitigation plans will be developed in consultation with NSDNR, if appropriate.

Standard mitigative measures to minimize the environmental effects of the Project on plant communities include the use of seed mixtures free of noxious weeds during site reclamation. Wherever practical, grubbed root mats should be used for site reclamation. In lieu of root mats, native species, seed mixes containing naturalized species which are well established in Nova

Scotia and which are not aggressive weeds in the wetland and forest plant communities present in the area should be used for reclamation.

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

5.4 WILDLIFE

5.4.1 Description of Existing Conditions

Information regarding use of the Project Area by wildlife was derived from several sources including a field survey and reviews of existing data. The field survey was conducted concurrently with the plant inventory during October 6 – 8, 2009 and recorded information on the presence of birds, mammals, and herpetiles (amphibians and reptiles). In addition, an ACCDC data search, the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992, MBBA 2009), Amphibians and Reptiles of Nova Scotia (Gilhen 1984) and the Nova Scotia Significant Habitat Mapping Database (NSDNR 2007b) were also consulted to provide records of wildlife in the vicinity of the Project Area. The population status of all species encountered during the field survey and reviews of existing data sources was determined with reference to provincial and federal sources, including the general status ranks of wild species in Nova Scotia (NSDNR 2007a), S-ranks of the ACCDC (ACCDC 2009), designations by the provincial *Endangered Species A*ct (NSDNR 2007c), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2009), and SARA.

The ACCDC data search was conducted to determine if any rare or sensitive wildlife species have been recorded in the vicinity of the Project Area. The ACCDC data were incorporated into a wildlife model to determine the likelihood that rare or sensitive wildlife species might inhabit the Project Area. As part of the modeling exercise, all records of wildlife species listed by NSDNR as at risk (Red listed) or sensitive to human activities or natural events (Yellow listed) (NSDNR 2007a) within a radius of 100 km were compiled. The habitat requirements of these species were compared to the environmental conditions of the Project Area to determine if suitable habitat was present for these species. In instances where appropriate habitat was present for a particular species, it was considered to be potentially present.

The Project Area provides moderate habitat diversity for wildlife. A large forested slope occupies the majority of the site and includes stands of immature mixedwood, immature hardwood, mature hardwood, and immature softwood. In addition, a forested area towards the bottom of the slope has been recently clear-cut and is currently in an early regenerative state. Much of the lower slope of the Project Area is occupied by the existing quarry and has little value for wildlife due to extensive disturbance activities and removal of vegetation. Wetlands are prominent downslope of the present quarry. Whereas mixedwood treed swamp occupies the majority of the wetland habitat, a patch of tall shrub swamp, an anthropogenic pond, and small marsh are also present.

Birds

Information on the distribution and abundance of birds in the vicinity of the Project Area was obtained from the Maritimes Breeding Bird Atlas (MBBA) database (Erskine 1992, MBBA 2009), a site visit, and the ACCDC data search. The MBBA provides information on the distribution and abundance of birds across the Maritime Provinces of Canada and may be used to provide an indication as to which species may be expected in the Project Area. The MBBA square in which the Project is located (20PS81) was used to determine the approximate number of breeding birds that may be found within the vicinity of the site. The breeding status of each species was determined from the criteria used in the MBBA (Erskine 1992). “Possible” breeders are generally those birds that have been observed or heard singing in suitable nesting habitat. “Probable” breeders are those birds that have exhibited any of the following: courtship behavior between a male and female; visiting a probable nest site; displaying agitated behavior; and/or male and female observed together in suitable nesting habitat. “Confirmed” breeders are those birds that exhibited any of the following: nest building or adults carrying nesting materials; distraction display or injury feigning; recently fledged young; occupied nest located; and/or adult observed carrying food or fecal sac for young.

A total of 48 bird species have been identified by the MBBA and the field surveys within the vicinity of the Project Area. Of these, 44 were observed by the MBBA and seven were identified during field surveys. Of those recorded by the MBBA, the breeding status of four was confirmed, 24 identified as probable, and 16 classified as possible. Four of the species observed during the field survey had not been recorded within the MBBA square, including golden-crowned kinglet, (*Regulus satrapa*), hairy woodpecker (*Picoides villosus*), red-breasted nuthatch (*Sitta canadensis*), and ruffed grouse (*Bonasa umbellus*). None of the species encountered by field surveys are considered rare or sensitive within the province. Of those recorded within the MBBA square, bobolink (*Dolichonyx oryzivorusis*) is the only species whose population is considered rare or sensitive within the province. Appendix F lists all bird species identified within the breeding bird atlas square and the field surveys, as well as information on their breeding and population statuses.

Bobolinks are associated with grassy hayfields and pastures that have been left unmown. Within eastern North America, declines in bobolink abundance are associated with mowing and haying of grassland habitat during the breeding season. Due to the absence of appropriate habitat, it is unlikely that bobolinks would inhabit the Project Area.

The ACCDC modeling exercise identified a total of 16 Red or Yellow-listed avian species that have been recorded within 100 km of the Project Area. Of these, five are considered “species at risk” by either COSEWIC or the Province of Nova Scotia; including red knot (*Calidris canutus rufa*), American peregrine falcon (*Falco peregrinus anatum*), Bicknell's thrush (*Catharus bicknelli*), harlequin duck (*Histrionicus histrionicus*), rusty blackbird (*Euphagus carolinus*), and short-eared owl (*Asio flammeus*). Of these, only rusty blackbird was identified by the modeling exercise as potentially inhabiting the Project Area. Of the other eleven rare or sensitive species

recorded by the ACCDC, the Project Area was considered to provide potentially suitable habitat for one - northern goshawk

Rusty blackbird is considered of special concern by COSEWIC and is regarded as sensitive by NSDNR. Additionally, it is ranked as “S3B” by the ACCDC which indicates that it is an uncommon breeder within the province. According to the ACCDC data search, the closest recorded population of rusty blackbird is approximately 4 km from the Project Area. During the breeding season, rusty blackbirds are typically associated with forest wetlands, such as slow-moving streams, peat bogs, sedge meadows, marshes, swamps, beaver ponds and pasture edges. In winter, it primarily occurs in damp woodlands and cultivated fields. The primary cause of habitat loss for this species is the conversion of wetlands for agriculture and urban development (COSEWIC 2006). The swamps within the southeastern end of the Project Area provide potentially suitable habitat for this species. However, rusty blackbird observations are typically made in areas that are well removed from human activities. Due to the extensive quarrying activities which have taken place on the site and its close proximity to the highway, it is unlikely that this species currently occupies the site.

The Project Area does not provide suitable habitat for any of the other provincially or federally designated “species at risk” that have been recorded within 100 km’s of the site. Red knot and harlequin duck are both associated with marine coastal habitats and could therefore not be supported by the Project Area which is located approximately 4 km from the nearest coastal habitats provided by Great Bras d’Or lake and St. Anns Bay. The forest conditions of the Project Area are not suitable for Bicknell's thrush which is confined to high-elevation regenerating clear-cuts and coastal areas with spruce-fir forests. The forests of the Project Area would be unsuitable for the short-eared owl which occupies open, grassy areas of the province. Whereas the American peregrine falcon may frequent any habitat type that provides hunting opportunities, this species prefers cliff habitats for nesting. The only cliffs present within the Project Area are those which have been created by quarry activities and these are not suitable as American peregrine falcon nesting habitat due to their temporary nature. Similarly, habitat conditions are not suitable for any of the additional Yellow-listed species listed by the ACCDC as being within 100 km of the Project Area.

Mammals

Information regarding the presence of rare mammals and sensitive mammal habitat within the vicinity of the Project Area was derived from a field survey, the ACCDC data search, and a review of the Nova Scotia significant habitat mapping data base (NSDNR 2007b). Whereas field surveys provide a good indication of the presence of large mammal species in the Project Area, knowledge of the distribution of small mammals in the Project Area is limited by their secretive nature. Fortunately, many small, rare mammals have very specific habitat requirements which can be used to predict areas where they are likely to be found.

Evidence of nine mammals was recorded within the Project Area during the field surveys. These include American beaver (*Castor canadensis*), American red squirrel (*Tamiasciurus hudsonicus*), coyote (*Canis latrans*), moose (*Alces alces*), snowshoe hare (*Lepus americanus*), southern red-backed vole (*Myodes gapperi*), and white-tailed deer (*Odocoileus virginianus*). None of these species are Red or Yellow listed, or considered "at risk" by provincial or federal sources. Visual sightings or recent spoor suggest that all of these species except American beaver presently frequent or inhabit the site. Evidence of American beaver was limited to old tree cuttings and dam along the margins of the anthropogenic pond.

Four Red or Yellow-listed mammal species have been recorded within 100 km of the Project Area. Two of these species, American marten (*Martes americana*) and Canada lynx (*Lynx canadensis*) are considered "endangered" by the Province of Nova Scotia. The other two species, fisher (*Martes pennant*) and long-tailed shrew (*Sorex dispar*) are both considered "sensitive" by NSDNR.

American marten are considered endangered by the Province of Nova Scotia, at risk by NSDNR, and are given a ranking of "S1" by the ACCDC indicating that they are extremely rare throughout the province. This species was once widespread throughout the province but their distribution has dramatically declined as a result of habitat loss and harvesting. Two populations of American marten are now found within Cape Breton – one on the northwest side of the highlands (mostly within the Cape Breton Highlands National Park), and the other within the southeastern highlands. The Project Area is in close proximity to the later population, which is believed to extend from the Ingonish River Valley southwest to Middle River, and American marten have been observed within approximately 7 km from the site. This species prefers habitat containing large contiguous patches of mature softwood or mixedwood forest, although mature hardwood forest is used as winter habitat in some portions of American marten range. Although the landscape surrounding the Project Area is moderately fragmented, some relatively large contiguous softwood and mixedwood stands are located adjacent to the site (Figure 2). The forests within the Project Area are dominated by immature-mature hardwood stands, with lesser amounts of mixedwood and softwood also being present. Although the forested area within the Project Area may not be ideal American marten habitat, there is some potential for this species to inhabit the site and /or to their wander in from nearby localities.

Canada lynx are considered endangered by the Province of Nova Scotia, at risk by NSDNR, and are given a ranking of "S1" by the ACCDC. Although lynx historically occupied parts of the mainland, it is now restricted to Cape Breton. Specifically, this species is currently restricted to the highlands of Victoria and Inverness Counties and several small areas on the eastern shore of Bras d'Or Lake (Parker 2001). Lynx are most common within boreal and mixedwood forests. Within such forests, they prefer stands with a diverse age structure that provide appropriate habitat for denning, cover and food. Lynx primarily feed on snowshoe hares which are most common in young (10-25 years), dense, mixed regenerating forest stands. In boreal areas, snowshoe hare populations typically undergo ten year cycles in which the population increases then crashes. Following a crash of snowshoe hares, lynx are known to disperse into adjacent

lowlands. Although lynx have been recorded within approximately 6 km from the Project Area, the site is outside the known distribution of core lynx breeding habitat within the highlands. However, individuals may wander into the Project Area in search of food, particularly following the crash of snowshoe hare populations.

Fishers are considered sensitive within Nova Scotia and are ranked as “S2” by the ACCDC indicating that they are rare within the province. Although previously extirpated from Nova Scotia as a result of over trapping and habitat loss, a small population has become established through reintroduction efforts. The closest known fisher record is approximately 28 km away from the Project Area. Fishers prefer large tracts of mature coniferous or mixedwood forest. Although they will also make use of second growth forests they generally avoid areas of human habitation and early successional forests. Fishers have large home ranges and typically travel along regular hunting circuits which may be up to 16 km in diameter. Although no evidence of fishers was encountered during the field surveys, their large ranges would inhibit considerable amounts of spoor in any particular area, and evidence of this species could therefore be easily missed. The mixedwood and coniferous forests of the Project Area have some potential to provide habitat for this species. However, given the large home ranges of fishers and the small size of the proposed quarry extension area, loss of suitable habitat as a result of Project activities is unlikely to cause an important adverse effect on this species.

Long-tailed shrews are considered sensitive by NSDNR and are ranked as “S1” by the ACCDC. This species is typically associated with talus slopes and rock slides in deciduous or coniferous forests and may rarely inhabit man-made artificial talus. The nearest known record of long-tailed shrews is approximately 12 km from the Project Area. Although a talus slope does exist within the Project Area, this habitat is comprised of gravel-sized material and does not provide the interstitial spaces, as are formed by larger rocks, which long-tailed shrews are associated with. As such, it is unlikely that long-tailed shrews inhabit the site or that Project activities will interact with this species.

A review of the NSDNR significant habitat mapping database identified northern and western portions of the Project Area as potential deer wintering habitat (Figure 3). Such areas represent localities where white-tailed deer tend to congregate, or “yard”, in large, high density groups during winter. These areas are identified within Nova Scotia using a combination of field observations, computer/mathematical models, and / or photograph/map analysis (Province of Nova Scotia 2009). They are often located on south-facing slopes, such as that of the Project Area, which provide shelter from the prevailing wind and offer maximum sun exposure. These areas are generally comprised of mature softwood or mixed stands which offer cover, as well as access to acceptable browse. Softwood cover is a particularly important feature of deer wintering areas because it forms a canopy which limits the amount of snow accumulating on the forest floor and also acts as a windbreak and thermal insulator. Although pure softwood stands provide excellent shelter, they are typically deficient in available browse. As such, pure softwood stands are primarily utilized by wintering deer when snow depths are restrictive (>50 cm) or weather is severe (Province of Nova Scotia 2009). Mixedwood stands may offer acceptable

amounts of cover in addition to a greater abundance of browse, and are therefore utilized by deer when snow depths are moderate (~20 cm). In areas where snow and/or temperature are not limiting factors, selection is based proportionately less on cover type and more on the presence of abundant, high quality browse.

As indicated by provincial forest cover mapping (Figure 2) and confirmed through field surveys, the deer wintering habitat within the Project Area is comprised of hardwood forest. Although this forest would offer abundant browse opportunities for white-tailed deer, the lack of conifer cover within this habitat would prevent it from being an adequate source of shelter during the winter months. Snow fall records from 1995 to 2002 in the nearby town of Baddeck (excluding year 2000 due to limited data) indicate that snow depths average approximately 14 cm within the area. Additionally, maximum snow depths averaged 51 cm and snow depths were 50 cm or greater for an average of 11 days per year during this interval (Province of Nova Scotia 2009). Snow fall varies considerably amongst years however, and heavy deposition is sometimes experienced – for example, snow depths during the winter of 2001 averaged 48 cm, were as deep as 102 cm, and were 50 cm or greater for 66 days. This data suggests that although mixedwood stands may sometimes provide suitable shelter for wintering deer, snow depths are sufficient to encourage the use of stands with heavy conifer cover. As such, despite the boundaries of the yard, as identified by NSDNR, it is unlikely that the identified portion of the Project Area currently serves as important deer wintering habitat. Furthermore, although extensive evidence of moose was observed throughout the forested slope, including visual sightings of individuals and abundant spoor, signs of white-tailed deer within the Project Area was limited to two observations of scat within the southeastern end of the Project Area. Outside the Project Area, the boundaries of the yard also encompass mixedwood stands, and may therefore have greater value as deer wintering habitat than that identified within the current site of interest.

The NSDNR significant habitat mapping database did not reveal the presence of any rare or sensitive mammal species in the immediate vicinity of the Project Area. Additionally, all of the habitats present in the Project Area are commonly encountered throughout the province and are unlikely to provide habitat for rare small mammal species.

Herpetiles

Information regarding amphibians and reptiles within the Project Area was obtained during the field surveys, the ACCDC data search, and reference to Amphibians and Reptiles of Nova Scotia (Gilhen 1984). Herpetile observations made during the site visit were done concurrently with vegetation surveys.

Four herpetile species were encountered during the surveys: green frog (*Rana clamitans*), northern spring peeper (*Pseudacris crucifer*), redback salamander (*Plethodon cinereus*), *occipitomaculata*), and wood frog (*Rana sylvatica*). Of the habitats within the Project Area, the anthropogenic pond would be most valuable for breeding herpetiles. In particular, this area

would provide suitable breeding habitat for amphibians associated with both ephemeral and permanent ponds. In contrast, lack of surface water pooling within the swamp and marsh habitats of the Project Area suggest that herpetile breeding opportunities within the majority of wetland habitat is low. However, these wetlands do provide herpetile foraging opportunities, as many areas some areas of the upland, although the value of the later would fluctuate considerably with season and moisture levels. None of the encountered species are considered to be uncommon, rare, or sensitive by either provincial or federal sources.

Wood turtle (*Glyptemys insculpta*) is the only rare or sensitive herpetile that has been recorded within 100 km from the Project Area, or is generally known from the area. Wood turtles are considered threatened by COSEWIC and *SARA*, vulnerable under the Nova Scotia Endangered Species Act, are ranked as S3 by the ACCDC, and are regarded as sensitive by NSDNR. Wood turtles are typically associated with watercourses and the riparian habitats associated with them. They nest on sandy or gravelly river banks but will also make use of features such as sand pits and road embankments near water courses that provide a sandy or gravelly substrate. Deep pools in larger rivers are often used as hibernaculum sites during the winter. Riparian habitats along watercourses are typically used as feeding sites. Wood turtles have been recorded within approximately 12 km from the Project Area but are not likely to inhabit the site due to the absence of watercourses. However, wood turtles may be found to nest in gravel pits at considerable distances (~ 500 m) from watercourses. Whereas the Project property boundary is in close proximity to several watercourses, there is some potential for this species to access the quarry pits for nesting purposes.

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

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

Although no rare or sensitive bird species are expected to occupy the Project Area, a breeding bird survey will be conducted in early June 2010 to record all species which inhabit the site. Should any rare or sensitive taxa be identified during the survey, the effects of Project activities on their local populations will be assessed and mitigation plans will be developed in consultation with NSDNR, if appropriate.

According to NSDNR (2007b), portions of the Project Area are within the boundaries of a deer wintering habitat. However, forest conditions within these sections of the Project Area are not

typical of those utilized by deer during the winter. In particular, they contain negligible amounts of softwood cover, which is required by white-tailed deer for shelter during winter months. As such, the Project Area is not expected to currently serve as an important area of shelter for wintering deer.

Although there is potential for several rare or sensitive mammals to frequent the site, the Project Area is unlikely to provide critical habitat for any of these taxa. The site is within the known distribution of the endangered American marten on Cape Breton Island but does not offer ideal habitat conditions for this species. Whereas the endangered lynx is known in close proximity to the Project Area and may wander into it, the site is outside of the current known breeding habitat for this species. Additionally, although the Project Area provides some potentially suitable habitat for fishers (which are considered sensitive by NSDNR), loss of suitable habitat as a result of Project activities is unlikely to cause an important adverse effect on this species as a result of its large home range and the relatively small size of the proposed quarry extension area. Furthermore, no rare small mammals are expected to inhabit the Project Area due to inappropriate habitat conditions and/or limitations in range distributions.

The Project Area is unlikely to provide critical habitat for any rare or sensitive herpetiles. No rare or uncommon herpetiles were encountered during the surveys and none are expected to inhabit the Project Area due to unsuitable habitat conditions and / or limitations in their range distributions. However, due to the proximity of the Project area to watercourses, there is some potential for wood turtles to utilize the quarry pits for nesting purposes. If any wood turtles are found within the Project area (they are the only native species of turtle to inhabit Cape Breton Island), NSDNR must be contacted immediately to develop a contingency plan in order to mitigate the effects of the Project on this species.

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

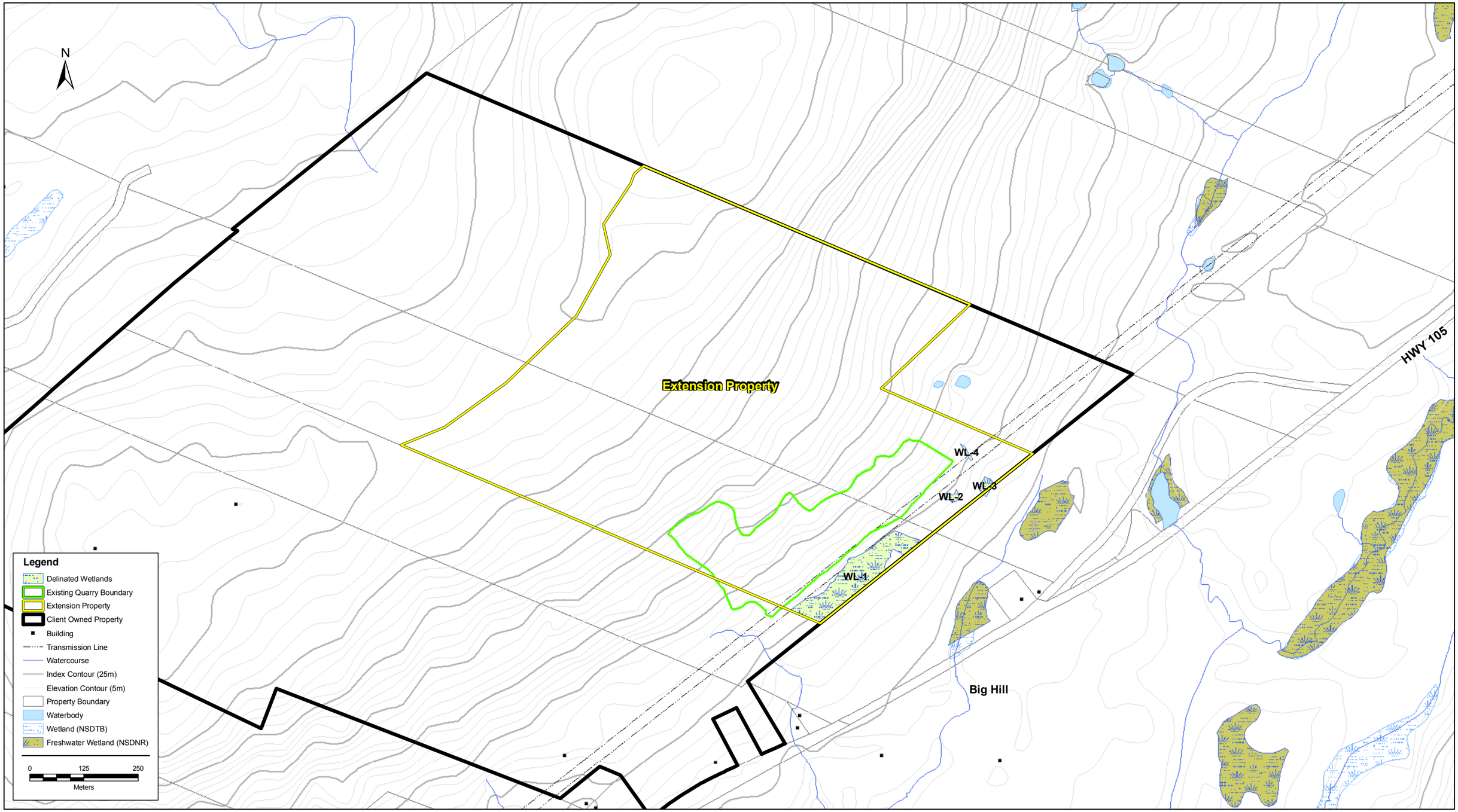
5.5 WETLANDS

5.5.1 Description of Existing Conditions

Four wetlands are present within the southeast end of the Project Area (Figure 4). Three of these are slope swamps whereas one is best characterized as a slope marsh, as identified by the Canadian Wetland Classification System (Warner and Rubec 1997). These wetlands occur on a seepage slope at the lower end of the large hill which comprises the Project Area. They receive groundwater from the Project Area as well as surface water run-off, especially after high precipitation or snow-melt events. Several of the wetlands contain drainage channels that continue outside of the Project Area and these are anticipated to connect to watercourses downslope of the site.

Swamps are mineral wetlands or peatlands and have a water table that is generally at or near the surface. Slope swamps are characterized by a sloping topography, such as may be found in drainageways or water tracks. Within such wetlands, internal water movement from the margin of the swamp or from other sources of mineral enriched waters may flow slowly through pools or channels, or as unilateral sheet flow. If peat is present, it consists mainly of well-decomposed wood, underlain at times by sedge peat. The swamps within the Project Area are primarily comprised of mixed treed vegetation types. However, an area of tall shrub swamp and an anthropogenic pond are found within the largest of the wetlands.

Marshes are mineral wetlands or peatlands that are periodically inundated by standing or slow flowing water. Slope marshes develop on lower elevation slopes where they occupy seepage areas where groundwater discharges. The surface water of marshes is typically rich in nutrients and fluctuates seasonally. During drier periods, low water levels may expose areas of matted vegetation or mud flats. The substrate is usually mineral material although well-decomposed peat may occasionally be present.



AUTHOR: M. Huskins-Shupe	DATE: July 13, 2010	GILLIS CONSTRUCTION QUARRY EXTENSION	FIGURE NO.: Figure 4
APPROVED BY: G. Asche	SCALE: 1:12,500	**WETLANDS & WATERCOURSES**	
1056547	COORDINATE SYSTEM: UTM NAD 83 ZONE 20		Stantec

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A description of each of the wetlands including their general character, vegetative composition, ecological functions, socio-economical value, and anthropogenic influences, as observed during a site visit on October 6 – 8, 2009, is presented in the following sections. A list of the various plant and wildlife species recorded in each wetland is provided in Appendix G.

Wetland 1

Wetland 1 is a complex formed by mixed treed and tall shrub slope swamp, as well as an anthropogenic pond. Because the wetland extends outside of the Project Area, its total area is unknown. However, within the Project Area it encompasses 1.83 ha. The existing quarry bed marks the uphill (northwestern) edge of the wetland whereas upland forest comprised of immature mixedwood, border it elsewhere. The wetland is primarily fed with groundwater from the large forested slope of the Project Area via multiple seepages at the base of the existing quarry but is also likely to receive surface water from the adjacent quarry, especially after high precipitation or snow melt events. Water moves through the wetland via intermittent channels as well as by unilateral sheet flow. Additionally, two surface channels flow into the anthropogenic pond. Whereas only one major outflow channel was observed for this wetland, several intermittent drainages within the body of the wetland continued outside of the Project Area and likely provide additional outflow channels elsewhere. The observed outflow channel was located immediately outside the Project Area in the northeastern corner of the wetland and was approximately 1 m wide. Surface water within the swamp component of the wetland was generally limited to that within the intermittent drainage channels but some surface water pooling may occur during the spring. Peat was observed to be 60 – 70 cm deep, although depths > 1 m were observed.

The large majority of the wetland is comprised of mixed treed swamp. Much of the area covered by this vegetation type is marginal in character, and includes species typical of both upland and wetland habitats. Tree cover within this mixed treed swamp is primarily provided by balsam fir and red maple, but white ash is also an important component in areas. An intermittent shrub layer is provided by a number of tree species, including striped maple, balsam fir, red maple, and white ash. In addition, the shrub velvetleaf blueberry (*Vaccinium myrtilloides*) is also common throughout this vegetation type. A well-developed herbaceous layer is comprised of a diversity of species, including dwarf red raspberry, dwarf dogwood, purple avens, cinnamon fern, and rough-leaf goldenrod. In addition, a number of species typically associated with upland forests, particularly trailing arbutus (*Epigaea repens*) are abundant on hummocks. A moderate moss layer is provided by shaggy-moss and peatmoss. A small area (approximately 15 x 15 m) towards the northeastern end of the wetland is comprised of tall shrub swamp. This vegetation type grades into mixed treed swamp at its northern, western, and southern edges, and into an upland ridge which borders the pond towards the east. This section of the swamp is dominated by speckled alder but a number of other species also contribute to the prevalent shrub layer, particularly balsam fir, red maple, and the subshrub red raspberry. The herbaceous layer within this habitat is comprised of a diversity of forbs and graminoids, with rough sedge, cinnamon fern, broad-leaf cattail, rough-leaf goldenrod, and sensitive fern being particularly abundant.

Although present, peatmoss coverage is not extensive within this habitat. Some intermittent tree layer is provided by balsam fir and red maple.

A small anthropogenic pond (approximately 20 x 20 m) and an accompanying satellite pool (approximately 2 x 3 m) exist at the northeastern end of the wetland. Although much of the pond is separated from the rest of the wetland by an upland ridge created by the mounding of the material that was excavated during its construction, an area of wetland habitat at its western edge is continuous with the swamp. A number of graminoids were present within the shallow water of the pond's edge, including broad-leaf cattail, narrow-panicled rush, soft rush, and blue-joint reedgrass. Additionally, forbs such as spotted jewel-weed are also found within this transition zone and the aquatic species nuttall pondweed was encountered within the shallow margins of the pond. The ridge of upland habitat that surrounds the pond is comprised largely of weedy taxa such as Canada goldenrod, flat-top fragrant-golden-rod, and the exotic creeping butter-cup.

A vegetation survey conducted in the wetland revealed the presence of 80 species of vascular plants. None of these species are considered at risk, sensitive, rare, or uncommon by either provincial or national sources (ACCDC 2009; COSEWIC 2009; NSDNR 2007a; and NSDNR 2007c). Whereas the wetland is dominated by native taxa, exotic species are common in area. In particular, colt's foot and creeping butter-cup are abundant alongside the small seepage channels which run through the wetland.

The wetland is of moderate value for wildlife. Three herpetiles were observed within the wetland during the site visit, including spring peeper, green frog, and wood frog. Whereas most of the wetland provides minimal herpetile breeding habitat, the anthropogenic pond could breeding amphibians associated with both ephemeral and permanent ponds. Bird observations within the wetland were limited to those typically associated with forested sites, including red breasted nuthatch and black-capped chickadee (*Poecile atricapillus*). Although waterfowl may frequent the pond, its small size and lack of vegetative cover limits the value of this habitat for waterfowl. Evidence of two mammals, red squirrel and American beaver, were observed within the wetland. However, because evidence of American beaver was limited to old tree cuttings and a dam along the margins of the anthropogenic pond, this species is not expected to currently utilize the wetland.

The wetland is moderately important for providing hydrological and biogeochemical functions. The swamp component of the wetland is fed via multiple seepages at the base of the existing quarry but is likely to receive surface water from the adjacent quarry following high precipitation or snow melt events. Sediments or other contaminants carried by the surface waters could be retained within the swamps through a combination of physical processes and interaction with vegetation. By acting as a filter for sediments or other contaminants, the swamp may contribute to water quality within the area. However, the sloped nature of the swamp suggests that it has limited capacity to capture and store storm water and that it's potential to recharge groundwater is low. The anthropogenic pond receives water via two surface channels which flow from the

existing quarry bed. Water levels within the pond would fluctuate considerably with the season and the occurrence of precipitation events. During high precipitation events, such as storms, the pond would moderate water flow by acting as a reservoir for flood waters. The pond may also act to improve water quality by acting as a reservoir for particulate matter carried in surficial runoff from the existing quarry. However, because the pond is not well-vegetated, its ability to contribute to water quality through interaction with vegetation is limited. Furthermore, because primary production from aquatic macrophytes is expected to be low, the wetland is not likely an important sink for nutrients which have been washed from the surrounding topography.

The wetland has little socio-economic value. Apart from serving as a settling pond for the existing quarry, there is no evidence to indicate that it is currently being 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.

Wetland 2

Wetland 2 is a 0.05 ha mixedwood treed slope swamp surrounded by immature mixed forest. The wetland is fed by seepage from the northwest and includes a narrow drainage channel (< 0.5 m wide) at its western end. Surface water within this wetland was restricted to the channel and peat depths were generally 60-70 cm.

The swamp has a moderate tree cover provided by red maple and balsam fir. Balsam fir, along with lesser amounts of red maple, serviceberry (*Amelanchier sp*.), and striped maple comprise a moderate shrub layer within the wetland. The cover of herbaceous vegetation is high and primarily comprised of dwarf red raspberry, cinnamon fern, and rough-leaf goldenrod. However, a number of other species are also common, including dwarf dogwood, brownish sedge, flat-top fragrant-golden-rod, field horsetail (*Equisetum arvense*), and woodland agrimony (*Agrimonia striata*). Peatmoss provides coverage over approximately half of the wetland's forest floor.

A vegetation survey conducted in the wetland revealed the presence of 29 species of vascular plants. None of these species are considered at risk, sensitive, rare, or uncommon by either provincial or national sources (ACCDC 2009; COSEWIC 2009; NSDNR 2007a; and NSDNR 2007c). Whereas the wetland is dominated by native taxa, the exotics species colt's foot and creeping butter-cup were common along the drainage channel at its western end.

The wetland is of low-moderate value for wildlife. No herpetiles, birds, or mammals were observed within the wetland during the field visit. Furthermore, it is not considered to provide suitable herpetile breeding habitat due to lack of surface water pooling. The wetland would not provide suitable waterfowl habitat and does not contain an abundance of any plant species that are known to be an especially important food source for wildlife. Habitat opportunities provided by the wetland for birds and mammals are considered comparable to those in the adjacent upland habitats.

Although a small drainage channel is found within the western end of the wetland, the swamp primarily receives water inputs from via seepages. However, much of the water within the wetland would feed into the drainage channel. The sloped nature of the swamp suggests that it has limited capacity to capture and store storm water. Furthermore, no evidence of surface water pooling, such as exposed areas of substrate or blackened leaves, were observed. Because of its sloped nature and small size, the wetland has limited ability to provide hydrological and biogeochemical functions within the watershed. However, there is some potential for the wetland to contribute to water quality through interaction with vegetation.

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

Wetland 3

Wetland 3 is a 0.09 ha mixedwood treed slope swamp, 0.08 ha of which is inside the Project Area. The swamp is primarily surrounded by immature mixed forest, but a patch of old-field immature conifer abuts its uphill edge. The wetland encompasses two seepage channels which merge together and are < 0.5 m in width. Surface water within this wetland was restricted to these channels and peat depths ranged from 30 to 65 cm.

The swamp has a moderate tree cover provided by red maple and balsam fir. A moderate shrub layer is formed by a diversity of tree species, including balsam fir, red maple, white ash, black spruce, and sugar maple. Herbaceous cover is primarily provided by cinnamon fern and dwarf dogwood, but a number of other forbs, including Canada goldenrod, royal fern, and the exotics black starthistle and colt's foot are also prominent. Peatmoss coverage is low and covers approximately 5% of the forest floor.

A vegetation survey conducted in the wetland revealed the presence of 34 species of vascular plants. None of these species are considered at risk, sensitive, rare, or uncommon by either provincial or national sources (ACCDC 2009; COSEWIC 2009; NSDNR 2007a; and NSDNR 2007c). A number of exotic plants particularly black starthistle and colt's foot are common within the wetland and likely reflect the anthropogenic nature of the adjacent regenerating old-field habitat located upslope of the wetland.

The wetland is of low-moderate value for wildlife. Only one bird, blue jay, was observed in the wetland during the site visit and no herpetiles or mammals were encountered. The wetland is not considered to provide suitable herpetile breeding habitat due to lack of surface water pooling. The wetland would not provide suitable waterfowl habitat and does not contain an abundance of any plant species that are known to be an especially important food source for wildlife. Habitat opportunities provided by the wetland for birds and mammals are considered comparable to those in the adjacent upland habitats.

The wetland receives water inputs from the northwest via two seepage channels. The sloped nature of the swamp suggests that it has limited capacity to capture and store storm water. Furthermore, no evidence of surface water pooling, such as exposed areas of substrate or blackened leaves, were observed. Due to its sloped character as well as its small size, the wetland has limited ability to provide hydrological and biogeochemical functions within the watershed. However, there is some potential for the wetland to contribute to water quality through its interaction with vegetation.

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

Wetland 4

Wetland 4 is a 0.02 ha slope marsh located within the transmission line corridor at the eastern end of the Project Area. The wetland is comprised of a broadened seepage track that flows towards the southeast. Whereas the majority of the marsh has a sloping topography, its lowest section is comprised of a small catchment basin which is relatively flat. The majority of the wetland is surrounded by the cut-over area of the transmission line corridor; but immature mixed forest abuts its lower and upper ends. The vegetative composition of this wetland has likely been influenced by activities associated with the creation and maintenance of the transmission line corridor, particularly the cutting and suppression of woody vegetation.

The wetland is dominated by herbaceous taxa, but the composition of the community differs between its upper and lower sections. Black sedge (*Carex nigra*) dominates the upper end of the wetland, whereas black starthistle, field horsetail, and peppermint are also common within this section of the marsh. In contrast, peppermint, broad-leaf cattail, and brownish sedge, along with lesser amounts of cinnamon fern and Canada goldenrod, dominate the basin found in the lower portion of the wetland. Some intermittent shrub coverage, provided by silky dogwood is also found within this section.

A vegetation survey conducted in the wetland revealed the presence of 40 species of vascular plants. None of these species are considered at risk, sensitive, rare, or uncommon by either provincial or national sources (ACCDC 2009; COSEWIC 2009; NSDNR 2007a; and NSDNR 2007c). A number of exotic plants, particularly black starthistle, and colt's foot are common within the wetland and reflect anthropogenic influences within the transmission corridor.

The wetland is of low-moderate value for wildlife. No herpetiles, birds, or mammals were observed within the wetland during the field visit. Due to a lack of surface water, the wetland is unlikely to provide habitat for breeding herpetiles. However, depending on the ability of the lower basin to retain surface water during spring, there is some potential for this area to provide limited breeding opportunities for amphibians which utilize ephemeral pools. The wetland would

not provide suitable waterfowl habitat and does not contain an abundance of any plant species that are known to be an especially important food source for wildlife. Habitat opportunities provided by the wetland for birds and mammals are considered comparable to those in the adjacent upland habitats.

The wetland receives water inputs from the northwest via a tiny seepage. The sloped nature of much of the marsh suggests that it has limited capacity to capture and store storm water. Furthermore, no evidence of surface water pooling, such as exposed areas of substrate or blackened leaves, were observed. Due to its sloped character and its small size, the value of the marsh for providing hydrological and / or biogeochemical functions within the watershed is very limited. However, there is some potential for this wetland to contribute to water quality by acting as a reservoir for particulate matter and through interaction of passing water with its vegetation.

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

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

In Nova Scotia, wetlands are protected under the Activities Designation Regulations made pursuant to the provincial *Environment Act*. Any loss of wetland habitat either through direct infilling or indirectly through alteration of wetland hydrology requires preparation of a wetland alteration application. NSE also requires submission of a compensation plan to replace the lost wetland functions.

Avoidance measures will be used to minimize the direct loss of wetland habitat within the Project Area where practical. Quarry extension will proceed in a northwestern (uphill) direction from the existing quarry pit and will therefore not encroach on the majority of wetland habitat which is located to the southeast (downhill from existing quarry). However, should avoidance measures not be practical for Project activities, appropriate wetland applications and compensation plans will be developed prior to any Project-related loss of wetland habitat. In addition, due to potential for wetland drainage channels to connect downslope, it will also be necessary to conduct a watercourse evaluation if Project activities are to encroach on habitats southeast of the existing quarry.

An important functional attribute of wetlands is the provision of habitat for wildlife and/or rare plant species. Because botanical and wildlife inventories conducted within the wetlands were performed late in the growing season (early October) it is recommended that supplemental wetland surveys be conducted during spring/early summer to complement the existing plant and wildlife inventories.

The Project has the potential to indirectly influence the wetlands through changes in hydrology, nutrients, or sediment input. However, mitigative measures will be taken during Project activities to prevent cutting off any channels that flow into to the wetlands or see them become repositories of significantly increased water flow, nutrients, or sediments. This will be accomplished through the use of flow retention structures and energy dissipation measures. Direct quarry activities will also not progress in this direction.

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

5.6 GROUNDWATER RESOURCES

Groundwater, an integral component of the hydrologic cycle, originates from percolation of rain, snowmelt, or surface water into the ground. This infiltrating water fills voids between individual grains in unconsolidated materials and fills fractures developed in consolidated materials. The upper surface of the saturated zone is called the groundwater table. The groundwater table intersects the ground surface at springs, lakes and streams where interaction between the groundwater and the surface water environment can occur. Groundwater flows through soil and bedrock from areas of high elevation (recharge areas) to areas of low elevation (discharge areas) where it exits the sub-surface as springs, streams, and lakes. There is a dynamic interaction between groundwater resources and surface water resources in Nova Scotia. Groundwater generally sustains the base flow of springs, streams and wetlands during dry periods of the year. More rarely, surface water bodies can contribute to groundwater storage under specific hydrogeological conditions.

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

The groundwater resource is a VEC because it provides potable water supply to almost all unserviced urban and rural residences in Nova Scotia.

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 extension and water supply wells that may be affected by quarry activities. For example, the area of influence or capture area of a typical low yield domestic water well is usually less than about 100 m, and predominantly in a direction hydraulically up-gradient of the well. A quarry that is excavated below the local groundwater table could be considered to behave like a

large well, and groundwater draining into the quarry would influence water levels immediately surrounding the excavation to a distance proportional to the size and depth of the quarry.

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

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 from blasting or heavy equipment operation is greater for fractured crystalline bedrock than for overburden wells or soft bedrock (*e.g.,* sandstone or shale) wells. Based on professional experience, the risk from blasting or major excavation is considered to be greatest within 50 m, moderate from 50 to 200 m, and minimal beyond about 200 m.

Vibration effects caused by blasting are conservatively considered for drilled wells within 800 m of the proposed quarry extension (*i.e*., the minimum distance from structures allowed for blasting without owner permission specified by the Pit and Quarry Guidelines). Potential effects of accidental spills are considered for all wells hydraulically down gradient of the proposed quarry extension. In general, the extent of the area potentially affected is dependent on the size and type of release, surface drainage and surficial geology; assessment boundaries are typically considered for 200 m in sand and gravel, and up to 50 m in glacial till overburden.

5.6.1 Description of Existing Conditions

The following discussion of the local groundwater resources and hydrogeology is based on a desktop study including review of relevant geological maps and local reports from the Nova Scotia Department of Natural Resources (DNR), and hydrogeology databases and well drilling records from the Nova Scotia Environment (NSE) and DNR interactive hydrogeology data base and Well Drillers Logs Database. This investigation did not include any field truthing for the location of wells, water well inspection, groundwater sampling and analysis, or groundwater depth measurements.

Project Location, Topography and Drainage

The proposed quarry extension is situated about 13 km northeast of the Village of Baddeck to the west of Highway No. 105. The site is located on a large southeast facing hill with ground elevations ranging from approximately 60 to 235 m above sea level.

Surficial Geology

The surficial geology in the Project Area (Figure 5) consists of ground moraine consisting of silty and stony till plain in the southeastern portion of the Project Area, and predominantly exposed bedrock with a thin veneer of glacial till in the north/northwestern upland portion of Project Area.

The silty and stoney tills are derived from both local and distal bedrock sources (Stea, Conley, and Brown, 1992). Its thickness and composition strongly reflect the nature of the underlying bedrock and range from thin silty sand tills with gravel and boulders to thick reddish-brown clay tills.

Based on a review of the Mineral Resources Land-Use Map of the Baddeck Area (D.H. Hopper et al, 2002), a sand and gravel deposit transects the lower elevation south eastern Project Area as shown in Figure 5. A review of this mapping also shows drumlin features southwest of the Project Area.

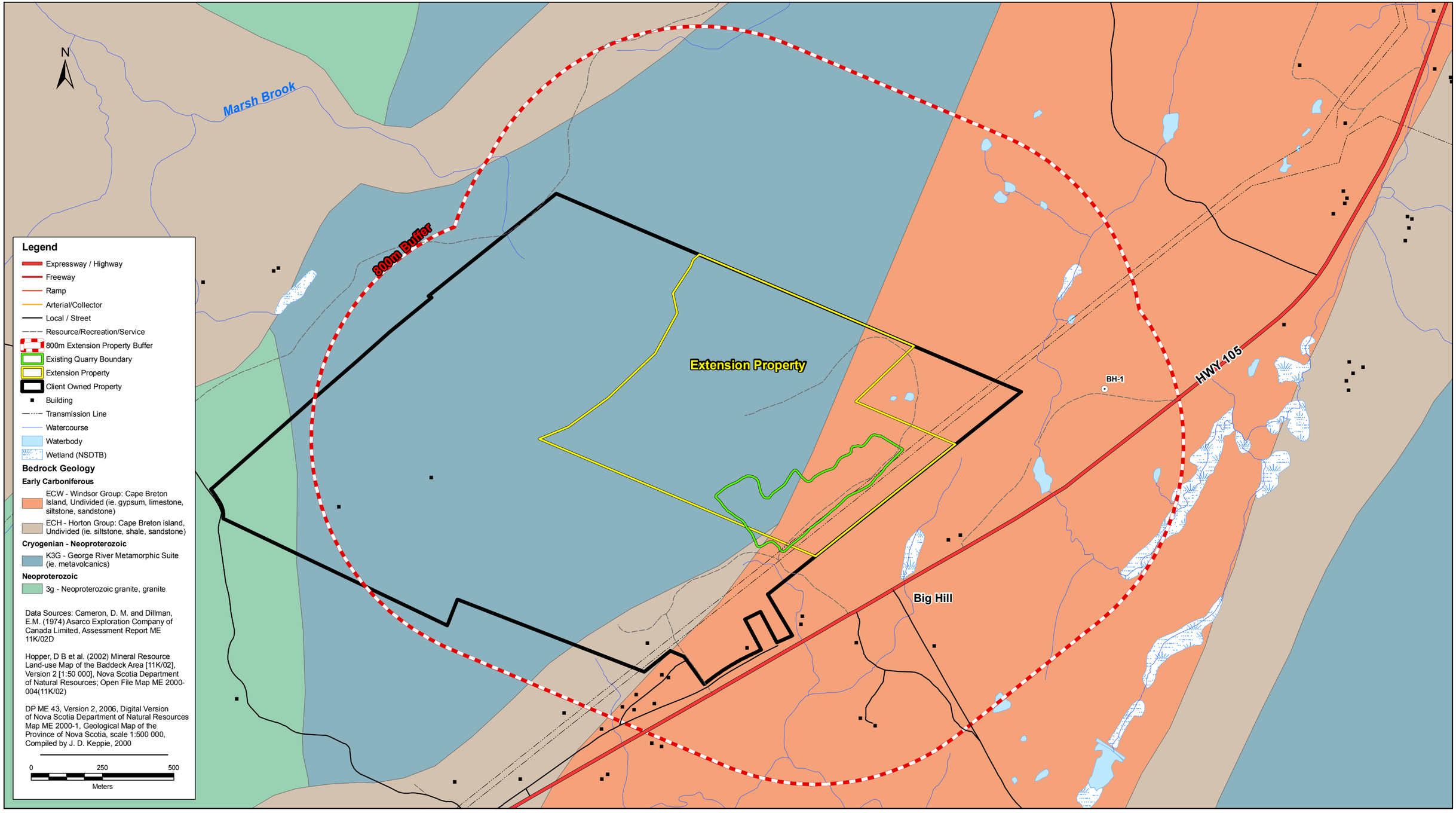
No water well drilling logs were retrieved for the vicinity of the Project Area and as such, overburden thicknesses could not be referenced to water well drillers logs.

Bedrock Geology

According to Keppie (2000), the bedrock underlying the proposed Project Area consists mainly of George River Metamorphic Neoproterozoic (Precambrian) aged rock. The contact with gypsum and limestone bedrock of the younger Windsor Group formation transects the southeastern portion of the Project Area (Figure 6).

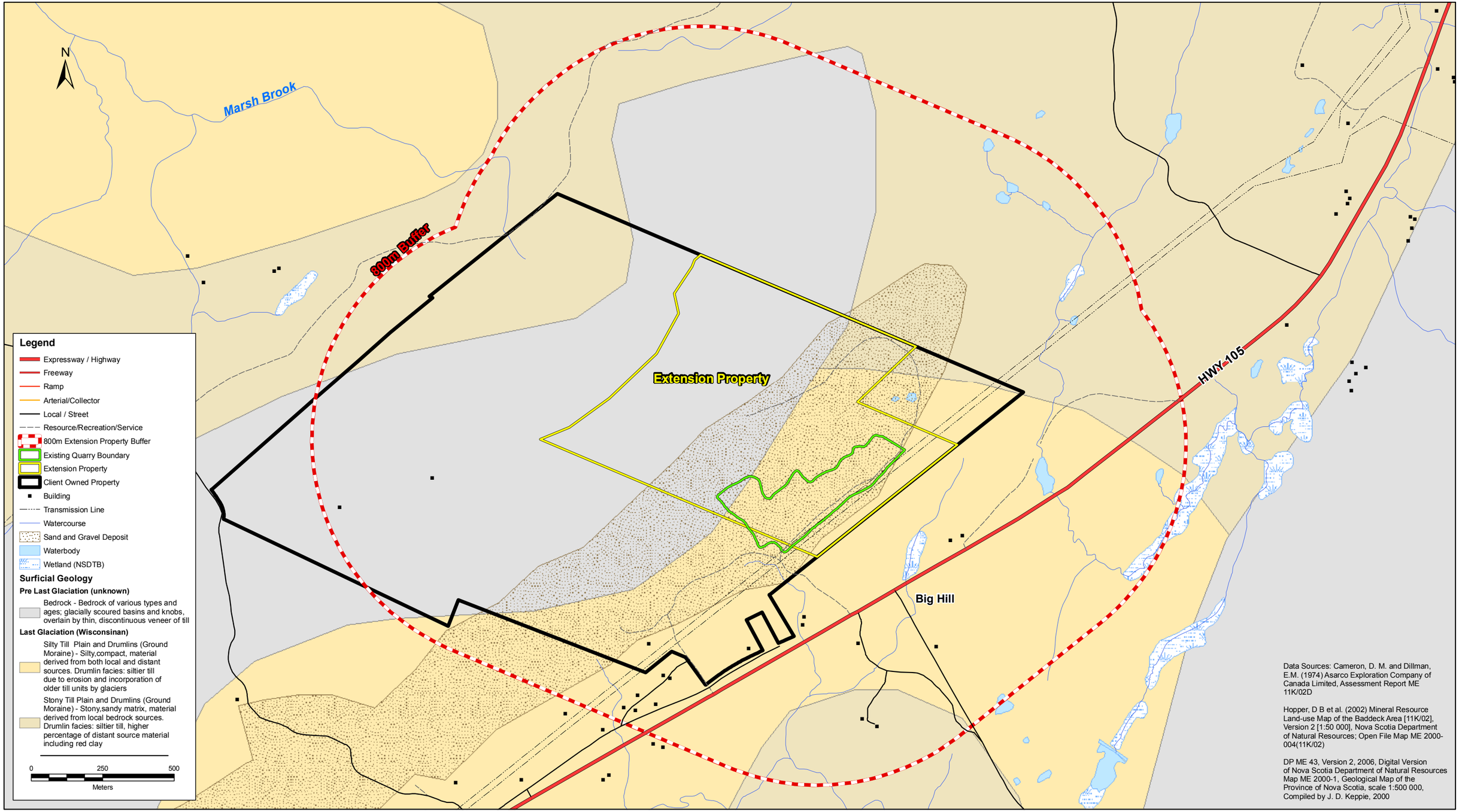
The regional geology mapping prepared by Keppie (2002) is supported by more localized mapping and diamond drill hole information completed in 1974 for the E.M. Dillman Option Big Hill Group (Cameron and Dillman1974). The Cameron mapping describes the bedrock in the Project Area to the west of the existing Gillis Quarry as grey biotite gneiss cut by granite dykes. Chlorite schist and chlorite-rich gneiss with epidote stains is also noted in this area. The Cameron mapping also shows the contact with the younger Windsor Group formation to transect the Project Area. A diamond drill hole (BH 1) drilled east of the existing Gillis Quarry(Figure 6) indicates massive white gypsum with minor blue anhydrite east of the contact.

A review of the Mineral Resources Land-Use Map of the Baddeck Area (D.H. Hopper et al, 2002) shows gypsum to be the only economic mineral occurrence within close proximity to the Project Area. No metallic mineral occurrences are shown to be located in proximity to the Project Area.



AUTHOR: G. Mesheau	DATE: July 13, 2010	GILLIS CONSTRUCTION QUARRY EXTENSION	FIGURE NO.: **Figure 5**
APPROVED BY: G. Asche	SCALE: 1:10,000	**BEDROCK GEOLOGY**	
PROJECT NUMBER: 1056547	COORDINATE SYSTEM: UTM NAD 83 ZONE 20		Stantec

Path: X:\Projects\NovaScotia\105xxxx\1056547_GillisConstructionQuarry\Mapping\MXD\ReportFigures



Data Sources: Cameron, D. M. and Dillman, E.M. (1974) Asarco Exploration Company of Canada Limited, Assessment Report ME 11K/02D

Hopper, D B et al. (2002) Mineral Resource Land-use Map of the Baddeck Area [11K/02], Version 2 [1:50 000], Nova Scotia Department of Natural Resources; Open File Map ME 2000-004(11K/02)

DP ME 43, Version 2, 2006, Digital Version of Nova Scotia Department of Natural Resources Map ME 2000-1, Geological Map of the Province of Nova Scotia, scale 1:500 000, Compiled by J. D. Keppie, 2000

AUTHOR: G. Mesheau	DATE: July 13, 2010	GILLIS CONSTRUCTION QUARRY EXTENSION	FIGURE NO.: **Figure 6**
APPROVED BY: G. Asche	SCALE: 1:10,000	**SURFICIAL GEOLOGY**	Stantec
PROJECT NUMBER: 1056547	COORDINATE SYSTEM: UTM NAD 83 ZONE 20		

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Groundwater Flow Patterns

Groundwater flow patterns in mountainous terrain generally reflect the local topography. A saddle shaped watershed divide between the Peter's Brook Watershed on the northwest and the Great Bras d'Or Lake on the southeast occurs in the central portion of the proposed extension area (Figures 1 and 4). Due to its situation with respect to the local topography, the Project Area is expected to lie within a local groundwater recharge area. The regional groundwater flow is inferred to be southeast toward the Great Bras d'Or Lake. Locally, flow from the southeast two-thirds of the property is southeast towards the community of Big Hill (Figure 1). Groundwater flow from the northwest third of the proposed extension area would be to the northwest, towards Peter's Brook, a municipal water supply source. A component of groundwater flow towards the quarry could occur from the high areas located north and southwest of the watershed divide (Figures 1 and 4).

Groundwater Resources

A review of available mapping was conducted to determine the probable locations of water wells within 800 m of the Project Area. A search of the Service Nova Scotia and Municipal Relations' Property Online database was also conducted to determine address and property ownership information for these areas. The results of this search were used to match well logs from the Nova Scotia Environment (NSE) Well Drillers Database for wells constructed between 1940 and 2009, and to determine well construction information for groundwater wells within the Project Area.

This search revealed no match between water well records and the addresses/properties within 800 m of the quarry extension area. The closest residential water supply wells are located south of the Project along Old Sawmill Road and Port Bevis Road, and to the southeast of the Project along Highway No. 105 and Big Harbour Road. It is assumed that these residences obtain potable water supply from drilled bedrock wells.

To date, there have been no reported interactions between existing Duncan Gillis Quarry activities and local water supply wells. In both current and future quarry operations, it is our understanding that there is to be no excavation of aggregate below the groundwater table.

To provide a general description of aquifer properties in the vicinity of the Project Area and the community of Big Hill, a summary of available domestic well records for Victoria, Inverness, Cape Breton and Richmond counties of Nova Scotia is provided in Table 5.1. Well records were retrieved from the Nova Scotia Environment Well Logs Database for wells drilled between 1940 and 2009, as well as the Nova Scotia Environment Pumping Test Inventory Database (2003). None of these wells are located within 800 m of the Project. However, the conditions encountered within these wells are indicative of the expected conditions of bedrock aquifers located in the vicinity of the Project site. These wells are grouped based on hydrostratigraphy to better compare hydraulic properties.

Water supply wells in the vicinity of the Project site are expected to be completed in two hydrostratigraphic units, including: Horton Group (siltstone, shale, sandstone, conglomerate), or the Windsor Group (gypsum, limestone, mudstone, siltstone, sandstone, conglomerate, shale). No domestic wells are identified for the George River formation which underlies the majority of Project (Table 5.1).

Table 5.1 Summary of Domestic Water Wells Records for Victoria, Inverness, Richmond and Cape Breton Counties, Nova Scotia

	Well Depth (m)	Casing Length (m)	Estimated Yield (igpm)	Water Depth (m)	Overburden Thickness (m)
Horton Group					
Minimum	11.6	6.1	3.0	flowing	1.2
Maximum	91.4	36.6	75.0	37.4	25.9
Average	42.9	15.9	18.6	14.0	11.6
Median	39.6	13.0	10.0	7.6	8.5
Number	21	18	21	14	11
Windsor Group					
Minimum	18.3	5.5	0.2	-	4.6
Maximum	68.6	50.3	50.0	17.4	27.4
Average	40.4	17.6	22.4	8.7	13.9
Median	36.6	13.4	20.0	9.6	9.1
Number	13	9	13	12	6
George River Group					
Minimum	30.5	11.6	0.1	-	7.0
Maximum	61.2	13.1	2.4	3.8	11.3
Average	76.5	12.4	<1	-	9.2
Median	76.5	-	-	-	9.2
Number	2	2	2	2	2

Note: Information was obtained from the NSE Well Log Database including wells constructed between 1940 and 2009.

While the well drilling logs provide an indication of potential well yields sufficient for individual domestic applications, constant rate pumping tests with durations of one to three days provide a good indication of sustainable yields for wells completed into these formations. Seven 50 m to 158 m deep wells completed into the Horton Group sandstone aquifer in Richmond, Inverness, Victoria and Antigonish counties indicate a geometric mean Transmissivity of 6.3 m^2/day, a moderate hydraulic conductivity of 9 x 10^{-4} cm/s, and sustainable yields of 11 to 454 L/min, mean 107 L/min (2.5 to 100 igpm, mean 23.5 igpm).

Eleven 18.3 m to 77 m deep wells completed into the Windsor Group shale and limestone aquifer in Richmond, Inverness, Victoria and Antigonish counties indicate a geometric mean Transmissivity of 5.7 m^2/day, a moderate hydraulic conductivity of 4 x 10^{-4} cm/s, and sustainable yields of 9 to 250 L/min, mean 68 L/min (2 to 55 igpm, mean 15 igpm).

Only three pumping tests were performed on wells completed into the George River formation bedrock aquifer (NSE Pumping test Inventory). Tests on the 93 m to 106 m deep wells at Neil's Harbor Victoria County and James River Antigonish County indicate a characteristically low Transmissivity of 0.4 m^2/day, a low hydraulic conductivity of 5 x 10^{-5} cm/s, and low sustainable yields of 7.7 to 15.5 L/min (1.7 to 3.4 igpm). This suggests a very tight bedrock with a low potential for contaminant transport at depth.

Groundwater Quality

Water quality potential is determined from known water quality characteristics for each hydrostratigraphic unit.

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

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

Little information is available respecting the groundwater quality for the George River Group. Based on study team experience, depending on the lithology, this unit has been known to provide reasonably good quality groundwater.

In addition to the above naturally-occurring water quality issues, based on study team experience, common problems reported by Nova Scotia well owners include: elevated sodium and chloride from road salt; coliform bacteria from surface sources impacting poorly constructed dug and drilled wells; and low pH and/or associate plumbing corrosion in shallow wells constructed in sand aquifers or fractured crystalline bedrock.

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

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

Water Quantity Effects

If the quarry encounters increased groundwater seepage as it expands, water will collect within its lowest point (*e.g.*, a settling pond or sump). Depending on the floor elevation and the resulting amount of groundwater encountered, dewatering of the proposed quarry extension

may be required should there be an event of significant rain. There are no plans in the proposed quarry area to mine below the groundwater table; therefore, no groundwater quantity effects are anticipated.

Water Quality Effects

Because the existing quarry and the extension area are located within the groundwater recharge area of residences to the southeast and southwest, and due to the close proximity of these residences to the quarry and extension area (< 800 m, Figure 1), there is a potential for the quarry operations to affect residences along Highway 105 southeast of the Project Area and along Old Sawmill Road and Port Bevis Road, southwest of the Project Area. Based on the location of the watershed divide, there is also a potential for groundwater movement from activities in the northern portion of the proposed extension towards the Peter's Brook Watershed, the Village of Baddeck current water supply. As with any quarry operation located in a groundwater recharge area, there is potential for accidental releases of deleterious substances to migrate downward through the base of the quarry to the water table, and thence to move down gradient from the quarry area. 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, if present.

Re-fueling activities will be conducted by a licensed contractor. As such, there is a very low potential risk of a major fuel release within the quarry property. Potential hazards would be limited to the unlikely event of a chemical or fuel release or a rupture of a hydraulic hose. This potential hazard is mitigated by the very low hydraulic conductivity of the George River Metamorphic bedrock formation, which results in a low potential for contaminant transport at depth.

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

In Nova Scotia, acid rock drainage is most commonly associated with slate from the Halifax Formation of the Meguma Group and coal bearing shales. The George River Metamorphic suite bedrock underlying the Gillis Quarry consists mainly of gneiss and chlorite schist. In general, felsic gneisses are not known to be a significant acid drainage risk.

The potential for acid drainage production in this area is low; there were no known reported acid generating rocks encountered in the existing quarry. Although not expected, localized acid generating bedrock is possible within localized mineralized zones. Since there are no reported metallic mineral occurrences in the vicinity of the Project Area, mineralized zones are not anticipated in the existing quarry or extension area.

Mitigation of Effects

Significant water quality impacts on bedrock groundwater supply wells are not anticipated due to a combination of distance, anticipated very low bedrock hydraulic conductivity and natural attenuation processes, primarily by dilution and dispersion, along the groundwater pathways. Furthermore, proper attention to the handling of fuels, lubricants and blasting agents should reduce the risks of local groundwater quality impact.

Short-term turbidity impacts caused by blasting vibration are not anticipated, due to distance (> 200 m) and since it is anticipated that the surrounding groundwater well users have wells completed in a different bedrock unit (Windsor Group or Horton Group) from the bedrock of the existing quarry and extension area (George River Metamorphic Suite). In the very unlikely event of short-term turbidity impacts, mitigation would typically involve provision of bottled water to affected residents. In the unlikely event of persisting long-term degraded water quality, or a sustained well yield loss event, the proponent would replace or repair any water supply well found to be adversely affected by their quarry operation, to the satisfaction of the owner.

Acid generating bedrock is not expected; however, should a mineralized zone be encountered the rock will be tested for acid generating potential. If determined to be acid generating bedrock, the material will be handled as prescribed in the Nova Scotia Sulfide Bearing Material Regulations.

Impacts on the Peter's Brook watershed can be best mitigated by prohibition of excavations north of the inferred watershed divide between Peter's Brook and Bras D'Or Lake watersheds. In the event that excavation is allowed above the water table, any activities within this area would require redirection of runoff towards the south.

Monitoring

Because the Project Area lies within the groundwater recharge area of the residences southeast of the Project Area along Highway No. 105, as a precautionary measure, an on-site groundwater monitoring program is recommended to monitor groundwater quality leaving the Project Area. It is recommended that one groundwater monitoring well be situated hydraulically down gradient of the quarry in a southeast direction between the quarry and residences along Highway No. 105. This well should be equipped with water level monitoring instruments which would allow the Proponent to determine the location of the water table on-site (needed to excavate above seasonal water table level). This well should be sampled to confirm the groundwater quality leaving the site and to provide an early warning of any chemical impacts in the unlikely event of a chemical or fuel oil release within the Project Area.

As the quarry progresses consideration should be given to the placement of an additional well southwest of the quarry extension area, in between the quarry and residences along Old Sawmill Road and Port Bevis Road. This monitoring well, possibly equipped with small sampling pumps, should be sampled to confirm the groundwater quality leaving the site and to provide an

early warning of any chemical impacts in the unlikely event of a chemical or fuel oil release within the Project Area.

As the quarry progresses in the northern portion of the proposed extension towards the current Peters Brook Water Supply area (which will likely take 100 years or more of quarrying to reach), the Proponent should engage in discussions with the Town of Baddeck to determine if the Town has switched to a groundwater sourced supply. Evaluation for a groundwater monitoring well in this area should be conducted at this time. However, an area approximately 10 kilometers to the west in the vicinity of Big Baddeck is the current area of focus for groundwater exploration for a future groundwater sourced well field for the Village of Baddeck. Although a potential location of a new well field has not been determined, it is highly unlikely that the proposed quarry expansion area would be targeted as a suitable area for a municipal groundwater supply development. As previously discussed, the bedrock underlying the proposed quarry expansion consists mainly of Pre-Cambrian metamorphic and metavolcanics of the George River Metamorphic suite. Due to the characteristic low yields and transmissivities measured for wells completed in the George River Metamorphic suite, the George River Metamorphic suite is considered unsuitable for municipal water supply development. Conversely, the Horton Group or Windsor Group formations are considered as more likely target locations for municipal well field development. Considering this, it is highly unlikely that the area of the proposed quarry expansion, which is underlain by George River Metamorphic suite bedrock, would be a suitable area for municipal well field development for the Village of Baddeck.

The exact details of the down gradient monitoring program will be determined in consultation with NSE during the preparation of the Part V Application.

5.7 ARCHAEOLOGICAL AND HERITAGE RESOURCES

5.7.1 Description of the Existing Environment

A desktop study was conducted to evaluate the potential for archaeological resources within the Project Area. The study determined that there were no recorded archaeological resources within the Project Area and that the archaeological potential for the presence of both First Nation's and historic resources was low.

The Project Area is on a large hill on the north side of Highway 105, very close to Big Hill and approximately 7 km northeast of Baddeck. There are no significant watercourses within or adjacent to the Project Area and it is approximately 6 km west of Great Bras d'Or.

Background Research

There is very little historical background material relating specifically to the Project Area or Big Hill. The Crown Land Grants Index Sheet #17 shows the lot being originally granted to Angus McLeod but at some point the original grant was split in half. The historic settlement of the Baddeck - St. Ann's area began with the Loyalists after 1784 but by 1793 there were only 179

settlers in the area. However, it is unlikely that the Loyalists settled within the Project Area and, the 1884 Geological Survey of Canada map shows some scattered houses to the southwest and northeast but nothing within it. The nineteenth century settlement in the area would have been based along the Baddeck-St. Ann's road for the most part, a portion of which is still extant to the north of Highway 105. Very little was found with reference to the settlement of Big Hill, apart from the fact that there was a school in the district in 1867. The post office in Big Hill was established in 1888 and was renamed Glen Tosh in 1914. No other resources were found that indicated any historical settlement within the Project Area.

Recorded Archaeological Sites

The Project Area falls within the Borden Grid CaCe but there are no recorded archaeological sites within that square. The records for the adjacent squares CbCe, CaCd, and CbCd were also checked but no relevant sites were found.

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

Archaeological Potential

First Nations

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

Historic

The background research found no evidence of historic settlement within the Project Area and the potential for historic archaeological resources should be considered low.

Conclusion and Recommendations

The Project Area is a large hill with no watercourses that is close to the much more natural resource-rich shores of the Bras d'Or Lakes, which would have had a stronger attraction to the Mi'kmaq. It is more likely that Mi'kmaq settlement occurred along the shores of the Bras d'Or and at the mouths of the major watercourses that drained into the lakes. The background research also indicates that there was no historic settlement within the Project Area. The conclusion is that there is a low potential for finding First Nation's or historic archaeological resources within the Project Area and it is recommended that the proposed project proceed as planned with respect to potential effects on archeological and heritage resources.

5.8 ATMOSPHERIC ENVIRONMENT

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

5.8.1 Description of Existing Conditions

Air Quality

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

Ambient air quality is monitored in Nova Scotia with a network of 13 sites, operated by NSE and Environment Canada. Motor vehicles, electrical power generation, pulp and paper processing and oil refining are the major local sources of air pollutants in the province Common air pollutants monitored regularly are SO_2, total particulate matter (TPM), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), particulate matter less than 10 microns in diameter (PM_{10}), carbon monoxide (CO), ground-level ozone (O_3), nitrogen dioxide (NO_2), hydrogen sulphide (H_2S) and total reduced sulphur (TRS). The closest NSE monitoring sites to the Project site are located in Port Hawkesbury at the Old Post Office on Embree and Granville Streets and in Sydney at the 71 Welton Street. In 2005 and 2006 sulphur dioxide (SO_2) was the only contaminant measured at the Port Hawkesbury site. Suphur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxides (NO_2), nitrogen oxide (NO), ozone (O_3) and particulate matter 2.5 ($PM_{2.5}$) are measured at the Sydney site. The annual average for 2005 for SO_2 in Port Hawkesbury (based on 10 months of data) was 2.8 ppb and the average for 2006 was also 2.8 ppb (Environment Canada 2008b). The annual average concentration in 2005 for SO_2, CO, O_3 and $PM_{2.5}$ at the Sydney monitoring site was 3 ppb (based on 7 months of data), 0.2 ppm (based on 4 months of data), 24 ppb and 5 mg/m^3, respectively. The annual average concentrations in 2006 for SO_2, CO, NO_2, NO, O_3 and $PM_{2.5}$ was 1 ppb (based on 8 months of data), 0.3 ppm, (based on 8 months of data), 2 ppb, 9 ppb, 27 ppb (based on 8 months of data) and 6 mg/m^3, respectively.

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

community to the Project that has this program implemented is Greenwood and the current air quality levels can be viewed online at Environment Canada.

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

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

Sound Quality

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

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

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

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

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

Air Quality

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

- Exhaust gas emissions due to incomplete combustion from diesel compression engine;
- Road dust;
- Wind erosion on storage piles;
- Removal of overburden;
- Blasting activities;
- Crushing operations;
- Material handling;
- Material transport; and
- Truck loading / truck unloading.

Some of the more important sources of airborne particulates are discussed in the following:

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

- Although there are also emissions of combustion gases and products of incomplete combustion from the exhaust of the on-site vehicles and equipment, these are considered nominal.

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

Dust generated by truck movement will be minimized by speed control, proper truck loading, application of water for dust suppression, where needed, proper construction of on-site roads, and/or other means as required by NSE.

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

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

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

Sound Quality

Quarrying activities will produce noise from equipment operation and blasting. Approximately 12 buildings, unrelated to the existing quarry, are located within 800 m of the Project property.

Blasting operations associated with the proposed extension will be conducted in accordance with current operations at the quarry, in accordance with the Pit and Quarry Guidelines (NSE 1999), with a frequency similar to past operations at the site and during daytime hours only. Blasting will be conducted in accordance with the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). It is understood that additional blast monitoring activities and/or reporting may be required by NSE.

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

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

Summary

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

5.9 SOCIO-ECONOMIC ENVIRONMENT

5.9.1 Description of the Existing Environment

Population and Employment

The existing Duncan Gillis Quarry is located on the outskirts of Baddeck, Cape Breton, Nova Scotia (Figure 1). The quarry property is in the Municipality of the County of Victoria. The quarry and proposed extension area are situated in a rural setting. Approximately 15 buildings are located within 800 m of the existing quarry site. All of these structures are also located within 800 m of the proposed Project (Figure 2).

Baddeck is located in Census Subdivision B of Victoria County. Between 2001 and 2006, the subdivision's population decreased 1.8% to 4,140 residents (Statistics Canada 2006). The employment rate in the region is 47.7%% and the unemployment rate is 20.0%. Over half of the labour force consists of sales and service occupations (27%); trades, transport and equipment operators and related occupations (17%); and business, finance and administration occupations (11%) (Statistics Canada 2006).

The population in the general area (*i.e.,* Victoria County) is 7,594 (Statistics Canada 2006). The population in this area decreased by 4.6% between 2001 and 2006. The employment rate in the County is 45.3% and the unemployment rate is 26.3% (Statistics Canada 2006). Over half of the experienced labour force consists of sales and service occupations (26%); occupations unique to the primary industry (20%); and trades, transport and equipment operators and related occupations (14%) (Statistics Canada 2006).

The existing quarry currently employs a minimum of two people year-round. The number of employees increases to 15-20 during aggregate production. Drilling and blasting activities require additional resources; these activities are sub-contracted to a professional blasting company. Transporting materials from the quarry also involves additional resources and is typically arranged through the customers. Hauling activity can vary according to market demand. The quarried material is typically used for highway projects and local construction.

Land Use

There are several current land uses within 800 m of the Project site, including urban/residential areas, an unpaved service road, a transmission line corridor and a 100-series highway. An

inactive lumber mill and gravel pit, and a cemetery are located just outside of the 800 m Project buffer.

The quarry property is located outside the boundaries of the Eastern District Planning Commission's (EDPC) designated Baddeck Plan Area for Victoria County, and is therefore not subject to any municipal zoning requirements.

Mining

A review of the NSDNR Abandoned Mine Openings Database indicates that there is one mine shaft within a 10 km radius of the boundaries of the Project property. This shaft is located in Goose Cove (approximately 9.8 km from the Project) and was used for mining gypsum. The status of the shaft is not known; however, it is not anticipated to interact in any way with the Project due to the separation distance.

Agriculture

No tracts of agricultural land are located within 800 m of the Project property. The nearest tract of land used for agricultural purposes is a plantation located approximately 905 m to the east of the Project property (Figure 2). The Proponent currently owns the existing quarry lands as well as the parcel on which the proposed quarry extension will be situated; therefore, no conflict with current or future agricultural practices is anticipated.

Forestry

Within the general Baddeck area there are protected Crown lands on which no forestry activities occur. However, most of the provincial Crown land in the Baddeck area is leased to NewPage Corporation (NewPage), which operates a pulp mill in Port Hawkesbury. NewPage conducts extensive silviculture and harvesting activities on most of this land, although these activities are carried out sporadically. Most of the highlands located near Baddeck have an extensive road system by which NewPage accesses this land base. NewPage has also carried out activities on Crown land in the lowlands surrounding the Baddeck area and plans to expand its activities in this region in the future (A. Hanam, pers. comm., 2010).

The Baddeck area also contains several small private woodlots that are used for siliviculture and harvesting activities. Many of these lots are managed by Baddeck Valley Wood Producers Co-op, although private contractors also carry on harvesting and, to a lesser degree, silviculture activities on individual private woodlots. A few landowners are also active in managing their own woodlots (A. Hanam, pers. comm., 2010).

Transportation

The existing quarry is located between Exits 10 and 11 of Trans-Canada Highway 105, approximately 270 m north of the intersection of the highway and Big Harbour Road. The

Project property is accessed via a paved private road which branches off of the Trans Canada Highway. This paved private road will continue to provide access to the proposed quarry extension area.

The average number of trucks hauling aggregates from the extended quarry will be dependent on market demand. This is consistent with current truck volume at the existing quarry. Truck traffic could increase, for a short period, if a large aggregate supply contract were awarded.

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

Recreation and Tourism

The Project property is located approximately 270 m north of Trans-Canada Highway 105, between Exits 10 and 11. This portion of highway forms part of two popular scenic travelways that are important tourist attractions in the area: Bras d'Or Lakes Scenic Drive and the internationally renowned Cabot Trail.

An unpaved service road in the immediate vicinity of the Project extension property has potential to be used by recreational users such as hikers, cross-country skiers, and all terrain vehicle (ATV) users.

The following parks and wilderness areas are situated within the vicinity of the Project site: North River Provincial Park and Wilderness Area is located approximately 9 km to the north, Uisge Ban Falls Provincial Park is located approximately 12 km to the northwest, and Middle River Wilderness Area is located approximately 17 km to the northwest.

Recreational fishing and hunting are permitted in the region surrounding the Project Area. The Project is situated in Recreational Fishing Area 1 (Nova Scotia Fisheries and Aquaculture 2009), Moose Management Zone 3, and Deer Management Zone 7 (NSDNR 2009).

The nearest lakes to the Project that are included in the provincial recreational fish stocking program are Dalem Lake and MacIntyre Pond (Nova Scotia Fisheries and Aquaculture 2009), which are located over 15 km to the northeast and west of the Project property, respectively. Both waterbodies are stocked with speckled trout (Nova Scotia Fisheries and Aquaculture 2009).

Two distinct hunting seasons occur in Moose Management Zone 3, the first season in 2009 took place from the last Monday of September until the following Saturday, inclusive, and the second season began on the first Monday of October and ended on the following Saturday, inclusive. Due to low deer density, no antlerless deer hunting stamps were available for Deer Management Zone 7 in 2007, 2008 or 2009 (NSDNR 2009). The seasons for hunting deer during 2009 were as follows: the special youth season ran from October 16 to October 24; the

general open season ran from October 30 to December 5; and the special bowhunting season for hunting deer ran from September 26 to October 29 and December 7 to December 12. All of these deer hunting seasons excluded Sundays (NSDNR 2009).

Human Health

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

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

Population and Employment

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

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

Land Use

Due to the existing industrial activity in the vicinity of the Project Area (*i.e.*, the Duncan Gillis Quarry and adjacent gravel pits, as indicated on Figure 2) and the distance of the proposed extension area from residences, impacts on existing and future adjacent land uses are not expected. All activities at the existing quarry and the proposed extension site will be conducted in accordance with the Pit and Quarry Guidelines and all setback distances specified in the Guidelines will be maintained.

Quarrying activities will produce noise from equipment operation and blasting. Approximately 12 buildings are located within 800 m of the extension property. The potential for noise from the quarry site to have a significant effect on residents is minimal.

Blasting operations associated with the proposed extension will be conducted in accordance with current operations at the quarry in accordance with the Pit and Quarry Guidelines (NSE 1999) and with a frequency similar to past operations at the site. Blasting will be conducted in accordance with the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). It is understood that additional blast monitoring

activities and/or reporting may be required by NSE. Details of a blast design plan and blast monitoring program will be provided to support the application for Industrial Approval.

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

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

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

Forestry

With respect to forestry and silviculture, it is expected that a quarry project would only directly impact the property on which it is located and normally would not have any negative impact on forestry activities on other properties in the area, unless access to those properties was impacted (A. Hanam, pers. comm., 2010). The Project is not anticipated to adversely affect access to any other properties.

The amount of land base removed from the overall forestry land base will be minor in relation to the entire forestry land base and is not expected to affect any forest industries, particularly since the Project is located on private property that is owned by the Proponent.

The proponent will, however, consider hiring a professional forester or forest technician to determine whether there would be any economic benefit from conducting silviculture treatments in affected stands and/or adjusting the timing of harvest operations to maximize product value. Also, when harvest operations do take place, all markets will be considered to ensure highest end use of harvested material.

Transportation

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

Recreation and Tourism

Located approximately 9 km from the nearest park or wilderness area, the Project is of sufficient distance from these potential recreational/tourism destinations that no interaction is likely to occur. The proximity of the Project to a popular scenic travelway (including d'Or Lakes Scenic Drive and the internationally renowned Cabot Trail) is not anticipated to result in any significant adverse effects on use of the highway for recreational or tourist purposes. Traffic is not

expected to be noticeably affected by the Project, and any potential aesthetic impacts resulting from the quarry extension would be similar to those currently associated with the existing quarry, which is not visible from the 100 series highway.

Although unpaved service roads are located within 800 m of the Project property, none are located within the proposed quarry extension area. Therefore the Project is not expected to significantly affect any recreational uses that may occur on these roads/trails.

The existing quarry and proposed extension of the operation are not likely to have an impact on hunting or 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 hunting and fishing management zones, but the Project is not located on Crown land and thus hunters and anglers would require permission from the property owner, Gillis Construction, to pursue their activities in the area. Moreover, the Project Area appears to be of little importance to local anglers due to the lack of desirable fishing locations, as the only waterbodies located within the Project extension boundary are situated within the footprint of the existing quarry operation. Therefore, the Project is not expected to impact recreational fishing activities.

Human Health

Project activities may result in a slight increase in air emissions; however, these impacts will be temporary and localized and are not expected to result in any significant effects on human health. Human health related issues pertaining to air quality are discussed in more detail in Section 5.8. The Project will not result in any impacts on the safety of travelers, as it will not entail any significant effects on traffic on public roads. The health and safety of nearby residences is not expected to be affected by the Project.

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

5.10 OTHER UNDERTAKINGS IN THE AREA

There are approximately three inactive pits and/or quarries located in the immediate vicinity of the existing quarry site as indicated on provincial mapping (Figure 2). As the proposed extension does not include an increase in production and that these undertakings are no longer activie significant adverse Project-related effects regarding other undertakings in the area are not likely to occur.

6.0 Effects of the Project on the Environment

Activities associated with the proposed quarry extension and operation will be conducted in accordance with the terms and conditions of the facility's future Industrial Approval for Gillis Construction's existing quarry operation and the Pit and Quarry Guidelines.

Environmental effects of the quarry extension will include the loss of terrestrial habitat within the proposed quarry extension area for the period of time prior to quarry reclamation and revegetation. No waterbodies (except the settling pond), watercourses or streams were identified in the Project Area based on aerial photography and field verification. Four wetlands are located within the southeast end of the Project Area. The quarry will expand in the northwest direction and therefore these wetlands will not be altered.

The results of flora and fauna habitat modeling indicate that the Project footprint has potential to support 57 rare or sensitive vascular plant species, as well as to provide habitat for and/or be frequented by one rare bird species (*i.e*., rusty blackbird) and three rare or sensitive mammal species (*i.e*., Canada lynx, American marten, and fisher). No rare or uncommon herpetiles are expected to inhabit the existing quarry or extension property. The Project Area is considered unlikely to provide critical habitat for any rare or sensitive taxa of flora or fauna. NSDNR mapping indicates that Project Area provides deer wintering habitat; however, field surveys determined that it is unlikely that the identified portion of the Project Area currently serves as important deer wintering habitat due to insufficient softwood cover. With the application of appropriate mitigative measures (*i.e*., compliance with *MBCA*, use of seed mixtures free of noxious weeds during site reclamation) and pending follow-up field surveys, significant Project-related effects on wildlife are not likely to occur. More detailed assessment and mitigative measures pertaining to rare and sensitive flora and wildlife are provided in Sections 5.3 and 5.4 respectively.

A groundwater monitoring program will be undertaken as per Section 5.6.2 and under the direction of NSE.

Although the potential for encountering acid rock in the Project Area is low, discovery of localized acid generating bedrock is possible within mineralized zones. Any such material present on the site during development or operation of the quarry extension will be managed according to provincial regulations and best practices pertaining to sulphide-bearing material and the prevention of acid drainage, if applicable.

Minor, localized impacts on air quality can be expected through the formation of airborne particulate matter. These impacts are readily controlled through standard mitigative measures (*e.g.*, dust suppression) and follow-up monitoring as necessary (see Section 5.8).

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

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

7.0 Effects of the Environment on the Project

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

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

There are a number of planning, designs, and construction strategies intended to minimize the potential effects of the environment on the Project so that the risk of damage to the Project or interruption of service can be reduced to acceptable levels. Mitigation measures include, but are not limited to, designing and installing erosion and sediment control structures to accommodate appropriate levels of precipitation, and considering weather conditions when scheduling activities, including scheduling of activities to accommodate weather interruptions. All Project activities will be taking place out-of-doors and thus weather has been and will be factored into all Project phases and activities. The Proponent proposes that the quarry remain operational 44 weeks per year or more, weather permitting, and will consider severe winter weather conditions when planning activities. Heavy snowfalls and significant snow accumulation will have an impact on the quarry’s ability to remain open.

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

8.0 Other Approvals Required

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

There are no known requirements for an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA) associated with the proposed quarry extension. No federal land or funding is required for the Project. There are no requirements for federal permits or authorizations under the CEAA Law List Regulation currently projected.

9.0 Funding

The proposed extension will be 100 percent privately funded.

10.0 Additional Information

No additional information is provided in support of this document.

11.0 References

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11.2 PERSONAL COMMUNICATIONS

Andrew Hanam, NSDNR Forestry Division, March 29, 2010

Municipality of Victoria County, March 2010

12.0 Appendices

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APPENDIX A
Registry of Joint Stocks

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

Print Close Window

PROFILE - GILLIS CONSTRUCTION (CAPE BRETON) LIMITED - as of: 2010-03-26 01:45 PM

Company/Society Name:	GILLIS CONSTRUCTION (CAPE BRETON) LIMITED
Registry ID:	1073121
Type:	N.S. Limited Company
Nature Of Business:	
Status:	Active
Jurisdiction:	Nova Scotia
Registered Office:	9198 Inlet Baddeck NS Canada B0E 1B0
Mailing Address:	Po Box 98 Baddeck NS Canada B0E 1B0

PEOPLE

Name	Position	Civic Address	Mailing Address
DUNCAN E. GILLIS	Director	BOX 98 BADDECK NS B0E 1B0	
DUNCAN E. GILLIS	PRESIDENT/SECRETARY	BOX 98 BADDECK NS B0E 1B0	
		9198 INLET	BOX 98

BETH GILLIS	Recognized Agent	BADDECK NS B0E 1B0	Baddeck NS B0E 1B0

ACTIVITIES

Activity	Date
Annual Renewal	2010-02-12
Annual Renewal	2009-02-20
Annual Renewal	2008-02-21
Annual Renewal	2007-01-17
Special Resolution	2006-10-05
Special Resolution	2006-10-05
Annual Renewal	2006-02-08
Annual Renewal	2005-02-18
Annual Statement Filed	2005-02-18
Annual Statement Filed	2004-01-19
Annual Renewal	2004-01-19
Annual Renewal	2003-01-10
Annual Statement Filed	2003-01-10
Annual Renewal	2002-02-21
Annual Statement Filed	2002-02-21
Annual Renewal	2001-03-02
Annual Statement Filed	2001-03-02
Annual Renewal	2000-02-29
Annual Statement Filed	2000-02-29
Address Change	1999-04-13
Annual Statement Filed	1999-04-13
Annual Renewal	1999-02-23
Annual Renewal	1998-02-25

Annual Statement Filed	1998-02-25
Annual Renewal	1997-03-18
Annual Statement Filed	1997-03-18
Annual Report Filed	1996-02-07
Agent Filed	1994-02-11
Special Resolution	1983-05-09
Change of Directors	1982-03-16
Status Report Filed	1975-03-07
Registered Office Change	1975-03-07
Incorporated	1975-02-28
Registered	1975-02-28

RELATED REGISTRATIONS

This Company ...	
GILLIS CONSTRUCTION	Registered
GILLIS TRUCKWAYS	Registered

APPENDIX B
Duncan Gillis Quarry Extension Hydrology Study

Hydrology Study for the Duncan Gillis Quarry Extension Project

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

File: 121510266

April 2010

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1.0 Introduction

1.1 GENERAL

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

1.2 OBJECTIVES

The main objectives of this hydrologic assessment are to:

1. Estimate the total change in surface water runoff amounts for the pre and post-development conditions.
2. Estimate the total capacity of the required flow retention/siltation facilities (i.e. retention pond) for the ultimate level of quarry extension.
3. Assess any potential impacts of the proposed quarry extension on downstream hydrologic elements with respect to water quantity and quality and provide recommendations to mitigate these potential impacts.

1.3 SITE DESCRIPTION AND BACKGROUND

The proposed quarry extension area (referred thereafter as the “site”) is located approximately 11 km northeast of the town of Baddeck, in Cape Breton, Nova Scotia. The proposed extension is situated around the area of the existing Duncan Gillis Quarry which covers approximately 7 Ha. The total area of the proposed extension is 77 Ha extending to the north and northwest towards the property boundaries. This study however was based on an original extension area of 81 Ha, prior to the resizing of the extension area as so that it did not overlap with a municipal water supply. After taking into account the mandatory 30 m buffer areas in the east and north sides of the property the actual extension area is reduced to 77.4 Ha (the other two sides of the property do not require a buffer because it falls within land owned by Gillis Construction Cape Breton Limited).

The site is somewhat rectangular in shape with its longest dimension extending from SE to NW. As indicated previously, the existing quarry encompasses an area of 7 Ha and the first blasting was first conducted in the early 1980’s. The aggregates from the quarry are extracted by blasting, crushing and stockpiling of material on site (overburden and bedrock) and are primarily utilized on highway projects and offered to the local construction market. It is expected that the operation of the proposed quarry extension will be the same as the existing quarry. The existing

quarry boundary, the proposed extension area and other main features of the area are shown in Figure 1.1.

The existing topography for the entire site slopes to the south. A berm has been constructed along the south side of the extension area and it is used to direct site run-off to the settling pond. Based on available GIS data, there is a watercourse located at the back of the property (Marsh Brook); however, the stream is located approximately 550 m away from the edge of the proposed quarry extension boundary. A municipal surface water supply area is located to the north of the site.

It is our understanding that the site will be extended gradually to the north and northwest until the entire proposed development boundary is reached. As previously indicated, a 30 m buffer area is also required, making the total development area in the order of 84.4 Ha (including the existing quarry).

Based on available stream and contour mapping (5 m resolution) the site is located within one sub-watershed that drains to the south. A series of small wetlands were also identified within the property. The wetlands along with other hydrologic features of the site are shown on Figure 1.2.

N

Marsh Brook

800m Buffer

Extension Property

HWY 105

Big Hill

KEY MAP

PROJECT LOCATION

NB

PEI

Sydney

Cape Breton

Bay of Fundy

NOVA SCOTIA

Halifax

Atlantic Ocean

0 50 100 150 200

Kms

Legend

- Expressway / Highway
- Freeway
- Ramp
- Arterial/Collector
- Local / Street
- Resource/Recreation/Service
- 800m Extension Property Buffer
- Existing Quarry Boundary
- Extension Property
- Client Owned Property
- Building
- Transmission Line
- Watercourse
- Building
- Index Contour (25m)
- Elevation Contour (5m)
- Property Boundary
- Waterbody
- Wetland (NSDTB)

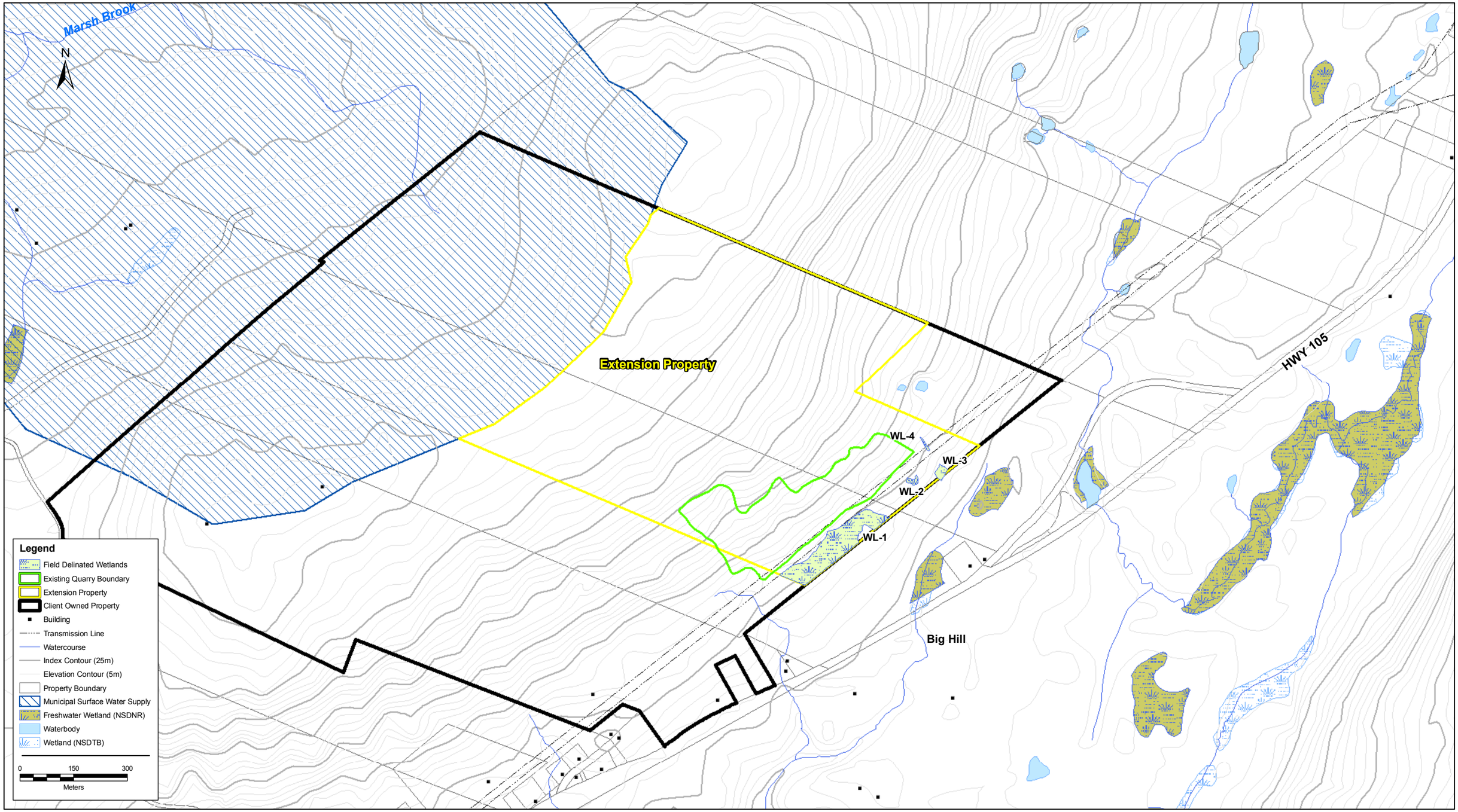
Data Source:
Base Data - NSGC

0 250 500

Meters

AUTHOR: G. Mesheau	DATE: July 13, 2010	GILLIS CONSTRUCTION QUARRY EXTENSION	FIGURE NO.: **Figure 1.1**
APPROVED BY: G. Asche	SCALE: 1:10,000	**PROJECT LOCATION AND EXTENSION AREA**	Stantec
PROJECT NUMBER: 1056547	COORDINATE SYSTEM: UTM NAD 83 ZONE 20		

Path: X:\Projects\NovaScotia\105xxxx\1056547_GillisConstructionQuarry\Mapping\MXD\ReportFigures



AUTHOR: M. Huskins-Shupe	DATE: July 13, 2010	GILLIS CONSTRUCTION QUARRY EXTENSION	FIGURE NO.: **Figure 1.2**
APPROVED BY: G. Asche	SCALE: 1:12,500	**HYDROLOGICAL FEATURES**	
1056547	COORDINATE SYSTEM: UTM NAD 83 ZONE 20		Stantec

Path: X:\Projects\NovaScotia\105xxxx\1056547_GillisConstructionQuarry\Mapping\MXD\ReportFigures

2.0 Methodology

2.1 MEAN ANNUAL SITE RUNOFF ESTIMATION

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

The mean annual flow at the site was also calculated using a prorated flow from an adjacent flow station.

2.2 FLOW RETENTION AND SILTATION TREATMENT SIZING

The discharge capacity and dimensions of the required flow retention and siltation treatment structures for the total proposed extension were calculated with the hydrologic model HEC-HMS version 3.4. HEC-HMS was developed by the U.S. Army Corp of Engineers and is widely accepted as a tool to conduct hydrologic modeling by engineers and scientists around the world. Additionally, the rational formula was used to confirm the results provided by HEC-HMS.

The parameters required for calculations were obtained from different sources. Annual precipitation data was obtained from climate normals (1971-2000) from Station 8200300 (Baddeck) operated by Environment Canada. Station 8200300 is located approximately 11 km to the southwest of the site. The surface slope, area and other physical parameters were approximated using GIS tools and available mapping. The concentration time was estimated with the Upland Method included in the National Engineering Handbook, Section 4, Natural Resources Conservation Service (NRCS, formerly the USDA Soil Conservation Service).

The required volume capacity for the flow retention and siltation structures was estimated based on a 6 hour duration rainfall with an associated Annual Exceedance Probability (AEP) of 0.04, which is a rainfall event with an associated return period of 25 years. The maximum discharge capacities for the hydraulic discharge structures were based on the 6 hour 0.01 AEP storm (1:100 year return period rainfall event). Rainfall Intensity-Duration-Frequency (IDF) curves were obtained from Station 8205700 (Sydney Airport), operated by Environment Canada. Station 8205700 is the nearest station with available data and is located approximately 47 km to the east of the site.

Flow data was obtained from Station 01FF001 (Middle River at Maclennans Cross) operated by Environment Canada. Station 01FF001 is located approximately 20 km to west of the site and has a watershed area of 123 km^2.

2.3 RESULTS

2.3.1 Mean Annual Site Runoff Estimation

Based on climate normals (1971-2000) from Station 8200300 (Baddeck), the average total annual precipitation at the site is in the order of 1500.9 mm.

Total annual evapotranspiration in the area has been estimated using the Thornthwaite Equation and average monthly temperature data from Station 8206415. Based on the Thornthwaite Equation, the estimated local annual evapotranspiration is in the order of 558 mm, or 37% of the average annual precipitation. Infiltration is assumed to be in the order of 8% of the average annual precipitation based on the hydrologic soil group, vegetation cover and average surface topography at the site combined with previous experience with similar sites in Nova Scotia (David MacFarlane, personal communication, February 8, 2010). The annual infiltration is therefore in the order of 120.1 mm.

The remaining 55% of the average annual precipitation can contribute to surface runoff to the site which corresponds to 822.8 mm per year. It has been estimated that surface runoff from the site will increase by approximately 20% as a result of the quarry extension; this takes into account an equivalent decrease in evapotranspiration and infiltration.

Although it is difficult to accurately determine the effects of climate change within the next century, there is a general agreement that the magnitude of precipitation events will likely increase. Since the site will be developed over a long period of time (in the order of 20 plus years) it is advisable to account for climate change effects, and therefore an extra 10% increase in mean annual precipitation was assumed. Therefore, the annual effective precipitation at the site is assumed to be 1086.1 mm.

The existing and expected mean annual flows were also estimated using proration data from Station 01FF001. The mean annual flow of 5.01 m^3/s was obtained from the HYDAT database (Environment Canada).

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

Table 2.1 Pre and Post Development Site Runoff Volumes

Scenario	Area (Ha)	Effective annual Precipitation (mm)	Runoff Volume (m^3)	Mean annual Flow (L/s)	Mean annual Flow (L/s)*
Existing condition	7	822.8	57,596	1.8	2.85
Proposed Extension	84.4	1086.1	916,584	29.0	34.3
*Based on a prorated mean annual flow from Sta. 01FF001					

Therefore, the expected total increase in the average annual site runoff due to the proposed quarry extension is in the order of 858,988 m^3 or a 1,591% increase from the existing condition. It is expected that this increase will happen gradually as the quarry expands its operation.

2.3.2 Flow Retention and Siltation Treatment Sizing

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

Table 2.2 Summary of Hydrologic Parameters used in HEC-HMS

Parameter	Quarry Extension Phase
Initial and Constant Loss Method	Initial Loss: 2.5 mm Constant Rate: 3.8 mm/hr Imperviousness: 70%
Clark Unit Hydrograph Routing Method	Concentration Time (Tc): 1.4 hr
Included Storms	6 hour 1:25 year return period 6 hour 1:100 year return period
Subcatchment Area	0.84 km^2
Baseflow	Not considered
Attenuation effects due to channel storage	Not considered
Modeling interval	5 min

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

Table 2.3 Model Parameters used for the Calculation of Tc (Upland Method)

Scenario	Area (Ha)	Flow Path Length (m)	Slope (m/m)	Concentration Time (min)
Quarry Extension	84.4	1,200	0.002	84

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

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

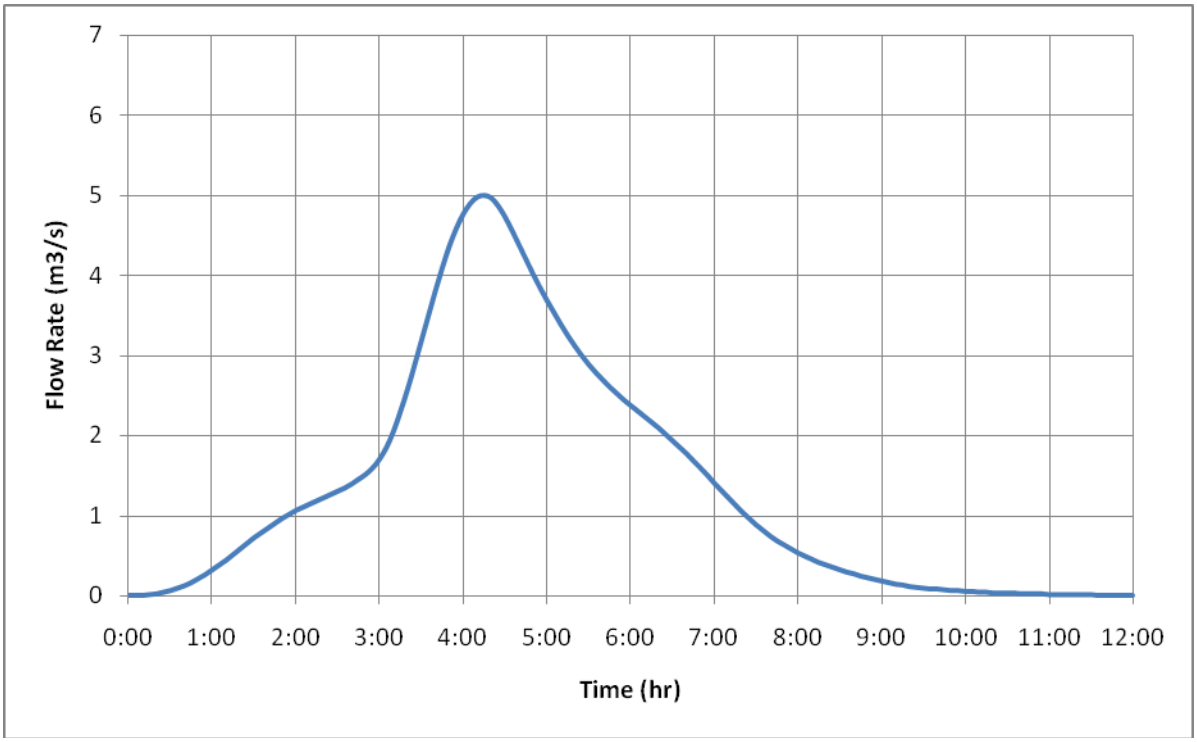
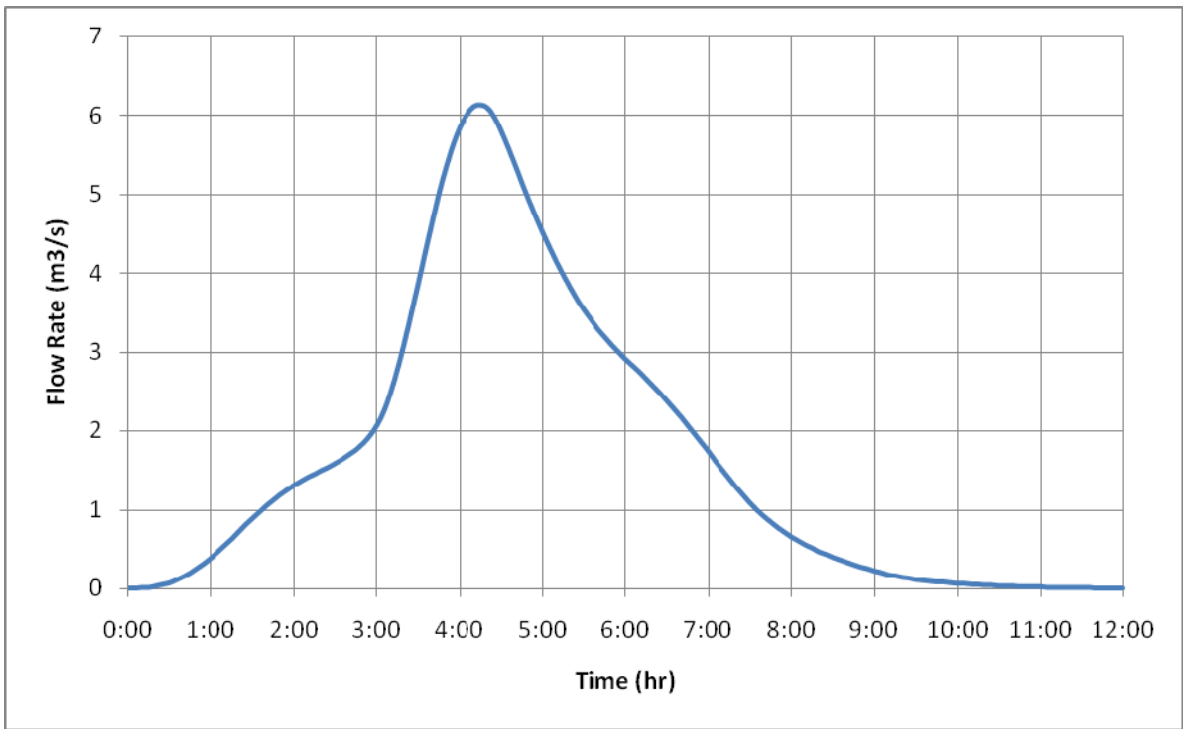


Figure 2.2 Flow Hydrograph for the 1:100 Year Rainfall Event for Full Quarry Extension



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

Table 2.4 Estimated Runoff Peak Flows and Volumes for Different Rainfall Events

Extension stage	Return Period	Peak Flow (m^3/s)	Volume (m^3)	Peak Flow (m^3/s)*
Full quarry extension (proposed)	1:25	4.99	57,930	4.6
	1:100	6.13	71,050	5.6

*Estimated using the Rational Formula

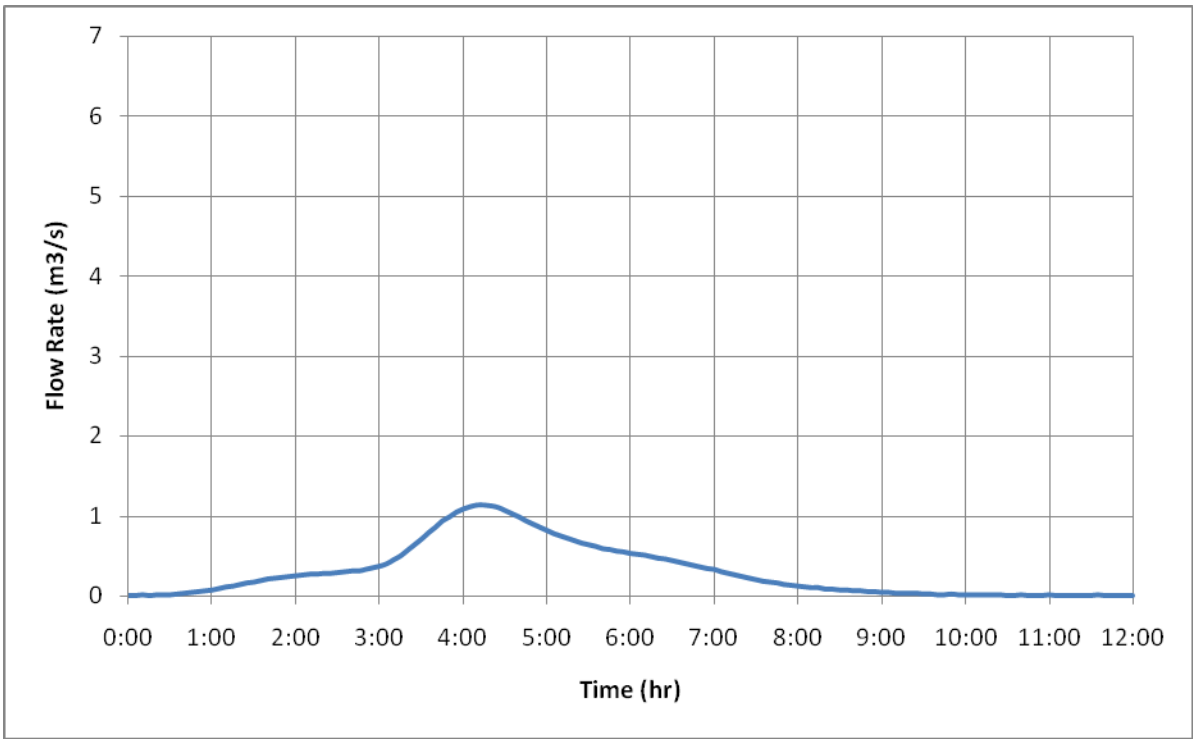
It is recommended to size the flow retention structures to retain the volume from the 1:25 year rainfall event. Therefore, the total volume of retention storage for the site for the ultimate level of quarry extension should be in the order of 57,930 m^3. This volume is only expected after the site has been developed fully, therefore it is feasible to maintain a smaller storage pond capacity which will require to be expanded with the quarry operation.

Based on the simulations completed for the 1:100 year 6 hour duration rainfall event, the peak flow is estimated to be in the order of 6.13 m^3/s. The construction of stormwater retention structures will have an attenuation effect on the peak flow from the 1:100 year rainfall event, therefore, since the storage pond should be able to store the 1:25 year storm the discharge structure at the exit of the retention ponds should be designed to accommodate as a minimum the excess discharge between the 1:25 and the 1:100 year rainfall events.

Therefore, the difference in flow hydrographs between the 1:25 and 1:100 year rainfall events are shown on Figure 2.3. Based on Figure 2.3, the weir structure should be sized as a minimum to convey 1.14 m^3/s.

Drawdown of water levels from the 1:25 year rainfall event detention storage level to the permanent pool retention level should be estimated based on the detention time that will improve water quality. A recommended drawdown period of 24 hours is expected to decrease suspended sediment concentrations by as much as 80%. Based on the low flow threshold of 24 hour discharge for runoff events equal or smaller that the 1:25 year rainfall event, the mean discharge capacity should be 0.67 m^3/s. As a result, an appropriately designed weir is recommended as the most suitable discharge structure which is expected to control peak discharge volumes reducing the threat of downstream erosion and extending the discharge time to downstream hydrologic features.

Figure 2.3 Excess Flow Rate from the 1:100 Year Rainfall Event with Storage Attenuation



2.3.3 Effects on Downstream Flows and Water Quality

The full quarry development is anticipated to increase the total mean annual runoff at the site by 858,988 m^3 from the existing condition. As mentioned previously, there are a number of identified wetlands on the site that are not indicated on provincial mapping. Based on the information provided by Gillis Construction Cape Breton Limited, the extension of the quarry will proceed in the northwest direction away from the wetlands and therefore, no alteration of these wetlands is expected.

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

The Nova Scotia Department of Environment (NSE) Pit & Quarry Guidelines (revised on May, 1999) establishes that the maximum suspended solids concentration in any effluent leaving the site cannot exceed 50 mg/L. In addition, the maximum arithmetic monthly average suspended solids concentration cannot exceed 25 mg/L.

It is anticipated that the largest potential for water quality impacts due to the quarry extension and operation would be erosion and an associated increased in sediment loads. There are

certain measures that can be adopted to reduce these impacts, including check dams along collection ditches and the placement of free draining cover materials over disturbed areas. The proper design of the retention ponds should include the capacity to remove sediment as needed to maintain the required volume and extend the life of the structures, or the addition of extra volume to accommodate sediment loads. Even with this measure, maintenance would likely be required from time to time to empty the retention ponds.

Surface runoff from the site should not be sent to downstream receptors before being routed in the retention ponds and the surface water runoff should comply with existing guidelines indicated previously to protect the aquatic environment. The streams are not likely to experience major changes in the flow regime as there are upstream areas of the subwatershed that can contribute to flow. However, a monitoring program for water quality and/or quantity may be warranted if major modifications to the aquatic regime are observed and corrective measures may be necessary to ensure that a good aquatic environment is maintained near the site.

3.0 Conclusions

The following conclusions are offered based on the hydrologic assessment for the proposed Duncan Gillis Quarry extension project.

The existing annual site runoff volume for the site is estimated to be in the order of 57,596 m^3. The expected total increase in the mean annual runoff for the site resulting from the proposed extension is in the order of 858,988 m^3 or a 1,591% increase from the existing condition.

The flow retention structures for the proposed full quarry extension should be able to accommodate a volume of 57,930 m_3 during the 6 hour 1:25 year storm as the largest event. The dimensions of the proposed retention pond(s) will depend on site characteristics, as an example, a retention pond able to accommodate this volume can have approximate dimensions of 110 m x 110 m x 5 m.

The outlet structures for the retention pond should be able to accommodate a discharge of 1.14 m^3/s, which corresponds to the difference in peak flows between the 1:25 year and the 1:100 year rainfall events.

Based on a recommended retention time of 24 hours for any precipitation event equal or smaller than the 1:25 year rainfall event, the discharge structure should be designed to conform to a mean discharge capacity of 670 L/s. This will facilitate the recommended 24 hour drawdown period. The maximum discharge capacity should be maintained as indicated previously.

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

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

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

4.0 Closure

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

5.0 References

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

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

Nova Scotia Department of the Environment, Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia. September, 2008.

Nova Scotia Department of the Environment (NSE). 1999. Pit & Quarry Guidelines.

APPENDIX C
Project Information Bulletin and Letters

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

February 26, 2010
File: 121510266

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

Attention: Mrs. Grace Conrad

Dear Mrs. Conrad:

Reference: Duncan Gillis Quarry Extension Project

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

The Project consists of an extension of quarry activities at an existing facility near Baddeck, Cape Breton, Nova Scotia. The developer, Gillis Construction Cape Breton Limited, is proposing to extend the area of the existing Duncan Gillis Quarry while maintaining approximately the same level of production which is used primarily in construction and paving Projects. Gillis Construction, who has operated the existing quarry for the past 41 years, is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

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

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

Sincerely,

STANTEC CONSULTING LTD.

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

Cc. Gillian Asche, SCL

Attachment

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

February 26, 2010
File: 121510266

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

Attention: Ms. Janice Maloney

Dear Ms. Maloney:

Reference: Duncan Gillis Quarry Extension Project

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

The Project consists of an extension of quarry activities at an existing facility near Baddeck, Cape Breton, Nova Scotia. The developer, Gillis Construction Cape Breton Limited, is proposing to extend the area of the existing Duncan Gillis Quarry while maintaining approximately the same level of production which is used primarily in construction and paving Projects. Gillis Construction, who has operated the existing quarry for the past 41 years, is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

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

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

Sincerely,

STANTEC CONSULTING LTD.

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

Cc. Gillian Asche, SCL

Attachment

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Dartmouth NS B3B 1W8
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Fax: (902) 468-9009

February 26, 2010
File: 121510266

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

Attention: Mr. Donald M. Julien

Dear Mr. Julien:

Reference: Duncan Gillis Quarry Extension Project

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

The Project consists of an extension of quarry activities at an existing facility near Baddeck, Cape Breton, Nova Scotia. The developer, Gillis Construction Cape Breton Limited, is proposing to extend the area of the existing Duncan Gillis Quarry while maintaining approximately the same level of production which is used primarily in construction and paving Projects. Gillis Construction, who has operated the existing quarry for the past 41 years, is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

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Sincerely,

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Cc. Gillian Asche, SCL

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3 Spectacle Lake Drive
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Tel: (902) 468-7777
Fax: (902) 468-9009

February 26, 2010
File: 121510266

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

Attention: Mr. Joe B. Marshall

Dear Mr. Marshall:

Reference: Duncan Gillis Quarry Extension Project

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

The Project consists of an extension of quarry activities at an existing facility near Baddeck, Cape Breton, Nova Scotia. The developer, Gillis Construction Cape Breton Limited, is proposing to extend the area of the existing Duncan Gillis Quarry while maintaining approximately the same level of production which is used primarily in construction and paving Projects. Gillis Construction, who has operated the existing quarry for the past 41 years, is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

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

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

Sincerely,

STANTEC CONSULTING LTD.

Robert Federico
Senior Project Manager
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Cc. Gillian Asche, SCL

Attachment

Stantec Consulting Ltd.
102 – 40 Highfield Park Drive
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Fax: (902) 468-9009

June 29, 2010
File: 121510266

Chief and Council
Wagmatcook First Nation
P.O Box 30001
Wagmatcook, NS, B0E 3NO

Attention: Chief Lester Peck and Council

Reference: Duncan Gillis Quarry Extension Project

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

The Project consists of an extension of quarry activities at an existing facility near Baddeck, Cape Breton, Nova Scotia. The developer, Gillis Construction Cape Breton Limited, is proposing to extend the area of the existing Duncan Gillis Quarry while maintaining approximately the same level of production which is used primarily in construction and paving Projects. Gillis Construction, who has operated the existing quarry for the past 41 years, is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

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

Sincerely,

STANTEC CONSULTING LTD.

ORIGINAL SIGNED BY

Gillian Asche
Project Coordinator
(902) 468-7777
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Attachment

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

June 29, 2010
File: 121510266

Chief and Council
We'koqma'q First Nation
P.O. Box 149
Whycocomagh, NS, B0E 3M0

Attention: Chief and Council

Reference: Duncan Gillis Quarry Extension Project

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

The Project consists of an extension of quarry activities at an existing facility near Baddeck, Cape Breton, Nova Scotia. The developer, Gillis Construction Cape Breton Limited, is proposing to extend the area of the existing Duncan Gillis Quarry while maintaining approximately the same level of production which is used primarily in construction and paving Projects. Gillis Construction, who has operated the existing quarry for the past 41 years, is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

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

Sincerely,

STANTEC CONSULTING LTD.

ORIGINAL SIGNED BY

Gillian Asche
Project Coordinator
(902) 468-7777
Gillian.Asche@stantec.com

Attachment

Gillis Construction Cape Breton Limited
Duncan Gillis Quarry Extension Project
Project Information Sheet

Project Overview

Gillis Construction Limited proposes to extend its quarry activities at the existing facility in Baddeck, Cape Breton, Nova Scotia (refer to Figure 1 on reverse). The current operation is approximately 7 hectares in area. The proposed extension will incorporate land north and north west of the existing quarry to increase the total size of the operation to approximately 81 hectares. Blasting, crushing and stockpiling of aggregate is proposed to take place at the extension site. The quarried material is primarily used for highway projects and local construction. Depending on market demand, the proposed activities will take place over an extended period of time until the material is exhausted. Based on current estimates, there are billions of tonnes of rock reserves within the proposed extension area.

Proposed project activities will be consistent with current quarry operations. These activities are operated in accordance with the *Nova Scotia Pit and Quarry Guidelines* (NSE 1999). Aggregate production begins with drilling and blasting, which will be conducted by a licensed blasting contractor. Blasting will take place approximately one to three times per year. After blasting, portable crushing equipment will be brought to the site to process the blasted rock. Various products (*i.e.*, various aggregate sizes) will be stockpiled at the quarry site until they are transported to local markets via tandem trucks or tractor trailer trucks via the existing truck route. The average number of trucks hauling aggregates from the quarry is approximately 22 per day, depending on market demand. This is consistent with current truck volume at the existing quarry and could increase, for a short period, if a large aggregate supply contract were awarded.

The anticipated average production rate is approximately 200,000 tonnes per year, with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule may be 12 hrs/day, 5 days/week, 44 weeks/year or more, depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

Environmental Assessment Process

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

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

Environmental Registration Components

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

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

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

Contacts

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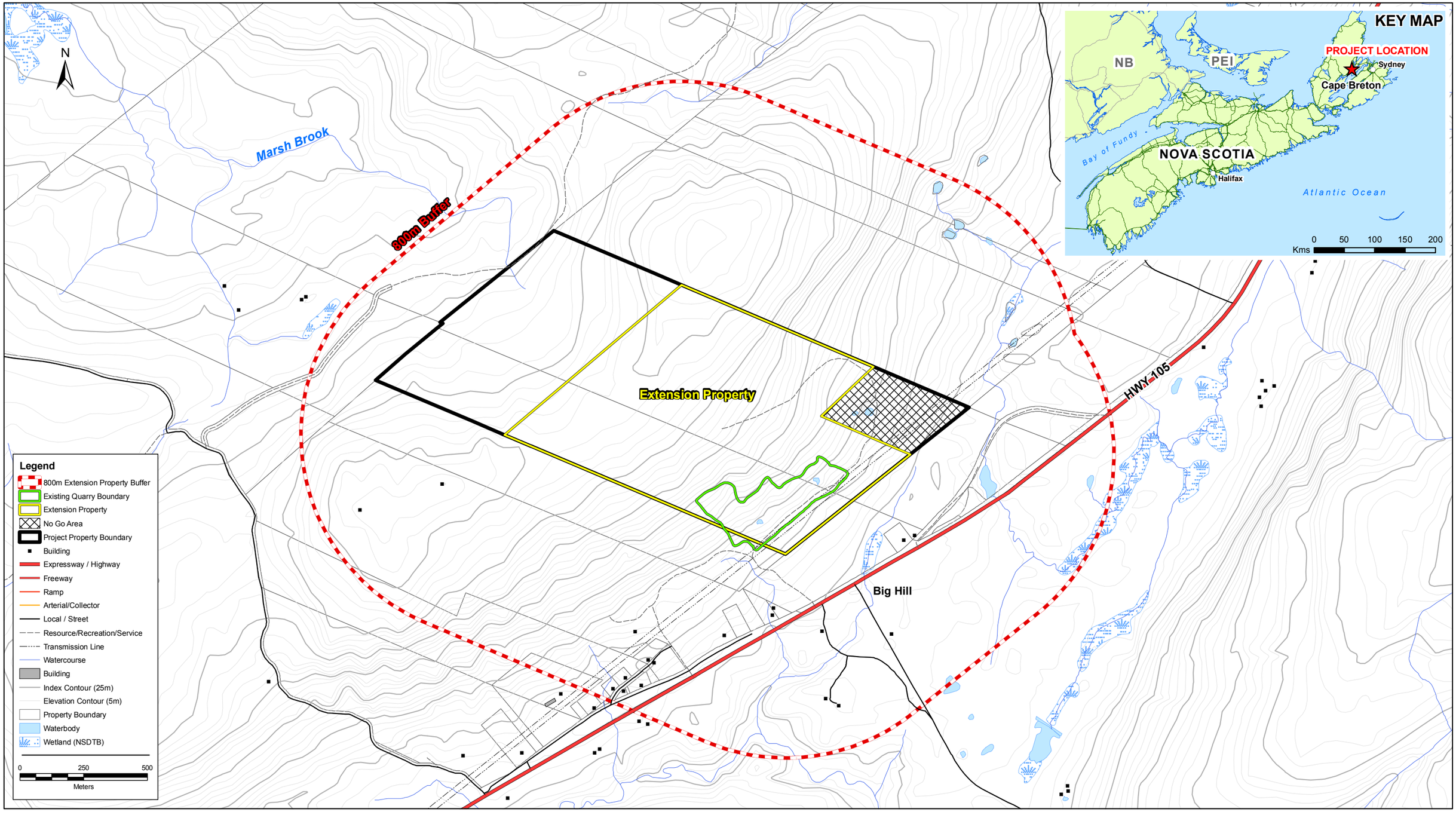

AUTHOR: G. Mesheau	DATE: October 20, 2009	GILLIS CONSTRUCTION QUARRY EXTENSION	FIGURE NO.: **Figure 1**
APPROVED BY: G. Asche	SCALE: 1:10,000	**PROJECT LOCATION**	
	COORDINATE SYSTEM: UTM NAD 83 ZONE 20		Stantec

Path: X:\Projects\NovaScotia\105xxxx\10565547_GillisConstructionQuarry\Mapping\MXD\ReportFigures

APPENDIX D
Rare and Sensitive Plants Identified during Modelling Exercise as being potentially Present in Project Area

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

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank
Short-Awn Foxtail	*Alopecurus aequalis*	Muddy margins of rivers and shallow ponds, and gravel margins where competitor species are few.	Summer	S2S3	Yellow
Drummond Rockcress	*Arabis drummondii*	Usually on dry slopes and talus, but occasionally in more fertile locations at lower elevations.	May to July	S2	Yellow
Hairy Rock-Cress	*Arabis hirsuta var. pycnocarpa*	Dry cliffs, crevices, ledges, talus slopes, and gravels.	May and June	S1S2	Red
Maidenhair Spleenwort	*Asplenium trichomanes*	Damp shaded cliffs, and talus slopes. Acidic rock such as granite, basalt and sandstone.	Can be identified without sprangia.	S2	Yellow
Lance-Leaf Grape-Fern	*Botrychium lanceolatum var. angustisegmentum*	Rich wooded hillsides.	July and August. Can be identified until early October if sporophore is present.	S2	Yellow
Marsh Marigold	*Caltha palustris*	Relatively rich swamps wet meadows and wet woods. In damp seepage areas and along creeks.	Flowers in early June but can be identified fro early May to late October	S2	Yellow
Marsh Bellflower	*Campanula aparinoides*	Meadows, ditches and river banks.	August	S3?	Yellow
Small-Flower Bitter-Cress	*Cardamine parviflora var. arenicola*	Dry woods, shaded or exposed ledges, and in sandy soils.	April to August	S2	Yellow
Cuckooflower	*Cardamine pratensis var. angustifolia*	Meadows, moist fields, and low areas.	Late May and early June	S1	Red
Crowded Sedge	*Carex adusta*	Dry, open places. Rocky coastal, nonforested, upland.	June to September	S2S3	Yellow
Chestnut-Colored Sedge	*Carex castanea*	Swamps and wet meadows, cliff crevices and ledges.	Not given for NS, Summer. Seeds (perigynia) required for identification	S2	Red
Bristly Sedge	*Carex comosa*	Swamps and shallow water.	June to August	S2	Yellow
Ebony Sedge	*Carex eburnea*	Cliffs and talus slopes, under conifers, particularly on calcareous substrates.	Flowering time not given, summer	S3	Yellow
Porcupine Sedge	*Carex hystericina*	Swamps, swales, and along brooks.	June to October	S1S2	Red
Russet Sedge	*Carex saxatilis*	Damp, peaty or gravelly soils.	Flowering time not given, summer	S1	Red
Slender Sedge	*Carex tenera*	Meadows, woodlands, and moist, dry openings.	Late May to August	S1S2	Yellow
Slender Sedge	*Carex tenera*	Meadows, woodlands, and moist, dry openings.	Late may to August	S1S2	Yellow
Sparse-Flowered Sedge	*Carex tenuiflora*	Wet woods and bogs.	not given for NS, most members of Heleonastesgroup flower June to August	S1	Red
Blue Cohosh	*Caulophyllum thalictroides*	Deciduous and intervale forest.	April to early June, can be identified when not in flower	S2	Red

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

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank
Long-Bract Green Orchis	*Coeloglossum viride var. virescens*	Boggy spots, damp mature woods, and fir or floodplain forests.	May to August	S2	Yellow
Large Yellow Lady's-Slipper	*Cypripedium parviflorum var. pubescens*	Rich calcareous woodlands, also in drier sections of seepage fed wetlands or old beaver pond woodland.	Flowers in June. Plant identifiable from late May to October	S2	Yellow
Showy Lady's-Slipper	*Cypripedium reginae*	Alkaline swamps and bogs.	Flowers June through August., Can be identified some weeks prior to bloom and at least to early October.	S2	Red
Hornemann Willow-Herb	*Epilobium hornemannii*	Damp rocks, the margins of rills, and similar moist low competition areas.	Flowers July and August, identifiable after to maybe October	S2S3	Yellow
Downy Willow-Herb	*Epilobium strictum*	Wet meadows, boggy swales and marshes.	July to September	S3	Yellow
Meadow Horsetail	*Equisetum pratense*	Open woods and wet meadows, usually in circumneutral soils.	Identifiable throughout the growing season	S2	Yellow
Philadelphia Fleabane	*Erigeron philadelphicus*	Old fields, meadows, and springy slopes.	Flowers June to August	S2	Yellow
Black Ash	*Fraxinus nigra*	Low ground, damp woods and swamps.	May and June. Can be identified without flowers.	S3	Yellow
Boreal Bedstraw	*Galium kamtschaticum*	Rich, deciduous forests and ravines. In fir-birch associations on Cape Breton Plateau.	Flowers June to August. Can be identified post-flowering until early October.	S3	Yellow
Giant Rattlesnake-Plantain	*Goodyera oblongifolia*	Deciduous climax forest. Slopes in damp, mixed forests, and ravines.	Flowers in late summer. Identifiable earlier and into fall by it's long leaf blades with white midvein and sparse blotching	S2S3	Yellow
Dwarf Rattlesnake-Plantain	*Goodyera repens*	Under conifers, growing with very few other plants.	Flowers July and August	S2S3	Yellow
Robinson's Hawkweed	*Hieracium robinsonii*	Rock crevices and cliffs, cobble shores, and along streams.	Flowers July and August	S2	Yellow
Golden-Heather	*Hudsonia ericoides*	Dry, rocky, and sandy barrens. Recently disturbed areas or on open sandy soils.	Late May to early July	S2	Yellow
Larger Canadian St. John's Wort	*Hypericum majus*	Wet or dry open soil.	July to September	S1	Red
Acadian Quillwort	*Isoetes acadiensis*	Water up to 1 m deep, bordering lakes or ponds, and occasionally along rivers.	Megaspores required for identification.	S3	Yellow
Dudley's Rush	*Juncus dudleyi*	Marshy ground.	June to September	S2?	Yellow
Mudwort	*Limosella australis*	Low areas by ponds, gravel lakeshores, the muddy edges of ponds behind barrier beaches and muddy river margins.	Late June to October.	S2S3	Yellow

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

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank
Southern Twayblade	*Listera australis*	Among the shaded sphagnum moss of bogs or damp woods.	June. Quickly senesces after flowering.	S1	Red
Beck Water-Marigold	*Megalodonta beckii*	Shallow, quiet waters, slow-moving streams, and ponds.	August and September	S3	Yellow
Mountain Sandwort	*Minuartia groenlandica*	Granitic ledges and gravel, on coasts at higher elevations.	June to August	S2	Yellow
Farwell's Water-Milfoil	*Myriophyllum farwellii*	Ponds and slow-moving streams.	Flowers June to September	S2	Yellow
Whorled Water-Milfoil	*Myriophyllum verticillatum*	Shallow waters, mainly in fine, muddy, sediment, or calcareous regions.	Flowers late June to September	S2	Yellow
Smoother Sweet-Cicely	*Osmorhiza longistylis*	Rich deciduous forests, intervales.	Flowers late June to July.	S2	Yellow
St John's Oxytrope	*Oxytropis campestris var. johannensis*	Exposed cliff crevices, gravelly and rocky scree, and headlands.	June to July	S1	Red
a Marsh Grass-of-Parnassus	*Parnassia palustris var. parviflora*	Grassy hollows in sand dunes and on tussocks in swamps	July	S2	Red
Canada Mountain-Ricegrass	*Piptatherum canadense*	Dry sandy soils.	Not provided	S2	Yellow
Large Round-Leaved Orchid	*Platanthera macrophylla*	Rich old deciduous or mixed woods.	August	S2	Yellow
Field Milkwort	*Polygala sanguinea*	Poor or acidic fields, damp slopes, and open woods or bush.	Late June to October.	S2S3	Yellow
Blunt-Leaf Pondweed	*Potamogeton obtusifolius*	Ponds, lakes, and slow-moving streams, often on a substrate of deep muck.	Flowers July to September	S2	Yellow
Cursed Crowfoot	*Ranunculus sceleratus*	Marshes, ditches, swampy meadows.	Not given for NS	S1S2	Red
Alderleaf Buckthorn	*Rhamnus alnifolia*	Calcareous bogs, swamps, swampy woods and meadows, marl bogs in rich aluvial soils.	Flowers mid -May to June. Identifiable from May to October and potentially year round.	S3	Yellow
Low Spike-Moss	*Selaginella selaginoides*	Moist areas bordering bog tussocks, peat bogs, and stream margins.	Produces spores in July and August. Likely identifiable when not snow covered but very easily overlooked	S2	Red
Lindley's Aster	*Symphyotrichum ciliolatum*	Open fields, lawns and the edges of woods.	August and September	S2S3	Yellow
Sticky False-Asphodel	*Triantha glutinosa*	Swamps, bogs and rocky beaches.	Flowers June to August, not readily noticeable until bloom, and likely later with fruit	S1	Red
Northeastern Bladderwort	*Utricularia resupinata*	Ponds, lakes and river shores.	Flowers July to September, likely little noticeable or identifiable out of flower	S1	Red
Thyme-Leaved Speedwell	*Veronica serpyllifolia ssp. humifusa*	Moist soils. Pastures and damp runs, creeping on the grass.	Mid-May to October.	S2S3	Yellow

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

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank
Squashberry	*Viburnum edule*	In cold woods and along streams. Characteristic of climax coniferous forest.	May to early August.	S2	Yellow
Northern Bog Violet	*Viola nephrophylla*	Cool mossy bogs, the borders of streams, and damp woods.	May to July.	S2	Yellow

APPENDIX E
Population Status of Vascular Plants Recorded in Project Area

Table E-1 Population Status of Vascular Plants Recorded in Project area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Abies balsamea	Balsam Fir	S5	GREEN
Acer pensylvanicum	Striped Maple	S5	GREEN
Acer rubrum	Red Maple	S5	GREEN
Acer saccharum	Sugar Maple	S5	GREEN
Acer spicatum	Mountain Maple	S5	GREEN
Achillea millefolium	Common Yarrow	S5	GREEN
Actaea pachypoda	White Baneberry	S4	GREEN
Agrimonia striata	Woodland Agrimony	S5	GREEN
Agrostis capillaris	Colonial Bentgrass	SE	EXOTIC
Agrostis perennans	Perennial Bentgrass	S4S5	GREEN
Agrostis scabra	Rough Bentgrass	S5	GREEN
Agrostis sp.	a Bentgrass	n/a	n/a
Agrostis stolonifera	Spreading Bentgrass	S5SE	GREEN
Alnus incana	Speckled Alder	S5	GREEN
Alnus viridis	Green Alder	S5	GREEN
Amelanchier laevis	Allegheny Service-Berry	S5	GREEN
Amelanchier sp.	a Service-Berry	n/a	n/a
Anaphalis margaritacea	Pearly Everlasting	S5	GREEN
Antennaria howellii ssp. neodioica	Pussy-Toes	S5	NOT ASSESSE
Antennaria neglecta	Field Pussytoes	S?	UNDETERMINE
Aralia hispida	Bristly Sarsaparilla	S5	GREEN
Aralia nudicaulis	Wild Sarsaparilla	S5	GREEN
Athyrium filix-femina	Lady-Fern	S5	GREEN
Betula alleghaniensis	Yellow Birch	S5	GREEN
Betula papyrifera var. cordifolia	Heart-Leaved Paper Birch	S5	?
Betula papyrifera var. papyrifera	Paper Birch	S5	GREEN
Bidens frondosa	Devil's Beggar-Ticks	S5	GREEN
Calamagrostis canadensis	Blue-Joint Reedgrass	S5	GREEN
Carex aquatilis	Water Sedge	S5	GREEN
Carex arctata	Black Sedge	S5	GREEN
Carex brunnescens	Brownish Sedge	S5	GREEN
Carex communis	Fibrous-Root Sedge	S5	GREEN
Carex crawfordii	Crawford Sedge	S5	GREEN
Carex crinita	Fringed Sedge	S4S5	GREEN
Carex debilis	White-Edge Sedge	S5	GREEN
Carex echinata	Little Prickly Sedge	S5	GREEN
Carex flava	Yellow Sedge	S5	GREEN
Carex folliculata	Long Sedge	S5	GREEN
Carex gynandra	A Sedge	S5	GREEN
Carex intumescens	Bladder Sedge	S5	GREEN
Carex leptonervia	Finely-Nerved Sedge	S5	GREEN
Carex nigra	Black Sedge	S5	GREEN
Carex novae-angliae	New England Sedge	S5	GREEN
Carex projecta	Necklace Sedge	S4S5	GREEN
Carex scabrata	Rough Sedge	S5	GREEN
Carex scoparia	Pointed Broom Sedge	S5	GREEN
Carex sp.	a Sedge	n/a	n/a
Carex stipata	Stalk-Grain Sedge	S5	GREEN

Table E-1 Population Status of Vascular Plants Recorded in Project area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Carex vulpinoidea	Fox Sedge	S4?	GREEN
Centaurea nigra	Black Starthistle	SE	EXOTIC
Cerastium arvense	Mouse-Ear Chickweed	S4?	GREEN
Chaenorhinum minus	Common Dwarf Snapdragon	SE	EXOTIC
Chamerion angustifolium	Fireweed	S5	GREEN
Cinna latifolia	Slender Wood Reedgrass	S5	GREEN
Cirsium arvense	Creeping Thistle	SE	EXOTIC
Cirsium vulgare	Bull Thistle	SE	EXOTIC
Clintonia borealis	Clinton Lily	S5	GREEN
Coptis trifolia	Goldthread	S5	GREEN
Cornus alternifolia	Alternate-Leaf Dogwood	S5	GREEN
Cornus canadensis	Dwarf Dogwood	S5	GREEN
Cornus sericea	Silky Dogwood	S5	GREEN
Corylus cornuta	Beaked Hazelnut	S5	GREEN
Danthonia spicata	Poverty Oat-Grass	S5	GREEN
Daucus carota	Wild Carrot	SE	EXOTIC
Dennstaedtia punctilobula	Eastern Hay-Scented Fern	S5	GREEN
Dianthus armeria	Deptford-Pink	SE	EXOTIC
Dichanthelium acuminatum	Panic Grass	S5	GREEN
Dichanthelium boreale	Northern Witchgrass	S5	GREEN
Doellingeria umbellata	Parasol White-Top	S5	GREEN
Drosera rotundifolia	Roundleaf Sundew	S5	GREEN
Dryopteris campyloptera	Mountain Wood-Fern	S5	GREEN
Dryopteris campyloptera X intermedia	a hybrid Wood-fern	HYB	?
Dryopteris carthusiana	Spinulose Shield Fern	S5	GREEN
Dryopteris cristata	Crested Shield-Fern	S5	GREEN
Dryopteris intermedia	Evergreen Woodfern	S5	GREEN
Dryopteris x boottii	a Hybrid Wood-fern	HYB	?
Dryopteris x triploidea	a Hybrid Wood-fern	HYB	?
Eleocharis acicularis	Least Spike-Rush	S5	GREEN
Elymus repens	Quackgrass	SE	EXOTIC
Epifagus virginiana	Beechdrops	S4S5	GREEN
Epigaea repens	Trailing Arbutus	S5	GREEN
Epilobium ciliatum	Hairy Willow-Herb	S5	GREEN
Equisetum arvense	Field Horsetail	S5	GREEN
Equisetum sylvaticum	Woodland Horsetail	S5	GREEN
Erigeron strigosus	Daisy Fleabane	S5	GREEN
Eupatorium maculatum	Spotted Joe-Pye Weed	S5	GREEN
Euphrasia stricta	Drug Eyebright	SE	EXOTIC
Euthamia graminifolia	Flat-Top Fragrant-Golden-Rod	S5	GREEN
Fagus grandifolia	American Beech	S5	GREEN
Festuca filiformis	Hair Fescue	SE	EXOTIC
Fragaria virginiana	Virginia Strawberry	S5	GREEN
Fraxinus americana	White Ash	S5	GREEN
Galeopsis tetrahit	Brittle-Stem Hempnettle	SE	EXOTIC
Galium trifidum	Small Bedstraw	S5	GREEN
Galium triflorum	Sweet-Scent Bedstraw	S5	GREEN
Gaultheria hispidula	Creeping Snowberry	S5	GREEN

Table E-1 Population Status of Vascular Plants Recorded in Project area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Geum rivale	Purple Avens	S5	GREEN
Glyceria canadensis	Canada Manna-Grass	S5	GREEN
Glyceria striata	Fowl Manna-Grass	S5	GREEN
Gnaphalium uliginosum	Low Cudweed	SE	EXOTIC
Gymnocarpium dryopteris	Northern Oak Fern	S5	GREEN
Hieracium canadense	Canada Hawkweed	S4S5	GREEN
Hieracium lachenalii	Common Hawkweed	SE	EXOTIC
Hieracium pilosella	Mouseear	SE	EXOTIC
Hieracium x flagellare	Whiplash Hawkweed	SE	EXOTIC
Hieracium x floribundum	Smoothish Hawkweed	SE	EXOTIC
Humulus lupulus	Common Hop	S4	UNDETERMINE
Huperzia lucidula	Shining Fir-Clubmoss	S5	GREEN
Hypericum canadense	Canadian St. John's-Wort	S5	GREEN
Hypericum perforatum	A St. John's-Wort	SE	EXOTIC
Impatiens capensis	Spotted Jewel-Weed	S5	GREEN
Iris versicolor	Blueflag	S5	GREEN
Juncus acuminatus	Sharp-Fruit Rush	S3S4	UNDETERMINE
Juncus articulatus	Jointed Rush	S5	GREEN
Juncus brevicaudatus	Narrow-Panicled Rush	S5	GREEN
Juncus effusus	Soft Rush	S5	GREEN
Juncus effusus var. pylaei	Soft Rush	S4?	?
Juncus tenuis	Slender Rush	S5	GREEN
Juniperus communis	Ground Juniper	S5	GREEN
Kalmia angustifolia	Sheep-Laurel	S5	GREEN
Lamium amplexicaule	Common Deadnettle	SE	EXOTIC
Ledum groenlandicum	Common Labrador Tea	S5	GREEN
Leontodon autumnalis	Autumn Hawkbit	SE	EXOTIC
Leucanthemum vulgare	Oxeye Daisy	SE	EXOTIC
Linnaea borealis	Twinflower	S5	GREEN
Lolium pratense	Meadow Rye Grass	SE	EXOTIC
Lonicera canadensis	American Fly-Honeysuckle	S5	GREEN
Lonicera villosa	Mountain Fly-Honeysuckle	S4S4	GREEN
Lupinus polyphyllus	Large-Leaved Lupine	SE	EXOTIC
Luzula multiflora	Common Woodrush	S5	GREEN
Lycopodium dendroideum	Treelike Clubmoss	S4?	GREEN
Lycopodium digitatum	Fan Club-Moss	S5	GREEN
Lycopodium digitatum	Fan Club-Moss	S5	GREEN
Lycopodium obscurum	Tree Clubmoss	S5	GREEN
Lycopodium tristachyum	Deep-Root Clubmoss	S4	GREEN
Lycopus americanus	American Bugleweed	S5	GREEN
Lycopus uniflorus	Northern Bugleweed	S5	GREEN
Maianthemum canadense	Wild Lily-of-The-Valley	S5	GREEN
Malus pumila	Common Apple	SE	EXOTIC
Medicago lupulina	Black Medic	SE	EXOTIC
Melilotus albus	White Sweetclover	SE	?
Melilotus officinalis	Yellow Sweetclover	SE	EXOTIC
Mentha x piperata	Peppermint	SE	EXOTIC
Mitchella repens	Partridge-Berry	S5	GREEN

Table E-1 Population Status of Vascular Plants Recorded in Project area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Mitella nuda	Naked Bishop's-Cap	S5	GREEN
Moneses uniflora	One-Flower Wintergreen	S5	GREEN
Monotropa uniflora	Indian-Pipe	S5	GREEN
Myosotis laxa	Small Forget-Me-Not	S5	GREEN
Nemopanthus mucronata	Mountain Holly	S5	GREEN
Oclemena acuminata	Whorled Aster	S5	GREEN
Oenothera biennis	Common Evening-Primrose	S5	GREEN
Oenothera perennis	Small Sundrops	S5	GREEN
Omalotheca sylvatica	Woodland Cudweed	S4S5	GREEN
Onoclea sensibilis	Sensitive Fern	S5	GREEN
Orthilia secunda	One-Side Wintergreen	S5	GREEN
Osmunda cinnamomea	Cinnamon Fern	S5	GREEN
Osmunda regalis	Royal Fern	S5	GREEN
Oxalis montana	White Wood-Sorrel	S5	GREEN
Oxalis stricta	Upright Yellow Wood-Sorrel	S5	GREEN
Phegopteris connectilis	Northern Beech Fern	S5	GREEN
Phleum pratense	Meadow Timothy	SE	EXOTIC
Picea glauca	White Spruce	S5	GREEN
Picea mariana	Black Spruce	S5	GREEN
Pinus strobus	Eastern White Pine	S5	GREEN
Plantago lanceolata	English Plantain	SE	EXOTIC
Plantago major	Nipple-Seed Plantain	SE	EXOTIC
Platanthera clavellata	Small Green Woodland Orchid	S5	GREEN
Platanthera dilatata	Leafy White Orchis	S4S5	GREEN
Platanthera sp.	an Orchid	n/a	n/a
Poa compressa	Canada Bluegrass	SE	EXOTIC
Poa palustris	Fowl Bluegrass	S5	GREEN
Polygonum hydropiperoides	Mild Water-Pepper	S5	GREEN
Polygonum persicaria	Lady's Thumb	SE	EXOTIC
Polystichum acrostichoides	Christmas Fern	S5	GREEN
Potamogeton alpinus	Northern Pondweed	S4	GREEN
Potamogeton epihydrus	Nuttall Pondweed	S5	GREEN
Potentilla norvegica	Norwegian Cinquefoil	S5	GREEN
Potentilla simplex	Old-Field Cinquefoil	S5	GREEN
Prenanthes altissima	Tall Rattlesnake-root	S4S5	GREEN
Prenanthes trifoliolata	Three-Leaved Rattlesnake-root	S5	GREEN
Prunella vulgaris	Self-Heal	S5	GREEN
Prunus pensylvanica	Fire Cherry	S5	GREEN
Pteridium aquilinum	Bracken Fern	S5	GREEN
Pyrola americana	American Wintergreen	S5	GREEN
Pyrola elliptica	Shinleaf	S5	GREEN
Ranunculus repens	Creeping Butter-Cup	SE	EXOTIC
Ribes glandulosum	Skunk Currant	S5	GREEN
Ribes lacustre	Bristly Black Currant	S5	GREEN
Rosa carolina	Carolina Rose	S4S5	GREEN
Rosa sp.	a Rose	n/a	n/a
Rosa virginiana	Virginia Rose	S5	GREEN
Rubus canadensis	Smooth Blackberry	S5	GREEN

Table E-1 Population Status of Vascular Plants Recorded in Project area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Rubus hispidus	Bristly Dewberry	S5	GREEN
Rubus idaeus	Red Raspberry	S5	GREEN
Rubus pubescens	Dwarf Red Raspberry	S5	GREEN
Rubus recurvicaulis	a bramble	S?	GREEN
Rumex acetosella	Sheep Sorrel	SE	EXOTIC
Rumex aquaticus	Alpine Dock	SU	EXOTIC
Rumex crispus	Curly Dock	SE	EXOTIC
Salix bebbiana	Bebb's Willow	S5	GREEN
Salix humilis	Prairie Willow	S5	GREEN
Salix sp.	a Willow	n/a	n/a
Sambucus nigra ssp. canadensis	Common Elderberry	S5	?
Sambucus racemosa	Red Elderberry	S5	GREEN
Scirpus atrocinctus	Black-Girdle Bulrush	S5	GREEN
Scirpus cyperinus	Cottongrass Bulrush	S5	GREEN
Scutellaria lateriflora	Mad Dog Skullcap	S5	GREEN
Senecio jacobaea	Tansy Ragwort	SE	EXOTIC
Senecio viscosus	Sticky Groundsel	SE	EXOTIC
Senecio vulgaris	Old-Man-In-The-Spring	SE	EXOTIC
Sisyrinchium montanum	Strict Blue-Eyed-Grass	S5	GREEN
Solidago canadensis	Canada Goldenrod	S5	GREEN
Solidago macrophylla	Large-Leaf Goldenrod	S4	GREEN
Solidago puberula	Downy Goldenrod	S5	GREEN
Solidago rugosa	Rough-Leaf Goldenrod	S5	GREEN
Solidago uliginosa	Bog Goldenrod	S5	GREEN
Sonchus oleraceus	Common Sowthistle	SE	EXOTIC
Sorbus americana	American Mountain-Ash	S5	GREEN
Sparganium angustifolium	Narrow-Leaf Burreed	S4S5	GREEN
Spergularia rubra	Purple Sandspurry	SE	EXOTIC
Spiranthes cernua	Nodding Ladies'-Tresses	S5	GREEN
Spiranthes lacera	Ladies'-Tresses	S5	GREEN
Streptopus lanceolatus	Rosy Twistedstalk	S5	GREEN
Symphyotrichum lateriflorum	Farewell-Summer	S5	GREEN
Symphyotrichum novi-belgii	New Belgium American-Aster	S5	GREEN
Symphyotrichum puniceum	Swamp Aster	S5	GREEN
Thalictrum pubescens	Tall Meadow-Rue	S5	GREEN
Thelypteris noveboracensis	New York Fern	S5	GREEN
Thelypteris palustris	Marsh Fern	S5	GREEN
Trientalis borealis	Northern Starflower	S5	GREEN
Trifolium campestre	Low Hop Clover	SE	EXOTIC
Trifolium repens	White Clover	SE	EXOTIC
Tussilago farfara	Colt's Foot	SE	EXOTIC
Typha latifolia	Broad-Leaf Cattail	S5	GREEN
Vaccinium angustifolium	Late Lowbush Blueberry	S5	GREEN
Vaccinium myrtilloides	Velvetleaf Blueberry	S5	GREEN
Veronica officinalis	Gypsy-Weed	S5SE	EXOTIC
Viburnum nudum	Possum-Haw Viburnum	S5	GREEN
Vicia cracca	Tufted Vetch	SE	EXOTIC
Viola blanda	Smooth White Violet	S5	GREEN

Table E-1 Population Status of Vascular Plants Recorded in Project area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Viola cucullata	Marsh Blue Violet	S5	GREEN
Viola sororia	Woolly Blue Violet	S5	GREEN
Viola sp.	a Violet	n/a	n/a

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

Table F-1 Breeding and Population Status of Birds Recorded during Field Surveys and within the Breeding Bird Atlas Square

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	MBBA Breeding Status	Field observations
Spotted Sandpiper	Actitis macularius	S5B	Green	Possible	Not observed
Northern Saw-whet Owl	Aegolius acadicus	S4B	Green	Possible	Observed
Ruby-throated Hummingbird	Archilochus colubris	S5B	Green	Possible	Not observed
Great Blue Heron	Ardea herodias	S5B	Green	Possible	Not observed
Ruffed Grouse	Bonasa umbellus	S5	Green	Not observed	Observed
American Goldfinch	Carduelis tristis	S5	Green	Probable	Not observed
Purple Finch	Carpodacus purpureus	S5B	Green	Possible	Not observed
Northern Flicker	Colaptes auratus	S5B	Green	Probable	Not observed
Rock Pigeon	Columba livia	SEB	Exotic	Probable	Not observed
Eastern Wood-Pewee	Contopus virens	S4B	Green	Possible	Not observed
American Crow	Corvus brachyrhynchos	S5	Green	Possible	Not observed
Blue Jay	Cyanocitta cristata	S5	Green	Possible	Observed
Yellow-rumped Warbler	Dendroica coronata	S5B	Green	Possible	Not observed
Magnolia Warbler	Dendroica magnolia	S5B	Green	Possible	Not observed
Yellow Warbler	Dendroica petechia	S5B	Green	Possible	Not observed
Bobolink	Dolichonyx oryzivorus	S3B	Yellow	Probable	Not observed
Alder Flycatcher	Empidonax alnorum	S5B	Green	Possible	Not observed
Yellow-bellied Flycatcher	Empidonax flaviventris	S5B	Green	Possible	Not observed
Least Flycatcher	Empidonax minimus	S5B	Green	Probable	Not observed
Common Yellowthroat	Geothlypis trichas	S5B	Green	Possible	Not observed
Bald Eagle	Haliaeetus leucocephalus	S5B,S4N	Green	Confirmed	Not observed
Dark-eyed Junco	Junco hyemalis	S5	Green	Probable	Not observed
Belted Kingfisher	Megaceryle alcyon	S5B	Green	Probable	Not observed
Lincoln's Sparrow	Melospiza lincolnii	S5B	Green	Probable	Not observed
Song Sparrow	Melospiza melodia	S5B	Green	Probable	Not observed
Common Merganser	Mergus merganser	S5B	Green	Possible	Not observed
Black-and-white Warbler	Mniotilta varia	S5B	Green	Probable	Not observed
Mourning Warbler	Oporornis philadelphia	S5B	Green	Probable	Not observed
Northern Parula	Parula americana	S5B	Green	Possible	Not observed
Savannah Sparrow	Passerculus sandwichensis	S5B	Green	Confirmed	Not observed
Downy Woodpecker	Picoides pubescens	S5	Green	Possible	Not observed
Hairy Woodpecker	Picoides villosus	S5	Green	Not observed	Observed
Black-capped Chickadee	Poecile atricapillus	S5	Green	Possible	Observed
Common Grackle	Quiscalus quiscula	S5B	Green	Possible	Not observed
Ruby-crowned Kinglet	Regulus calendula	S5B	Green	Possible	Not observed
Golden-crowned Kinglet	Regulus satrapa	S5B	Green	Not observed	Observed
Ovenbird	Seiurus aurocapilla	S5B	Green	Confirmed	Not observed
American Redstart	Setophaga ruticilla	S5B	Green	Probable	Not observed
Red-breasted Nuthatch	Sitta canadensis	S5	Green	Not observed	Observed
White-breasted Nuthatch	Sitta carolinensis	S4	Green	Possible	Not observed
Barred Owl	Strix varia	S5	Green	Probable	Not observed
European Starling	Sturnus vulgaris	SE	Exotic	Confirmed	Not observed
Tree Swallow	Tachycineta bicolor	S5B	Green	Possible	Not observed
American Robin	Turdus migratorius	S5B	Green	Probable	Not observed
Red-eyed Vireo	Vireo olivaceus	S5B	Green	Probable	Not observed
Blue-headed Vireo	Vireo solitarius	S5B	Green	Possible	Not observed

Table F-1 Breeding and Population Status of Birds Recorded during Field Surveys and within the Breeding Bird Atlas Square

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	MBBA Breeding Status	Field observations
Mourning Dove	Zenaida macroura	S5B	Green	Possible	Not observed
White-throated Sparrow	Zonotrichia albicollis	S5B	Green	Probable	Not observed

APPENDIX G
Plants Recorded within Wetlands

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

Common Name	Scientific Name	Wetland 1	Wetland 2	Wetland 3	Wetland 4
Striped Maple	*Acer pensylvanicum*		P		
Red Maple	*Acer rubrum*		P	P	P
Sugar Maple	*Acer saccharum*	P	P	P	P
Mountain Maple	*Acer spicatum*	P			
Woodland Agrimony	*Agrimonia striata*	P	P		
Colonial Bentgrass	*Agrostis capillaris*			P	
Perennial Bentgrass	*Agrostis perennans*			P	
Rough Bentgrass	*Agrostis scabra*	P			
a Bentgrass	*Agrostis sp.*			P	
Spreading Bentgrass	*Agrostis stolonifera*			P	
Speckled Alder	*Alnus incana*	P			
Allegheny Service-Berry	*Amelanchier laevis*	P			
a Service-Berry	*Amelanchier sp.*				P
Pearly Everlasting	*Anaphalis margaritacea*		P		
Wild Sarsaparilla	*Aralia nudicaulis*	P			
Lady-Fern	*Athyrium filix-femina*	P		P	P
Yellow Birch	*Betula alleghaniensis*				P
Devil's Beggar-Ticks	*Bidens frondosa*	P			
Blue-Joint Reedgrass	*Calamagrostis canadensis*	P			
Water Sedge	*Carex aquatilis*	P			
Brownish Sedge	*Carex brunnescens*		P	P	P
Little Prickly Sedge	*Carex echinata*	P			
Yellow Sedge	*Carex flava*	P			P
Long Sedge	*Carex folliculata*	P			
Black Sedge	*Carex nigra*				P
Necklace Sedge	*Carex projecta*	P			
Rough Sedge	*Carex scabrata*	P			
Stalk-Grain Sedge	*Carex stipata*	P			
Fox Sedge	*Carex vulpinoidea*	P			
Black Starthistle	*Centaurea nigra*			P	P
Creeping Thistle	*Cirsium arvense*		P		
Bull Thistle	*Cirsium vulgare*	P			
Clinton Lily	*Clintonia borealis*	P			
Alternate-Leaf Dogwood	*Cornus alternifolia*	P			
Dwarf Dogwood	*Cornus canadensis*		P		P
Silky Dogwood	*Cornus sericea*	P		P	P
Beaked Hazelnut	*Corylus cornuta*	P			
Deptford-Pink	*Dianthus armeria*	P			
Parasol White-Top	*Doellingeria umbellata*				P
Spinulose Shield Fern	*Dryopteris carthusiana*	P		P	
Crested Shield-Fern	*Dryopteris cristata*	P	P	P	
Evergreen Woodfern	*Dryopteris intermedia*		P		P
a Hybrid Wood-fern	*Dryopteris x boottii*	P			
Least Spike-Rush	*Eleocharis acicularis*	P			
Trailing Arbutus	*Epigaea repens*				P
Field Horsetail	*Equisetum arvense*		P	P	P
Spotted Joe-Pye Weed	*Eupatorium maculatum*	P			
Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	P	P	P	
American Beech	*Fagus grandifolia*	P			

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

Common Name	Scientific Name	Wetland 1	Wetland 2	Wetland 3	Wetland 4
Virginia Strawberry	*Fragaria virginiana*	P	P	P	
White Ash	*Fraxinus americana*	P	P		P
Small Bedstraw	*Galium trifidum*	P			
Creeping Snowberry	*Gaultheria hispidula*	P			P
Purple Avens	*Geum rivale*	P			
Fowl Manna-Grass	*Glyceria striata*	P	P		P
Common Hop	*Humulus lupulus*			P	P
Spotted Jewel-Weed	*Impatiens capensis*	P			
Blueflag	*Iris versicolor*	P			
Sharp-Fruit Rush	*Juncus acuminatus*			P	
Jointed Rush	*Juncus articulatus*	P			
Narrow-Panicled Rush	*Juncus brevicaudatus*			P	
Soft Rush	*Juncus effusus*	P	P	P	
Common Labrador Tea	*Ledum groenlandicum*	P			
Twinflower	*Linnaea borealis*	P	P		P
American Fly-Honeysuckle	*Lonicera canadensis*	P			P
Mountain Fly-Honeysuckle	*Lonicera villosa*	P	P		P
American Bugleweed	*Lycopus americanus*	P			
Northern Bugleweed	*Lycopus uniflorus*			P	P
Yellow Sweetclover	*Melilotus officinalis*	P			
Peppermint	*Mentha x piperata*				P
Naked Bishop's-Cap	*Mitella nuda*	P			
Indian-Pipe	*Monotropa uniflora*	P			
Small Forget-Me-Not	*Myosotis laxa*	P			
Mountain Holly	*Nemopanthus mucronata*	P	P		P
Whorled Aster	*Oclemena acuminata*				P
Sensitive Fern	*Onoclea sensibilis*	P			
Cinnamon Fern	*Osmunda cinnamomea*		P	P	
Royal Fern	*Osmunda regalis*				P
Northern Beech Fern	*Phegopteris connectilis*		P		
Black Spruce	*Picea mariana*		P		P
English Plantain	*Plantago lanceolata*			P	
Leafy White Orchis	*Platanthera dilatata*			P	P
Fowl Bluegrass	*Poa palustris*	P		P	
Mild Water-Pepper	*Polygonum hydropiperoides*	P			
Lady's Thumb	*Polygonum persicaria*	P			
Nuttall Pondweed	*Potamogeton epihydrus*	P			
Norwegian Cinquefoil	*Potentilla norvegica*	P			
Tall Rattlesnake-root	*Prenanthes altissima*	P			
Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	P			
Self-Heal	*Prunella vulgaris*	P	P	P	P
Fire Cherry	*Prunus pensylvanica*		P		
Bracken Fern	*Pteridium aquilinum*	P			
Creeping Butter-Cup	*Ranunculus repens*		P	P	P
Bristly Black Currant	*Ribes lacustre*				P
Virginia Rose	*Rosa virginiana*				P
Red Raspberry	*Rubus idaeus*	P		P	
Dwarf Red Raspberry	*Rubus pubescens*	P		P	
Black-Girdle Bulrush	*Scirpus atrocinctus*	P			

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

Common Name	Scientific Name	Wetland 1	Wetland 2	Wetland 3	Wetland 4
Cottongrass Bulrush	*Scirpus cyperinus*	P			
Mad Dog Skullcap	*Scutellaria lateriflora*	P			
Canada Goldenrod	*Solidago canadensis*	P	P	P	P
Rough-Leaf Goldenrod	*Solidago rugosa*	P	P	P	
Common Sowthistle	*Sonchus oleraceus*	P			
American Mountain-Ash	*Sorbus americana*				P
Narrow-Leaf Burreed	*Sparganium angustifolium*	P			
Rosy Twistedstalk	*Streptopus lanceolatus*	P			
Farewell-Summer	*Symphyotrichum lateriflorum*	P			P
New Belgium American-Aster	*Symphyotrichum novi-belgii*			P	
Swamp Aster	*Symphyotrichum puniceum*	P			
Tall Meadow-Rue	*Thalictrum pubescens*	P			P
New York Fern	*Thelypteris noveboracensis*	P			P
Marsh Fern	*Thelypteris palustris*			P	
Northern Starflower	*Trientalis borealis*				P
Colt's Foot	*Tussilago farfara*		P	P	P
Broad-Leaf Cattail	*Typha latifolia*	P	P	P	
Velvetleaf Blueberry	*Vaccinium myrtilloides*	P			
Possum-Haw Viburnum	*Viburnum nudum*	P			
Marsh Blue Violet	*Viola cucullata*	P			
a Violet	*Viola sp.*	P			

APPENDIX H
Response to Government Review Comments

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
1	Valerie Francella, Environmental Assessment and Marine Programs, Environmental Protection Operations Directorate (Atlantic)	Based on the project description, it is not likely that EC has a power, duty or function in relation to the proposed project that would trigger the *Canadian Environmental Assessment Act*. At this time, it is recommended that the Proponent review the report and ensure that it reflects applicable regulatory information and best management practices discussed in the attached document, *Environment Canada Guidance Related to the Environmental Assessment of Aggregate Pit Mines and Quarries in the Atlantic Provinces, April 2008*.	Comment acknowledged. The proponent is aware of the EC guidance document referenced and has prepared the registration document in consideration of those BMPs.
2	Sarah MacKay/Don Anderson, NSDNR	I have reviewed this document for wildlife issues. As mentioned in the draft additional wildlife, plant and wetland surveys must be conducted in the spring to look for potential Yellow and Red species. The survey done in October, although comprehensive, was not sufficient to done a thorough job. I may have additional comments pending the outcome of these surveys. The portion of the deer winter area that is contained in the site is mainly hardwood/mixed wood. The softwood portion is on the adjoining lands. Much of this area has been harvested over the year greatly diminishing the areas usefulness as a yard. As result work done over the years to expand the quarry site should not have a negative effect on Deer in the area. Draft is fine with me pending the outcome of the additional surveys.	Comment acknowledged. Results from the spring breeding bird and early vegetation surveys will be submitted to NSDNR when available, late summer 2010.
3	Heather McMillan, Senior Policy Advisor, Policy and Evaluation, Corporate Strategy and Operations	From a tourism perspective, the main areas of interest regarding the proposed expansion are truck traffic, visual aesthetics, noise, and a consideration of whether the expansion would negatively affect tourism in the region. The quarry is located off Trans Canada Highway (TCH) 105 near Baddeck, in proximity to both the Cabot Trail and Bras d'Or Lakes Scenic Drive. Trucks hauling aggregate will access the TCH via a paved private road. This road is currently utilized for quarry activity. Volume of truck traffic will depend on market demand for aggregate products. It is noted in the document that traffic increases will be for short periods of time. As the ground transportation link to Newfoundland, the TCH 105 currently has heavy truck traffic. It is not expected that the potential for increased traffic will substantially impact tourism generated traffic. The site does not appear to be located in a manner which will affect the visual aesthetics of major highways, coastal views, scenic drives, or tourism services and amenities. It is noted that the extension to the quarry will not be visible from the 100 series highway. Equipment operations and blasting will generate noise from the quarry site.	Comment acknowledged.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
3	Heather McMillan	There are provincial guidelines in place which require sound levels be monitored and not exceed specific thresholds. Where this is an expansion of an existing quarry, it is not anticipated that the sound quality will be degraded beyond current levels. Appropriate monitoring and mitigation should be ensured. The quarry is located within proximity to two provincial parks considered to provide tourism value: Uisge Ban Falls Provincial Park (12 km northwest) and North River Provincial Park (9 km north). These distances appear to provide a sufficient buffer to ensure that the aesthetic and quality of the environmental components (i.e. vegetation, wildlife, birds etc.) are not impacted in these parks. The Department of Natural Resources - Parks Division would be better positioned to comment on the impact this project may have on the parks. While there is some fishing, hunting, and recreational activity identified within proximity to the quarry, the site in question is privately owned property. Recreational activities here would be at the discretion of the user and are not promoted by the Department of Tourism, Culture, and Heritage. Tom Wilson, Director of Recreation and Tourism for the Municipality of the County of Victoria, was contacted to discuss the impacts of the quarry expansion on tourism in the area. He did not raise any concerns with respect to this project. Given the above observations, the Department of Tourism, Culture and Heritage, from a tourism perspective, is comfortable that the proposed expansion to the existing quarry would not appear to significantly impact tourism or have a negative effect on the visitor experience. As you are aware, our heritage staff does not comment on draft registration documents. Comments from the heritage perspective will be captured when the final registration document is registered.	

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
4	John Drage Hydrogeologist, Water & Wastewater Branch	My only comment on the draft document is with regards to the Village of Baddeck's plan to switch from surface water to a groundwater supply. As discussed in Section 5.2 of the EA, the Village is currently in the process of exploring for a suitable groundwater supply. At this point, the potential location of the new wellfield has not been determined, however, it would be helpful to discuss the likelihood of the area in the vicinity of the proposed quarry expansion being targeted as a municipal groundwater supply. This information could be added to Section 5.6 on groundwater resources.	An area approximately 10 kilometers to the west in the vicinity of Big Baddeck is the current area of focus for groundwater exploration for a future groundwater sourced well field for the Village of Baddeck. Although a potential location of a new well field has not been determined, it is highly unlikely that the proposed quarry expansion area would be targeted as a suitable area for a municipal groundwater supply development. As previously discussed, the bedrock underlying the proposed quarry expansion consists mainly of Pre-Cambrian metamorphic and metavolcanics of the George River Metamorphic suite. Due to the characteristic low yields and transmissivities measured for wells completed in the George River Metamorphic suite, the George River Metamorphic suite is considered unsuitable for municipal water supply development. Conversely, the Horton Group or Windsor Group formations are considered as more likely target locations for municipal well field development. Considering this, it is highly unlikely that the area of the proposed quarry expansion, which is underlain by George River Metamorphic suite bedrock, would be a suitable area for municipal well field development for the Village of Baddeck.
5	Jay Hartling, NS Office of Aboriginal Affairs	This is an evaluation of Aboriginal engagement by the proponent, as per proponents' guide. I'm not sure what EA branch tells proponents - but following the guide would be an easy solution: - letters were not sent to the Mi'kmaq communities closest to the project; - no requirement to send to the CMM or UNSI; - KMK is spelled incorrectly in their letter - the correct spelling is in the proponents' guide; and - doesn't look like any efforts were made to meet w. the closest communities, or to offer a meeting. Given the location (Baddeck) and the sensitivity around quarries - they should consider being more proactive.	The proponent has been in contact with two of the local band offices, Wagmatcook and We'koqma'q, and offered to meet with both bands to discuss the Project and answer questions. Letters containing information pertaining to the Project were also sent to both bands (refer to Appendix C).

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
6	Darrell Taylor, Environmental Analyst, Water and Wastewater Branch, NSE	My main comments at this time are with respect to potential impacts to a nearby stream which is tributary to Peter's Brook -the water supply to the village of Baddeck. Due to this important water use it is particularly important for the proponent to ensure protection of these surface water resources by employing suitable mitigation measures, and protection plans. Although some appropriate measures are proposed greater protection measures may be prudent, including baseline water quality and quantity monitoring plans which I did not see proposed. Another stream is noted down-gradient in a southerly direction. Impacts to this stream and identified wetlands in this area should be prevented/ mitigated as well.	The text in Section 5.2 has been updated to clarify the drainage patterns from the site related to Marsh Brook (up-gradient of the proposed extension area) and Big Harbour Brook (down-gradient of the proposed extension area). The need for suggested mitigation to apply to down-gradient areas (i.e., Big Harbour Brook) has also been more clearly communicated. The text has been updated concerning the potential for surface water monitoring programs. No surface water monitoring is recommended at this time given the lack of surface water connection between the proposed extension site and both the upstream (i.e. Marsh Brook) and downstream (i.e. Big Harbour Brook) surface water resources. Cross referencing to the proposed groundwater well monitoring program has been made.
7	Angela Swaine, Environmental Analyst, NSTIR	TIR has reviewed the draft environmental registration report for the proposed Gillis Construction Quarry Expansion. At this time TIR has no comments.	Comment acknowledged.
8	Lisa Paon, Habitat Biologist, DFO	What is the minimum buffer between Marsh Brook and other nearby watercourses (i.e. to the southeast the tributaries to Big Harbour Brook) and the proposed quarry expansion?	Figure 3 illustrates the proposed quarry extension area relative to the watercourses that fall inside (Marsh Brook) and outside the Property Boundaries (Big Harbour Brook tributaries), and includes a map scale. The minimum distance between the proposed extension boundary and the closest watercourse (as illustrated in Figure 3) is 50 m.
9	Lisa Paon, Habitat Biologist, DFO	It appears that there are water bodies between the extension property and the boundary of the Client Owned Property on the eastern side. Are these water bodies fish bearing? Are there any connectors from these to the proposed quarry extension area?	The two water bodies visible outside of the proposed Project extension area represent two sink holes that do not tend to be filled with water year round. As they are located outside of the proposed Extension Area they were not assessed as a part of this study. However, based on available mapping, no surface water connection is anticipated between these two holes and the quarry extension area

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
10	Lisa Paon, Habitat Biologist, DFO	Could the use of explosives adjacent to the watercourse/wetland buffers increase the risk of surface water seepage into the quarry?	The use of explosives could increase the risk of seepage from the stream into the quarry floor due to the possible creation of new cracks in the soil and/or bedrock that separates both, however, there are many factors involved to determine if this could happen and to what level of extent. One way to determine the level of risk is by conducting a geotechnical investigation near the areas of concern. All regulations pertaining to the use of explosives should be followed along with the proper procedures stated in the approval to operate. It is advisable to conduct an inspection in the quarry wall and the buffer areas prior to and after blasting to determine if new fractures were created and if these are conveying water from the stream to the quarry floor. Potential effects on rock from blasting and associated vibration are discussed in Section 5.6. This section also outlines the risk associated with blasting at different distances from the blast zone relevant to how the blast travels through different types of rock. As well, any blasting that occurs close to the eastern and southeastern sides of the proposed project extension area (*i.e.*, closest to the Big Harbour Brook tributaries outside the Project Boundary) will adhere to the *DFO Guidelines for the use of Explosives In or Near Canadian Fisheries Waters* (1998)."