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Environmental Assessment Registration for the Hants County Aggregate Quarry Extension Project

Municipal Enterprises Ltd.
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File: 121510261

July 2010

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1.0 PROPONENT AND PROJECT IDENTIFICATION

1.1 PROPONENT INFORMATION

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

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Signature

July 26, 2010
Date

1.2 PROJECT INFORMATION

Name of the Undertaking:	Hants County Quarry Extension Project
Location of the Undertaking:	Windsor, Hants County, NS

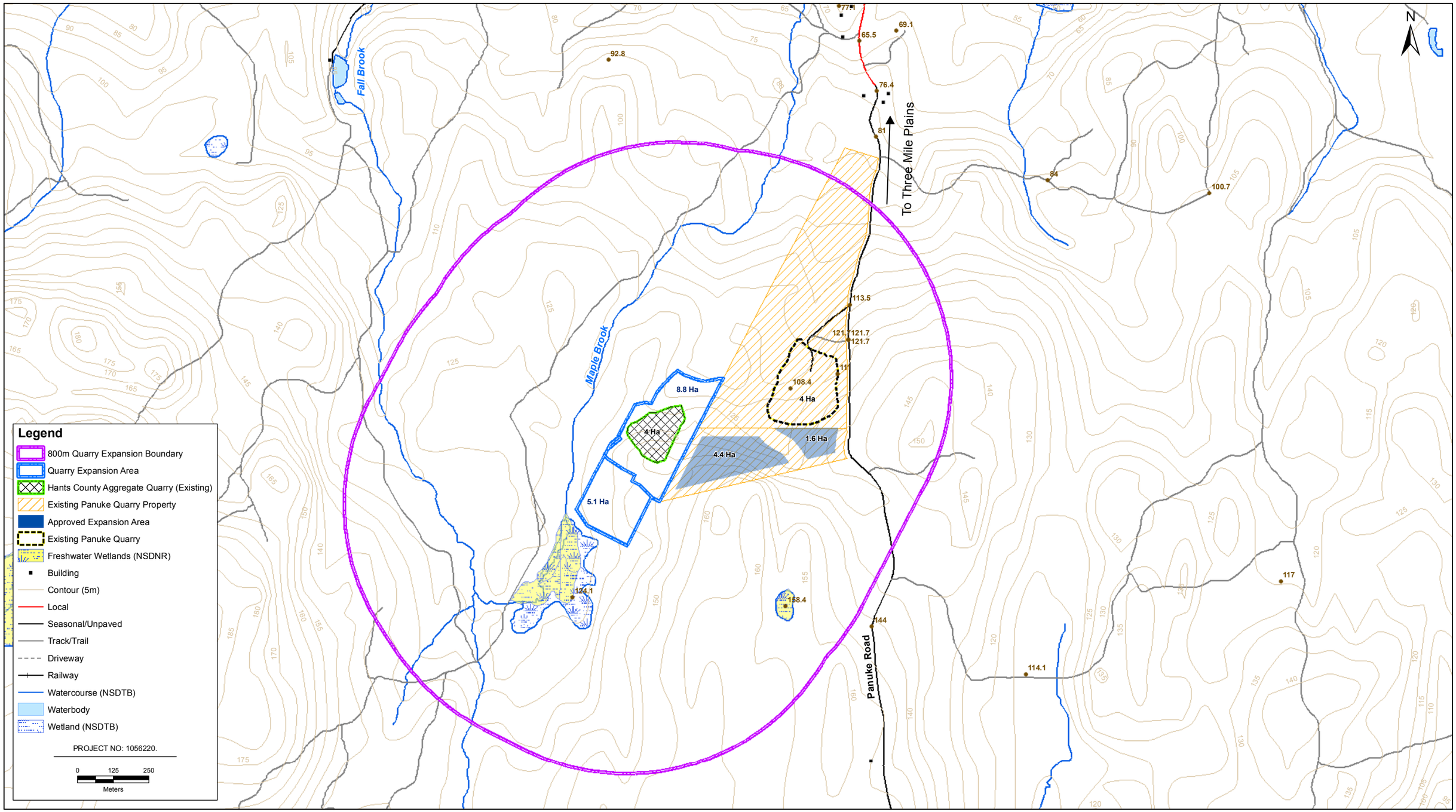
2.0 PROJECT INFORMATION

2.1 DESCRIPTION OF THE UNDERTAKING

Municipal Enterprises Limited (MEL, the Proponent) owns and operates a quarry, located at 700 Panuke Road in Three Mile Plains, Hants County, Nova Scotia, called the Panuke Quarry. MEL is currently proposing to purchase and extend an adjacent quarry, the Hants County Aggregate Quarry, and incorporate its operations as a component of the existing Panuke Quarry by amending the existing Approval permit. Both quarries are located in the West Hants Municipal District (Figure 1). The existing Panuke Quarry is operating under an Industrial Approval (No. 2001-019700-A01), pursuant to Division V of the Activities Designation Regulations, issued by Nova Scotia Environment and Labor (NSEL), effective until September 9, 2011. This permit allows for construction and operation of a quarry on property parcel number 45270493. A copy of the Approval permit is appended to this report (Appendix A).

MEL is proposing to combine the operations of the Hants County Aggregates Quarry with the existing Panuke Quarry. The current operation at Hants County Aggregates is 3.9 hectares (ha) in area. The proposed extension of the existing Hants County Aggregates Quarry will incorporate land north, south and southwest of the existing quarry to increase the total size of the operation to approximately 13.9 ha (not including the adjacent Panuke quarry). Blasting, crushing and stockpiling of aggregate currently takes place at the Hants County Aggregate site and this is not expected to change. The quarried material at this site is primarily used for Nova Scotia Transportation and Infrastructure Renewal (NSTIR) projects; but after amalgamation with Panuke Quarry, the intent is that the Hants County Aggregates site will be used for both NSTIR contracts and general contracts. The existing Panuke quarry is approximately 4.0 ha in area and has an approved extension area of 6 ha. It is primarily used as a source of aggregate in the making of asphalt. The combined operations will cover an area of 23.9 ha. The proposed activities will take place over a period of time until the material is exhausted. Based on current estimates, there are over 1 million tonnes of rock reserves on both properties. The extended Hants County Aggregate site could therefore sustain aggregate production for approximately 10 years.

Proposed project activities will be consistent with current quarry operations at the Hants County Site. Aggregate production includes drilling and blasting, which is conducted by a licensed blasting contractor. Blasting takes place approximately one to two times per year. After blasting, portable crushing equipment is brought to the site to process the blasted rock. Various products (*i.e.,* various aggregate sizes) are 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 estimated truck traffic will be consistent with current truck volume at the existing quarry and will only increase, for a short period of time, if a large aggregate supply contract were awarded.



DATE: 07/06/2010	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **Figure 1**
PREPARED BY: G. MESHEAU		
MUNICIPAL ENTERPRISES LIMITED	**PROJECT LOCATION**	Stantec

The anticipated average production rate at the Hants County site is approximately 60,000 to 100,000 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 quarry will be open nine months of the year, however the portable crushing equipment is only on site two to three times a year for duration of ten days to two weeks a time. This proposed schedule is consistent with the current operating schedule.

2.2 GEOGRAPHIC SETTING

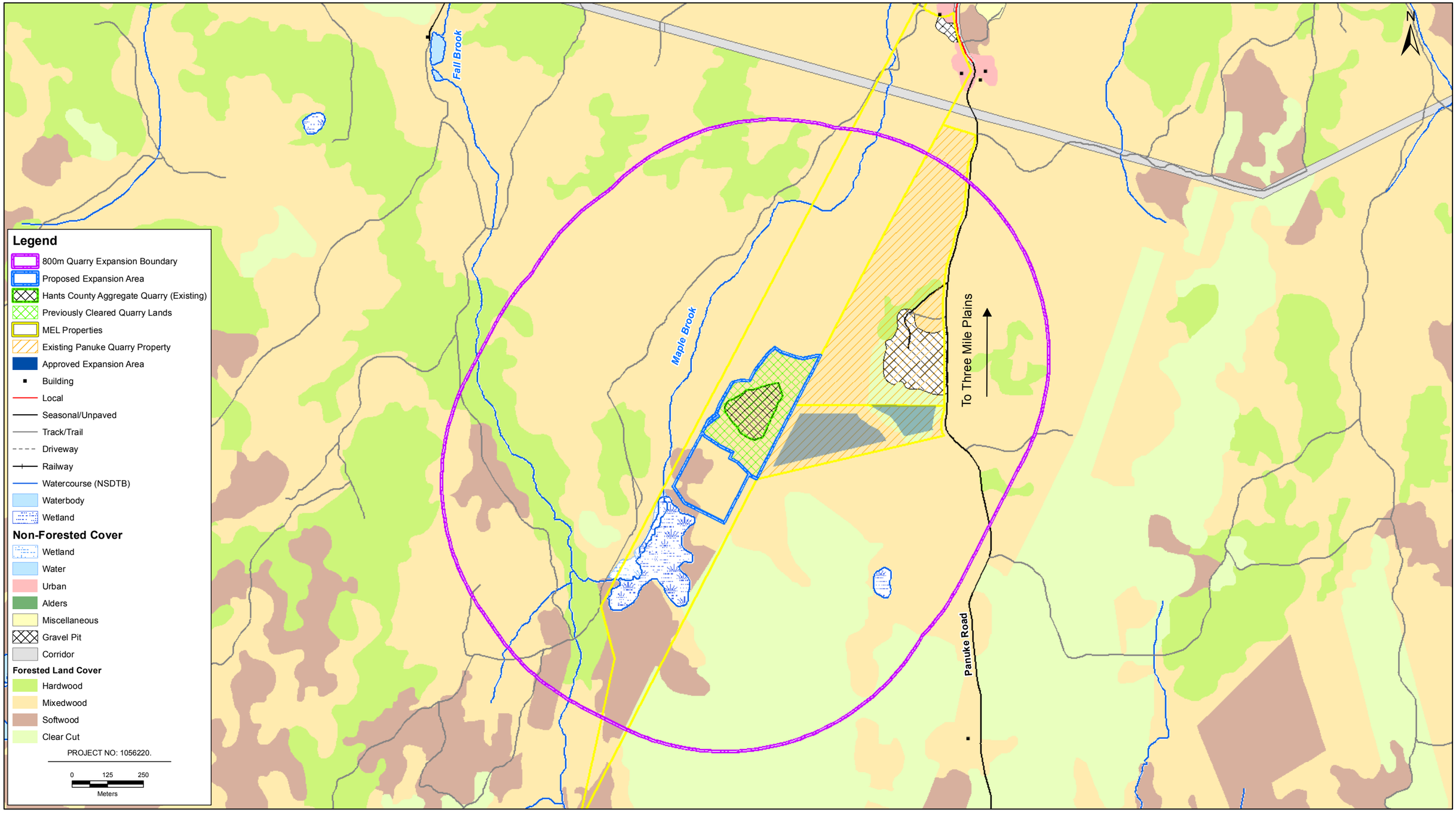
Hants County Aggregate is in the small community of Three Mile Plains, Hants County, Nova Scotia (Figure 1). It is located at the following geographic coordinates: 414006 E and 4976415 N. The Project property is bounded at its northeast extent by the Panuke Quarry and at its southwest extent by a major wetland complex, and the existing quarry operation is accessed via a private road extending off Panuke Road. The existing Panuke Quarry is situated on lands that are owned by the Proponent that have undergone various stages of clearing. MEL proposes to purchase and extend the existing Hants County Aggregate operation and amend the Panuke Quarry's existing Approval permit to include the Hants County Aggregate Quarry.

The surrounding lands are mostly undeveloped. The eastern half of the Project area has been highly modified by human activities. This area is primarily occupied by the existing quarry pit as well as by land that has been cleared and grubbed of its vegetation. Recently clear-cut (within approximately five years) forest surrounds the southern and western ends of this highly disturbed area (Figure 2). The western half of the Project area is forested and primarily comprised of immature mixedwood. The mixedwood forest grades into a stand of immature hardwood within the northern end of the Project area. There is one major wetland and a brook located southwest of the existing Hants County Aggregate Quarry and extension area. The Proponent has redesigned the Project to avoid interactions with the wetland and watercourse identified onsite.

Residential development in the immediate vicinity of the Project is relatively low, with no structures unrelated to the quarry within 800 m. A local road with a low distribution of residential development extends east of the proposed extension area, approximately 3 km, to Trunk 1 (Figure 1). The zoning of the land area is General Resource.

2.3 PROJECT COMPONENTS

The existing quarry operations at the Hants County Aggregate site consist of a laydown area for the portable crushing equipment, various aggregate stockpiles, quarry floor and working face, settling pond, scale and scale house, and access road. The existing property currently does not have liquid asphalt permanently stored on site, it is delivered to the site while making asphalt and it is removed thereafter. Fuel oil is stored on site in temporary above ground storage containers. These materials are currently handled in accordance with existing regulations and this will continue following the extension. No new fuel storage or dangerous goods will be associated with the proposed extension.



DATE: 07/06/2010	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **Figure 2**
PREPARED BY: G. MESHEAU		
MUNICIPAL ENTERPRISES LIMITED	**LAND CLASSIFICATION**	Stantec

Overburden that has been stripped prior to drilling and blasting is stored on site for subsequent use during site reclamation. The piles have been hydroseeded to reduce potential for erosion and sedimentation. This, or similar practices will continue throughout the development and operation of the proposed extension area.

The laydown area is located on the quarry floor. The crushing equipment is transported to the site as required (*i.e.,* after blasting). Aggregate stockpiles are currently located at a dedicated location within the quarry limits, as space allows. As the quarry extends, no additional stockpile areas will be established and the existing stockpile area will be used. Surface runoff and quarry drainage are collected on the quarry floor, which has the capacity to hold a significant quantity of water. Currently, overflow from the quarry floor drains to a settling pond located directly in front of the quarry face. Additional settling pond volume will be developed with the extension of the Hants County Aggregate operations, as required (as indicated in the hydrology study Appendix B). Details regarding the amount of additional settling pond volume required for proposed quarry operations will be further refined at the Industrial Approval amendment stage.

The nearest residence is located greater than 800 m from the boundary of the proposed quarry extension limits. As shown in Figure 1, there are no businesses located within 800 m. The general direction of quarry advancement will be southwest from the existing quarry face.

2.4 SITE PREPARATION AND CONSTRUCTION

The existing quarry has been in operation for over 35 years. Access to the existing quarry development is along existing roads. To minimize the potential for erosion and sedimentation, grubbing and removal of overburden will be conducted on an as needed basis, to accommodate drilling and blasting activities. Currently approximately 8.8 ha of the extension area has already been cleared and overburden removed. Topsoil, grubbed material and overburden are stockpiled on site and have been stabilized with hydroseed for subsequent use during site reclamation. These, or similar stabilization procedures will continue throughout the operations of the proposed extension.

Quarry drainage and surface runoff collects on the quarry floor. Overflow from the quarry floor is currently directed to a settling pond located directly in front of the quarry face. Additional pond volume will be developed as the extension proceeds, as required (Appendix B). Water from the settling ponds will be used to provide a water supply for dust suppression during crushing in dry periods.

2.5 OPERATION AND MAINTENANCE

The proposed Project activities (*i.e.,* the quarry extension) will be consistent with the current quarry operations, and will be in accordance with the Pit and Quarry Guidelines (NSEL 1999) and any future issued approvals. The Pit and Quarry Guidelines apply to all pit and quarry operations in the province of Nova Scotia and provide: separation distances for operations,

including blasting; liquid effluent discharge level limits; suspended particulate matter limits; sound level limits; and requirements for a reclamation plan and security bond.

Aggregate production begins the clearing of the site, followed by the removal of overburden. The next step in the process is the drilling and blasting of the rock. It is anticipated that blasting will occur one to two times a year. 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 in 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). Excavation of aggregate in quarry operations will not take place below the groundwater table; the benched face height will be determined during the industrial approval process.

The blasted rock will be processed by portable crushing equipment that will be on site two to three times a year, for duration of ten days to two weeks at a time. Aggregate product will be stockpiled in designated areas within the quarry boundaries. 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 Panuke Road. The number of trucks hauling aggregate is expected to remain unchanged although this may fluctuate periodically due to local market conditions.

The anticipated average production rate is approximately 60,000 to 100,000 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 10 hrs/day, 5 days/week, 36 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 one seasonal employee in the scale house; however, there are up to ten employees during aggregate production. This number is expected to remain the same following site extension. Drilling and blasting activities involve additional resources; these activities are sub-contracted to a professional blasting company. Hauling of materials from the quarry also involves additional labour and equipment requirements. Hauling (or trucking) is typically arranged through the Proponent.

2.6 EFFLUENTS AND EMISSIONS

The implementation and use of environmental devices, techniques and regulations now used in the construction industry will minimize any potential environmental damage to the area. Devices such as diversion ditches, check dams, siltation ponds, straw hay mulch and hydroseeding will be used to control sedimentation, as required. All operations will be carried out in a controlled

environment to ensure sound, vibration, dust and sediment parameters are met to all Provincial and Federal guidelines and regulations.

In accordance with best practices and standard NSE requirements, runoff controls will be in place to ensure that effluent generated during operations is managed appropriately. Surface runoff at the quarry currently collects on the quarry floor and is then directed to a settling pond. Details regarding the increase in size of the settling pond required for proposed extended quarry operations and potential runoff mitigation measures are discussed in Appendix B and will be further refined at the Industrial Approval application stage.

Overflow, if any, will be monitored and sampled according to the Pit and Quarry Guidelines and conditions stipulated 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, during a significant rain fall, exceeds final effluent discharge limits as determined through monitoring, contingency measures may include pumping of sediment laden water to vegetated areas (away from watercourses) or through filter bags for additional filtration and/or use of additional filtration devices or structures. A stormwater management plan will be submitted as part of the quarry development plan during the Industrial Approval application process.

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

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

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

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

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

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

Sound monitoring will be conducted at the request of NSE.

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

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

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

During quarry operations the only hazardous materials anticipated on-site will be those associated with the normal operation of construction equipment. These substances include: gasoline, diesel fuel, lubricants and antifreeze liquid. There is one above ground diesel tank located on the Panuke Quarry site that is contained within a berm and used as a back-up fuel source should regular fuel delivery be disrupted.

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

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

In the event of a leak or spill during refueling, maintenance, or general equipment operation, immediate action will be taken to stop and contain the spilled material. All contaminated

material will be collected and stored in an appropriate manner so as not to be re-released to the environment until such time as it will be transported to an approved treatment/disposal facility. All spills will be reported to the 24-hour environmental emergencies reporting system (1-800-565-1633) in accordance with the Emergency Spill Regulations. A Spill Contingency Plan will be developed in support of the application for amendment to the existing Industrial Approval.

2.7 DECOMMISSIONING AND RECLAMATION

MEL 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 possibly be removed for operational purposes.

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

As distinct areas within the quarry become inactive, the earthen areas will be graded to a stable slope (max 2.5:1) or rock slopes (max 2:1), where required, or leveled to allow future commercial, industrial, recreational, or residential land use. These inactive areas will be covered with overburden and seeded in the absence of laying a root mat. Generally the rehabilitation will also consist of, but not be limited to: grading and contouring of all slopes and exposed rock faces in consideration of rock falls, slope stability, and safety; spreading existing stockpiled topsoil; and hydroseeding in the absence of laying a root mat.

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

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

3.0 SCOPE

3.1 SCOPE OF THE UNDERTAKING

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

3.2 PURPOSE AND NEED FOR THE UNDERTAKING

The purpose for the Project is to allow MEL to extend the existing Hants County Aggregate quarry footprint and amalgamate its operations with the existing Panuke Quarry. The quarry is currently operated according to the Pit and Quarry Guidelines for TIR contracts.

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 Hants County Aggregate Quarry is drilling and blasting. Alternative methods for extraction of the rock (*i.e.,* mechanical means) are not practical or feasible in this instance due to the nature and characteristics of the rock (*e.g.,* hard and dense). Therefore, there are no feasible alternatives to drilling and blasting as a means of extracting this material.

An alternative facility location is also not a feasible alternative. The extension is occurring in an area that has been previously disturbed and is already exposed to mining/quarrying activities. Extension of the quarry will not require immediate construction of any new facilities (*i.e.,* roads or buildings), as the existing facilities are currently sufficient for current and extended operations. Additional flow retention structures will be installed/constructed as the quarry develops to accommodate the additional surface runoff and quarry drainage (Appendix B). 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 March 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. Landowners adjacent to the quarry were contacted (see Section 4.0) for the purpose of issues identification. The Proponent also contacted representatives of the Confederacy of Mainland Mi'kmaq, the Native Council, the Mi'kmaq Rights Initiative, and the Union of Nova Scotia Indians.

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

- Surface Water Resources;
- Rare and sensitive flora;
- Wetlands;

- Wildlife;
- Groundwater;
- Archaeological and Heritage Resources;
- Air quality; and
- Socio-economic Environment.

4.0 PUBLIC INVOLVEMENT

4.1 METHODS OF INVOLVEMENT

On February 19, 2010, 105 Project Information Bulletins (Appendix C) were distributed to landowners within approximately 1.0 km of the quarry. The purpose of the bulletin was to advise local residents and businesses immediately adjacent to the existing quarry and proposed Project site (*i.e.,* those who are potentially most affected) and provide them with opportunity to comment on the proposed undertaking.

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

In early June 2010, representatives of MEL met with members of the community liaison committee, previously established for the Paunke Quarry, to discuss issues of concern. The company agreed to address most concerns and subsequent meetings are to be held.

4.2 STAKEHOLDER COMMENTS AND STEPS TAKEN TO ADDRESS ISSUES

To date, no comments have been received in relation to the information sent to the First Nations or aboriginal organization representatives.

Two local residents commented on the Public Information Sheet that was submitted on February 19, 2010. The concerns raised by these individuals and proposed resolutions are summarized in Table 4.1.

Table 4.1 Summary of Stakeholder Comments and Concerns

Stakeholder	Issue/Concern	Response/Proposed Resolution
Local Resident	1. Concerned with the potential effects that the Project could have on the nearby watershed area. 2. Concerned with the anticipated increase in traffic on Panuke Road.	1. No watercourses are expected to be affected by quarry extension. Surface runoff at the site will be managed through settling ponds and other measures and will comply with Pit and Quarry Guidelines as well as permit conditions for water quality. 2. Truck traffic will not increase as a result of the proposed Project.
Local Resident	1. Concerned with how the combining of operations (*i.e.,* Panuke and Hants quarries) will affect residents living on Panuke Road. 2. Concerned with traffic on Panuke Road.	1. The quarries are combining in the sense that there will be only one operator, that of Municipal Enterprises, for both quarries (*i.e.,* Municipal is acquiring the Hants County Aggregate Quarry). Production rates and quarry activities will remain the same. 2. Truck traffic will not increase as a result of the proposed Project.

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

5.1 ASSESSMENT METHODS

Field studies were conducted by Stantec, between September 26 and October 7, 2009, to investigate and establish the existing conditions and to determine appropriate mitigation, if necessary, to minimize environmental effects from the proposed extension Project. These surveys consisted of: vegetation survey; wetlands survey; breeding bird survey; mammal survey; and herpetile survey. These surveys were undertaken by qualified biologists employed by Stantec Consulting Ltd. (Stantec). An aquatic field survey was undertaken by qualified aquatic specialists. A desktop assessment of potential archaeological and heritage resources was undertaken by a professional archaeologist. Additional information, in support of the field studies and the assessment, was gathered through a review of: air photos; site mapping; and other information sources, such as the Nova Scotia Museum, Statistics Canada, the Nova Scotia Department of Transportation and Public Works (NSTIR), and the Nova Scotia Department of Natural Resources (NSDNR).

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

To assess the potential environmental effects of a project and determine the significance of an effect, it is important to consider the magnitude, frequency, duration, geographical extent and reversibility of the potential effect. The study team has considered these elements for each VEC.

5.2 SURFACE WATER RESOURCES

Surface Water was selected as a VEC because of the potential for Project activities to interact with the freshwater environment. Indicators of the VEC include aquatic life, fish habitat and surface water quality, as well as potential water uses for agriculture, recreation, industry or potability. There are no watercourses located within the Project Area proposed for quarry extension under the current EA. Maple Brook runs in close proximity to the Project property, coming closest to the property at its southwest corner. The Proponent has redesigned the Project to avoid interactions with this watercourse. However given its proximity to the Project property, the aquatic environment of Maple Brook was assessed under this EA.

There are no known agricultural, recreational, industrial or potable uses of Maple Brook. Maple Brook is anticipated to connect to the St. Croix River eventually, via several tributaries. While the St. Croix River may be used for recreational purposes, Maple Brook is of insufficient size to support navigation and is not known to be used for other recreational activities. Agricultural land use does occur in the area (*e.g.,* Three Mile Plains) but is not anticipated to be influenced by

Maple Brook specifically. A Protected Water Area (*i.e.,* PWA - Mill Lakes Watershed) is located in close proximity to the Project but does not encompass Maple Brook (Figure 3). The Mill Lakes Watershed PWA has been designated as such under the *Water Act* because it surrounds a public water supply source ((N.S. Reg. 264/86 2009)). Existing legislation protects all lands and watercourses within the PWA from a wide range of activities by either prohibiting or restricting certain uses and practices within the PWA. Since Maple Brook falls outside the PWA boundaries, it is not affected by the land use restrictions enforced within the PWA. Fall Brook is the next closest watercourse that does fall within the PWA. The surface water carried by Maple Brook is not known to connect with Fall Brook either within or downstream of the Project Property area (Figure 3).

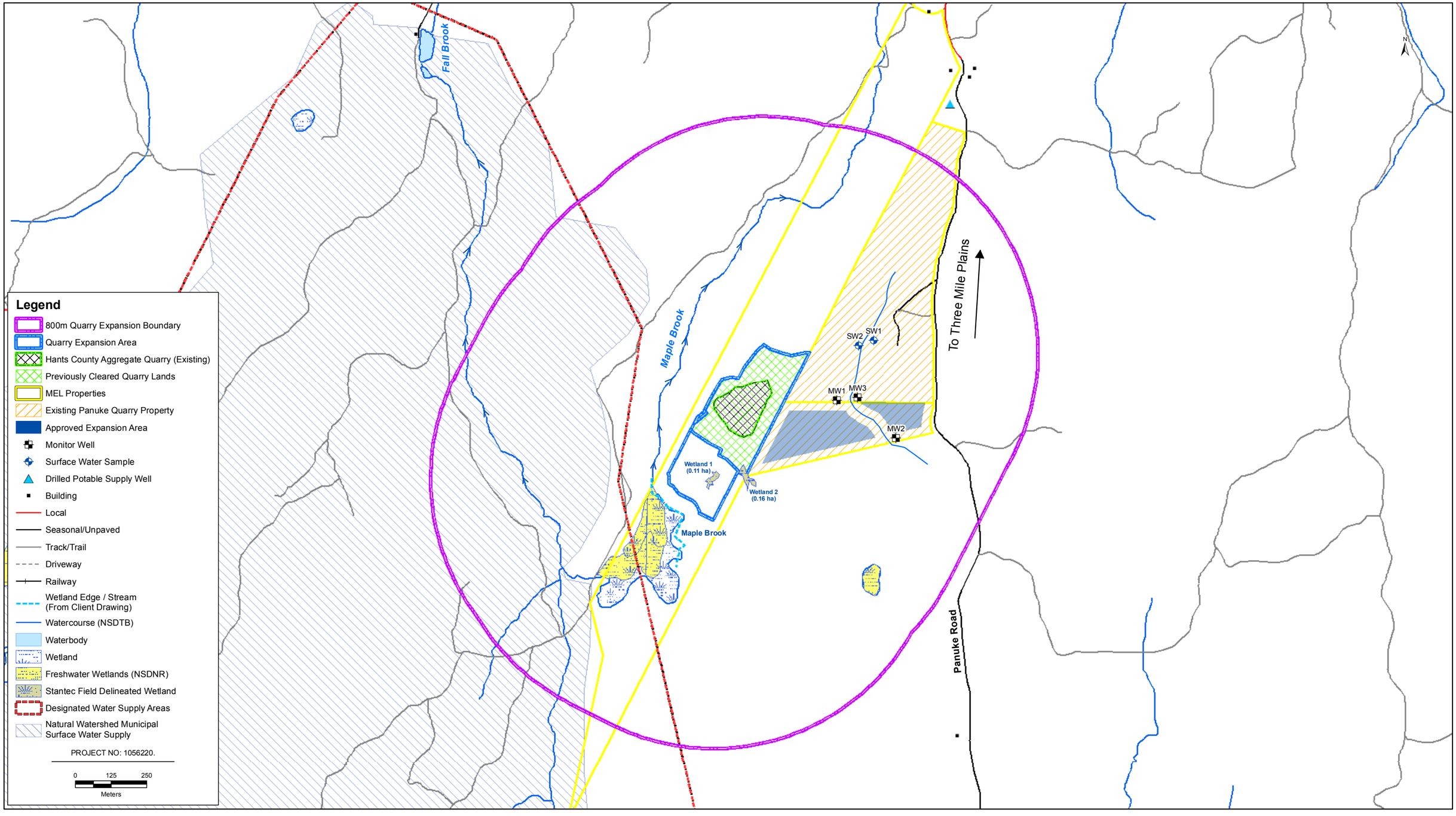
The St. Croix River and the Mill Lakes PWA are located outside the Project property. However, mitigation is suggested in the following sections to prevent downstream effects from Maple Brook on downstream aquatic environments, including the St. Croix River. The remainder of the Surface Water VEC discussion will focus on surface water quality, aquatic life and fish habitat within Maple Brook.

5.2.1 Description of Existing Conditions

Fieldwork was conducted on October 7, 2009 by two Stantec aquatic scientists. The field-based stream assessment included a fish habitat survey and *in-situ* water quality sampling within the one watercourse appearing on 1:10,000 mapping (Nova Scotia Digital Topographic Database) in the vicinity of the proposed quarry extension boundaries. As described above, the one watercourse, Maple Brook, does not cross the currently proposed extension area, but runs very close to the proposed boundary. Therefore, the watercourse was assessed and mitigation suggestions are presented. Maple Brook is expected to feed into the St. Croix River eventually via one of several tributaries to the St. Croix River, including the Lebreau Creek Brook and the Avon River (*i.e.,* Pesaquid Lake).

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

Watercourse descriptions are provided below for the one stream assessed, Maple Brook. This information details the watercourse survey results and characterizes the stream. By characterizing the watercourse, the Hants County Aggregate Quarry can ensure that appropriate mitigation is implemented. Additionally, any site-specific concerns that may require special mitigation can be identified.



DATE: 25/06/2010	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **Figure 3**
PREPARED BY: G. MESHEAU	**ENVIRONMENTALLY SENSITIVE AREAS**	Stantec
MUNICIPAL ENTERPRISES LIMITED		

Key *in-situ* water quality results are outlined for Maple Brook, as well. The intent of the water quality discussion is to compare the results with applicable guidelines from the Canadian Council of Ministers of the Environment (CCME). Specifically, results are compared with the CCME guidelines for the protection of freshwater aquatic life (CCME-FAL 2007) to determine the likelihood that the watercourse can or cannot support aquatic life. Additionally, the collection of water quality data prior to proposed Project activities helps to establish a baseline against which pre-, during-, and post-construction water quality data can be compared. The water quality parameters collected *in-situ* using a handheld multimeter (YSI 556) includes dissolved oxygen, pH, specific conductivity and water temperature. These parameters experience natural variation on a seasonal and annual basis. The results presented in the current report represent the surface water quality in the watercourse at a single point in time.

No electro-fishing was conducted during this survey as DFO regulations prohibit electro-fishing in the St. Croix River and its tributaries. Photographs were taken along the stream to document habitat (see Appendix D).

Watercourse Description

Maple Brook is a well defined stream running outside the western edge of the existing Hants County Aggregate Quarry property boundaries and flows north. The watercourse falls within the Hants County Aggregate Quarry property boundaries and comes closest to the quarry extension area at the southern end of the currently proposed extension boundary (Figure 3). It is expected that the watercourse eventually drains into the St. Croix River through one of several potential tributaries to that river, although connectivity to these downstream tributaries was not confirmed during the field assessment. The stream can be characterized as a heavily tea stained, perennial stream supporting multiple substrate types and flow patterns. The stream water quality is influenced by the wetlands in the area.

At the time of the survey, the stream supported high flows following a substantial rain event (approximately 50 mm) 24-48 hours prior to the field-based assessment. The stream characteristics varied from wide, relatively shallow stream with a rocky, cobble-dominated substrate surrounded by mixed forest (see photos 1-2, Appendix D) to a progressively narrower, deeper stream feeding through a wetland (see photos 3-6, Appendix D) closer to the proposed extension boundary. Macrophytes were present throughout the assessment area, with some sections supporting abundant aquatic vegetation. Woody debris was also present throughout the stream and in some areas could be considered abundant. In the upstream portion of the assessed stream area, close to the proposed extension boundary, the flow type was predominantly a run. In the downstream, rocky substrate section outside the Hants County Aggregate Quarry property boundary riffles and some shallow pools were also observed.

Additional physical habitat features are summarized for the watercourse in Table 5.1. These measurements were collected at a single point in time and as such will experience natural variation seasonally.

Table 5.1 Summary of Stream Assessment at Hants County Aggregate Quarry

Date & Time	**7-Oct-09**
Site Coordinates	**413228E 4975963N**
Site Description Site Measurements and Characteristics	Maple Brook
Precipitation Previous 24 hours	None (~50 m rain from 24 – 48 hours previous to assessment)
Wetted Width average (m)	2.2
Bankfull Width average (m)	2.2
Depth (min. - max. range) (cm)	50
Woody Debris (range throughout site)	Present - abundant
Macrophytes (range throughout site)	Present - abundant
Algae	Present
Canopy Cover (%) (range throughout site)	0 - 80
Riparian Vegetation (Dominant)	Mixed Forest and Wetland
Water Quality	
DO (mg/L)	6.88
DO (%)	62.6
Water Temperature (˚C)	11.18
pH	5.49

Generally, the water clarity was good, with no signs of turbidity. A section along the north side (down gradient) of the existing quarry is protected by a silt fence. The *in situ* water quality results collected in the stream (Table 5.1, above) confirm that Maple Brook has the potential to support aquatic life when compared to the CCME-FAL guidelines. As is often observed in various areas in Nova Scotia, the pH level measured in Maple Brook was somewhat acidic (5.49). The pH fell below the CCME guidelines of 6.5-9.0 but is within the range known to support aquatic life in Nova Scotia. Low pH or acidic waters are common in various areas of the province. Acidification can be caused by a variety of combinations of anthropogenic and natural soil composition conditions such as high sulfur content, which, once becoming oxidized leaches into the ground and surface water, lowering pH (Goodwin, 2004). The dissolved oxygen (DO) recorded in the stream at the time of the survey met the CCME guidelines for the lowest acceptable DO concentration for early and other life stages of aquatic life.

None of the watercourses identified on the Project Property are known to interact with drinking water supplies or other protected surface waters, although the Mill Lakes Watershed PWA is in the vicinity, as discussed above. The assessment presented below concerning hydrogeology and groundwater on the site (*i.e.,* Section 5.6.2), discusses a water well review for the Project Property. Available mapping information was reviewed to determine the probable locations of water wells within 800 m of the Project area. No wells were found to be located within the 800 m Project Area. Further consideration of water wells and hydrogeology in the general area is presented in Section 5.6.2 below.

With implementation of the mitigation described herein to protect on-site surface water and prevent effects downstream in the Avon River, St. Croix River, and their tributaries, no impact to surface waters is anticipated to result from the proposed Project Activities.

Fish Survey Results

Maple Brook was not electrofished during the stream survey. DFO regulations prohibit electrofishing in the St. Croix River and its tributaries, which Maple Brook is anticipated to drain into. Electrofishing is prohibited in these and other inner Bay of Fundy (iBoF) waters because the iBoF populations of Atlantic salmon (*Salmo salar*) are listed as endangered on Schedule 1 of the federal *Species at Rick Act* (*SARA*). The water quality, varying flow patterns and diverse substrate types observed with the surveyed area during the field based stream assessment confirm that Maple Brook has the potential to support small bodied and large bodied fish species at various stages of their life history (*e.g.,* migration and feeding). However, no iBoF Atlantic salmon spawning habitat (*i.e.,* well aerated gravel beds) was observed within the assessed section of the stream survey. Therefore, neither iBoF Atlantic salmon nor other species of salmonids are expected to spawn within with section of the stream located in proximity to the proposed extension area. Appropriate mitigation must nevertheless be undertaken to prevent potential downstream effects on fish and fish habitat, including potential salmonid habitat elsewhere in the drainage system.

Summary

During the October sampling period, one watercourse was confirmed on the Hants County Aggregate Quarry site, Maple Brook. The watercourse exhibited clear, flowing, tea-stained water and instream habitat capable of supporting aquatic life at the time of the survey. The water from Maple Brook is anticipated to drain into the St. Croix River downstream through one of the River's several tributaries. Therefore, fish sampling was not carried out. No salmonid spawning habitat was observed within the section of stream assessed, in the vicinity of the proposed quarry extension area. The potential for downstream effects within the St. Croix River, the Avon River, and their tributaries must be mitigated.

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

Potential Surface Water Quality and Aquatic Habitat Effects

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

Other potential environmental effects on surface water quality that may occur during quarry activities include increases in total suspended sediments (*i.e*., increased turbidity), a change in hydrologic conditions, and changes in pH from runoff. These changes in surface water quality can lead to effects on the benthic invertebrate community, in addition to potential physical effects resulting from sedimentation and siltation. There are no known reported acid generating rocks in the existing quarry, so it is unlikely that acid drainage from mineralized zones will occur from the quarry activities. Acid drainage affects the pH of surface water systems by increasing the acidity of the water and as such is very detrimental to aquatic life.

An accidental release of deleterious substances associated with quarry site activities (*e.g.*, nitrates from blasting agents and petroleum hydrocarbons from heavy equipment) also have the potential to affect water chemistry down gradient of the accidental release site if the deleterious substance is not controlled. Nitrates have the potential to cause nutrient enrichment in freshwater systems and petroleum hydrocarbons can cause general contamination of the water and aquatic habitat.

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

Mitigation of Effects

No active quarry components will be located within 60 m of the banks Maple Brook without prior government approval. No Project-related vehicles will be driven through streams. Natural vegetation will be maintained within this buffer. If avoidance of the watercourse is not possible in the future, approval to alter the watercourse must be granted under the Nova Scotia Activities Designation Regulation. Prior to filing a Watercourse Alteration Approval application, a site visit may be needed to update the stream habitat assessment. Streams are dynamic environments subject to physical and chemical change over time and as such should be reassessed if more than two years have passed since the initial assessment. Alteration of Maple Brook is currently not planned during the life of the quarry extension.

In addition to provincial regulations, any alteration of Maple Brook would also have to be approved by Fisheries and Oceans Canada (DFO). The surveyed area of Maple Brook showed diverse habitat and good water quality anticipated to support fish. DFO has developed the Policy for the Management of Fish Habitat (DFO 1986), which applies to all development and industrial projects in or near watercourses that could harmfully alter, disrupt, or destroy fish habitat by chemical, physical, or biological means *(i.e.,* HADD). The guiding principle of this policy is to achieve no net loss of the productive capacity of fish habitats. Appropriate mitigation is required to prevent effects on fish and fish habitat within Maple Brook as well as further downstream in the drainage system.

Clearing, grubbing, and topsoil stripping activities can increase the potential for sediment erosion and deposition down gradient, particularly during periods of heavy rainfall or snow melt. These activities will also result in a reduction of evapotranspiration and a corresponding increase in surface runoff, which in turn increases potential for sediment erosion and deposition.

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

Accidental release events associated with the Project have potential to result in environmental effects. Precautions and preventative measures will be taken to minimize potential for the occurrence of accidental events that may occur during the life of the Project and to reduce the impacts of any associated environmental effects. It is difficult to predict the precise nature and severity of accidental events. However, the probability of serious accidental events or those causing significant adverse environmental effects is low, particularly when construction and operation procedures incorporate environmental protection and contingency and emergency response plans. Spills of petroleum, oils, lubricants or blasting material may occur during quarry activities during refuelling of machinery, maintenance activities, and failure of hydraulic lines or storage containers. These spills are usually highly localized and readily cleaned up by onsite crews using standard spill remediation equipment.

Based on the results of the 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 Maple Brook or other surface water resources are not likely to occur.

5.3 RARE AND SENSITIVE FLORA

5.3.1 Description of Existing Conditions

The site was surveyed by Stantec botanists on September 26, 2009 and during June 7, 2010. A vascular plant inventory of the Project area was compiled during the surveys and habitat descriptions were performed. The Project area supports a number of upland habitat types including immature mixedwood, softwood and hardwood forest, clear-cut, and disturbed area. Two wetlands are also present within the Project area. Whereas both of these are mixedwood treed swamps, a large portion of one is at an early stage of successional development following tree harvesting activities.

The eastern half of the Project area has been highly modified by human activities. This area is primarily occupied by the existing quarry pit as well as by land that has been cleared and grubbed of its vegetation. Recently clear-cut (within approximately five years) forest surrounds

the southern and western ends of this highly disturbed area. Tree cover within the clear-cut portions of the site is negligible, but regenerating red maple (*Acer rubrum*) and large-tooth aspen (*Populus grandidentata*) form a prominent shrub layer. Red raspberry (*Rubus idaeus*) is abundant within this habitat as are a number of herbaceous taxa, including bristly sarsaparilla (*Aralia hispida*), dwarf dogwood (*Cornus canadensis*), bracken fern (*Pteridium aquilinum*), and poverty oat-grass (*Danthonia spicata*).

The western half of the Project area is forested and primarily comprised of immature mixedwood. Tree cover within this habitat is dominated by red maple and balsam fir (*Abies balsamea*), although other species, such as quaking aspen (*Populus tremuloides*) are present. A moderate shrub layer is dominated by balsam fir and red spruce (*Picea rubens*), with lesser amounts of red maple and sheep-laurel (*Kalmia angustifolia*) also being present. The herbaceous layer is comprised of a diversity of species, including bracken fern, dwarf dogwood, goldthread (*Coptis trifolia*), whorled aster (*Oclemena acuminata*), eastern hay-scented fern (*Dennstaedtia punctilobula*), and clinton lily (*Clintonia borealis*). An intermittent moss cover is provided by three-lobed bazzania (*Bazzania trilobata*) and red-stemmed moss (*Pleurozium schreberi*).

The mixedwood forest grades into a stand of immature hardwood within the northern end of the Project area. Tree cover within this habitat is comprised of a diversity of species, including large-tooth aspen, red maple, white ash (*Fraxinus americana*), balsam fir, and sugar maple (*Acer saccharum*). An intermittent shrub layer is primarily formed by balsam fir and white ash along with scattered occurrences of American fly-honeysuckle (*Lonicera canadensis*). Common herbaceous species within the mixedwood forest include clinton lily, wild lily-of-the-valley (*Maianthemum canadense*), violet (*Viola sp*.), and spinulose shield fern (*Dryopteris carthusiana*).

A pocket of immature softwood forest is present within the northwestern corner of the Project area. This habitat has a dense overstory canopy comprised of balsam fir, red maple, red spruce (*Picea rubens*), and scattered eastern white pine (*Pinus strobus*). Balsam fir and red spruce also form a moderate shrub layer within this habitat. A minimal herbaceous layer is comprised of scattered occurrences of wild lily-of-the-valley, clinton lily, partridge-berry (*Mitchella repens*), and painted trillium (*Trillium undulatum*). The well-shaded forest floor has a well-developed moss layer consisting primarily of red-stemmed moss, stair-step moss (*Hylocomium splendens*), three-lobed bazzania, and broom moss (*Dicranum sp*.).

The mixedwood treed swamps are located within the western half of the Project area. Tree cover within these wetlands is comprised of red maple, white ash, quaking aspen, as well as lesser amounts of balsam fir and black spruce (*Picea mariana*). These tree species also form an intermittent shrub layer within the swamps. The composition of herbaceous vegetation varies considerably within the wetlands and is dominated by both forbs and graminoids including three-seed sedge (*Carex trisperma*), dwarf dogwood, fowl manna-grass (*Glyceria striata*), and New York fern (*Thelypteris noveboracensis*). The hummocky character of these swamps is expressed by the moss layer which is comprised of a patchy arrangement of peatmoss (*Sphagnum spp*.) interspersed with species that are more characteristic of upland conditions, including stair-step moss and red-stemmed moss.

Approximately half of one of the swamps has been recently (within approximately five years) clear-cut. This habitat is characterized by extensive coverage of cottongrass bulrush (*Scirpus cyperinus*). A number of other graminoids are also common however, including brownish sedge (*Carex brunnescens*), rough bentgrass (*Agrostis hyemalis*), and Canada manna-grass (*Glyceria canadensis*). New York fern is also an important component of the herbaceous layer. A well-developed shrub layer is present within portions of the cut-over swamp and is comprised of a mixture of species, including red maple, quaking aspen, gray birch (*Betula populifolia*), red raspberry, and white ash.

Rare Vascular Plants

Prior to field surveys, 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 considered by the Nova Scotia Department of Natural Resources (NSDNR) to be "at risk", "may be at risk" (*i.e.,* Red listed) or "sensitive" to human activities or natural events (*i.e.,* Yellow listed) within a radius of 100 km from the Project area were compiled by means of an Atlantic Canada Conservation Data Center (ACCDC) data search (these records were originally obtained by Jacques Whitford (2008) as part of an EA on the adjacent Panuke Quarry property). The habitat requirements of these species were compared to the habitat descriptions compiled for the Project area to determine if suitable habitat was present for these taxa. Knowledge of the habitats present within the Project area was determined through 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 were also incorporated into the model in order to determine when the rare or sensitive taxa would be best identified.

A total of 189 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, 50 of these could potentially be present within the Project area, including 25 Red-listed and 25 Yellow-listed species. One "species at risk" protected by the *Nova Scotia Endangered Species Act* (NSESA), northern white cedar (*Thuja occidentalis*), was identified as being potentially present within the Project area. This species is listed as "vulnerable" by the province and was considered to potentially inhabit the swamps of the Project area. No federally designated "species at risk" were identified as being potentially present. The results of the model suggested that there was 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 were associated with wetlands and intact mixed/deciduous forests, these habitats were considered to be most likely to harbour rare or sensitive taxa. Appendix E 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 2009 – 2010 surveys were identified and their population statuses in Nova Scotia determined through a review of the species rankings

prepared by NSDNR (NSDNR 2010), ACCDC (ACCDC 2010), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2009), and those protected by the provincial *Endangered Species A*ct (NSDNR 2007b). No rare or sensitive taxa, as identified by COSEWIC, the provincial *Endangered Species Act*, or NSDNR were encountered during the field survey. However, two provincially uncommon taxa, as identified by the ACCDC were encountered. A list of the 191 vascular plant taxa found on site during field surveys and information on their population status is provided in Appendix F.

Although considered secure in the province by NSDNR, the populations of two orchids, large roundleaf orchid (*Platanthera orbiculata*) and hooker orchis (*Platanthera hookeri*) are given a ranking of "S3" by the ACCDC indicating that they are uncommon and are of long-term concern. Large roundleaf orchid is scattered throughout the province in damp, shaded forests (Zinck 1998). Thirty-one individuals of this species were encountered within the hardwood and mixed wood stands of the Project area. Hooker orchis is typically associated with mixed woods (Zinck 1998) and was observed at two locations on the property during the spring plant survey.

The timing of the spring and fall plant surveys was appropriate for identifying the list of species highlighted during the rare plant modeling exercise. Although some of the rare or sensitive plants would have flowered outside the timing of the survey, most are readily identified by their seeds and/or general morphological characteristics, such as leaf shape. Furthermore, botanical inventories of the adjacent Panuke Quarry property (JWL 2008), conducted on July 7 and August 8, 2006; and June 20 and August 18, 2007, did not reveal the presence of any Red or Yellow listed species.

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

The Project has the potential to influence the populations of plant species by causing direct habitat loss and indirectly through changes in habitat conditions, such as may be brought about by altered hydrological regimes. However, no federally or provincially designated "species at risk" or rare or sensitive plants, as identified by NSDNR (2010) were found within the Project area. Additionally, previous botanical inventories conducted on the adjacent Panuke Quarry property (JWL 2008) did not encounter any rare or sensitive vascular plants. Although two provincially uncommon species were encountered within the Project area (roundleaf orchid and hooker orchis), it is not expected that Project activities will cause a significant adverse effect on their populations and specific mitigative measures are not necessary for these taxa.

Other mitigation employed in the extension of the quarry will include the use of progressive reclamation and the use of native plant species wherever possible in the reclamation process. In the progressive reclamation process only the area needed for quarry extension in any one year would be grubbed. The subsoil, topsoil and root mat of this area would be placed in a portion of the pit that is no longer in use. Topsoil and root mat would be stockpiled temporarily (no more than one year) until the subsoil was placed. The topsoil would then be placed over the subsoil and dressed with the root mat. The root mat would provide a source of native plant species propagules in the form of buried seeds, roots, shoots and rhizomes as well as soil

micro-organisms, however, hydroseeding stockpiles is an acceptable alternative to utilizing root mats. 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 wetland and forest plant communities which are present in the area should be used for reclamation.

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

5.4 WILDLIFE

5.4.1 Description of Existing Conditions

Information regarding use of the Project area by wildlife was derived from several sources including field surveys and a review of existing data. A field survey of the project area was conducted concurrently with the plant inventory during September 26, 2009 and recorded information on the presence of birds, mammals, and herpetiles (amphibians and reptiles). Following this, a breeding bird survey was conducted during June, 2010, along with additional wildlife observations. Results from field surveys performed on the adjacent Panuke Quarry property as part of a previous EA (JWL 2008) were also reviewed. 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 2007a) were also consulted to provide records of wildlife in the vicinity of the Project area.

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 records were originally obtained by Jacques Whitford as part of an EA on the adjacent Panuke Quarry property (JWL 2008).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” or “may be at risk” (i.e., Red listed) or “sensitive” to human activities or natural events (i.e., Yellow listed) within a radius of 100 km were compiled. The habitat requirements of these species were compared to the habitat descriptions compiled for the Project area to determine if suitable habitat was present. 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. Its eastern half is primarily occupied by the existing quarry pit as well as by land that has been cleared and grubbed of its vegetation. These disturbed habitats are surrounded by recently clear-cut forest along their southern and western ends. The western end of the Project area is comprised of immature

forest. Although primarily mixedwood, stands of softwood and hardwood forest are also present. Additionally, two marginal wetlands are present within the Project area. Whereas both of these are mixed treed swamps, half of one has been recently clear-cut. Neither of these wetlands had any surface water at the time of visitation but evidence of ephemeral flooding was present.

Birds

Information on the distribution and abundance of birds within the Project area was primarily obtained during a breeding bird survey. This survey took place during the evening of June 7th and in the morning of June 8th, 2010 between the hours of 07:00 and 11:00. During this time, representative habitats on the property were visited by a birder with 20 years experience and all birds heard or observed were recorded. Additional observations of bird activity within the Project area were made on September 26, 2009. The breeding status of each species observed during these visits was determined with the criteria used in the Atlas of Breeding Birds of the Maritime Provinces (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.

Several sources of information on the distribution and activity of birds within the vicinity of the Project area were reviewed prior to the breeding bird survey. In particular, data from an existing EA for an adjacent property (JWL 2008) and from the Maritimes Breeding Bird Atlas (MBBA) were used to help identify species of conservation occur that could potentially occur on site, as well as their breeding status. The breeding bird survey on the adjacent Panuke Quarry property was conducted by Jacques Whitford Limited on July 7, 2006 and June 20, 2007 between the hours of 06:00 and 12:00. The 2006 breeding bird survey included areas within the central and western portions of the current Project area. The Maritimes Breeding Bird Atlas (MBBA) database (Erskine 1992, MBBA 2009) provides information on the distribution and abundance of birds within 10 km X 10 km census squares across the Maritime Provinces of Canada. The MBBA square in which the Project is located (20MQ17) was used to compile a list of breeding birds that have been recorded within the vicinity of the site. The breeding status of each species obtained from these data sources were determined using the criteria outlined by the Atlas of Breeding Birds of the Maritime Provinces. In addition, the ACCDC modeling results were also consulted to identify any additional birds that could potentially inhabit the site.

The population status of each species identified by the field surveys and additional sources was determined using up-to-date sources. Lists of provincially rare or sensitive birds were derived from the General Status of Wildlife in Nova Scotia (NSDNR 2010), Species at Risk in Nova Scotia (NSDNR 2007b), and the ACCDC (ACCDC 2010). The statuses of nationally rare species were obtained from COSEWIC (2009).

A total of 82 bird species have been identified by the MBBA and the field surveys within the vicinity of the Project area. Of these, 68 have been recorded by the MBBA, 32 were encountered during 2006 - 2007 field surveys in the vicinity of the site, and 34 were identified during 2009 - 2010 surveys of the current Project area. Of those recorded by the MBBA, the breeding status of 22 was confirmed, 31 identified as probable, 15 classified as possible, and one species was observed which exhibited no indication of breeding. The species recorded during the 2006 – 2007 field surveys included four which were confirmed breeders, 11 that were identified as probable, and 21 which were classified as possible breeders. Field surveys of the Project area itself during 2009 – 2010 identified six species as probable breeders, 27 as possible, and one additional species was observed which exhibited no indication of breeding. Appendix G 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.

Of the species recorded during the 2009 – 2010 surveys of the Project area, five may be considered to be of conservation concern. Although not protected by the NSESA or the federal *Species at Risk Act* (SARA), the populations of eastern wood-pewee (*Contopus virens*), golden-crowned kinglet (*Regulus satrapa*), gray jay (*Perisoreus canadensis*), ruby-crowned kinglet (*Regulus calendula*), and yellow-bellied flycatcher (*Empidonax flaviventris*) are all considered "sensitive" within the province by NSDNR (2010). The sensitive rankings assigned to these species reflects a decline in their Nova Scotian populations, as brought about by many factors within both their winter and summer grounds; including habitat loss, fragmentation, anthropogenic climate change, and other stressors.

Eastern wood-pewees have just recently been ranked as sensitive by NSDNR. In addition, they are currently assigned a rank of "S3S4B" by the ACCDC indicating that they are uncommon to fairly common throughout their range in the province but are of long-term concern. Within Nova Scotia, eastern wood pewees are typically associated within and at the edges of forests, particularly those with a moderate to high hardwood component. During the 2010 breeding bird survey, two male eastern wood pewees were observed singing in the Project area, where they were associated with both hardwood and mixed wood stands. The population of eastern wood pewee has shown widespread decline, especially in central North America, including Nova Scotia (CWS 2009). Although the cause of this decline is largely unknown, one potentially contributing factor has been identified as an overpopulation of white-tailed deer in eastern forests. That is, in areas with high deer density, the intermediate forest canopy is disturbed by browsing which affects the foraging space of the eastern wood pewee.

Golden-crowned kinglets have also just recently been assigned a status of "sensitive" by NSDNR. The ACCDC assigns a rank of "S4" to this species indicating that although they are fairly common throughout their range in the province, they are of long-term concern. Golden-crowned kinglets are typically found in dense coniferous stands of the province where they are year-round residents. Two males were heard singing within the mixed woods of the Project area during the 2010 breeding bird survey and this species is therefore classified as a "possible" breeder on the site. An individual was also observed on the property during the site visit in September of 2009, suggesting that this species is a year-round resident of the Project area.

The golden-crowned kinglet is one of the most commonly encountered forest songbirds in the province but has been assigned a “sensitive” ranking due to perceptions that its population is declining and that it is sensitive to logging initiatives.

Gray jays are considered sensitive by NSDNR and are ranked “S3S4” by the ACCDC indicating that they are uncommon to fairly common throughout their range in the province but are of long-term concern. Gray jays are year-round residents of Nova Scotia and are associated with coniferous woodlands where they build their nests in spruce or fir trees. A pair of gray jays was observed within the mixed / conifer dominated forests at the western end of the Project area during the 2009 site visit. As a result of being observed within suitable breeding habitat, they have been classified as “possible” breeders within the Project area. However, their absence from the Project area during the 2010 breeding bird survey suggests that the earlier observation may have been of individuals passing through the site rather than utilizing it for more intensive purposes. Gray jays have shown a slight decline in abundance in Nova Scotia during the last few decades. Due to their association with boreal habitat conditions, they are particularly sensitive to anthropogenic climate change at the southern end of their range (which includes Nova Scotia).

Ruby-crowned kinglets have just recently been ranked as sensitive by NSDNR and are given a rank of “S4B” by the ACCDC indicating that they are fairly common throughout their range in the province, but are of long-term concern. A male ruby-crowned kinglet was observed singing within the mixed woods of the Project area (it’s typical habitat within the province) and is therefore classified as a possible breeder. For reasons unknown, the population of this species has shown a steady decline in Nova Scotia during the last several decades (CWS 2009).

Yellow-bellied flycatchers have also been recently assigned a status of “sensitive” by NSDNR. In addition, they are assigned a rank of “S3S4B” by the ACCDC indicating that they are uncommon to fairly common throughout their range in the province and are of long-term concern. This species is associated with a variety of habitats, including swamps and damp coniferous woods and was observed singing within the mixed woods of the Project area. The sensitive ranking assigned to this species by NSDNR is expected to reflect a general decline in its abundance within the province, as may be brought about by a number of interacting factors.

Although no federally or provincially designated “species at risk” were observed during recent field surveys of the Project area, the 2006 – 2007 field surveys conducted for the adjacent Panuke Quarry EA identified both common nighthawk (*Chordeiles minor*) and Canada warbler (*Wilsonia canadensis*) as occurring in the vicinity of the Project area.

Common nighthawks are classified as “threatened” by both COSEWIC and the province of Nova Scotia. In addition, they are regarded as “at risk” by NSDNR and are given a ranking of “S3B” by the ACCDC indicating that breeding populations are uncommon throughout their range in the province and are of long-term concern. Common nighthawks nest on the ground usually in cut-over and burned forests or on the flat roofs of buildings in urban areas (Erskine 1992). This species has undergone moderate population declines particularly among the urban nesting

populations. A single common nighthawk was flushed from a clear-cut on the adjacent Panuke Quarry property during the 2007 breeding bird survey. Based on the common nighthawk being observed in suitable nesting habitat, it was classified as a possible breeder. Although the presence of recently cleared forest within the Project area provides some potential habitat for this species to inhabit the site, it was not observed during the 2010 breeding bird survey and is therefore not expected to currently utilize the site.

Canada warblers have recently been assigned a "threatened" status by COSEWIC, but are not listed as a "species at risk" under the *Nova Scotia Endangered Species Act*. They are, however, considered "at risk" by NSDNR and are ranked as "S3B" by the ACCDC indicating that breeding populations are uncommon throughout their range in the province and are of long-term concern. Canada Warbler is a forest interior species and is usually found in the dense understory vegetation of wet mature to mid-age hardwood and mixed forests (Erskine 1992). Although this species has undergone significant population declines, it is still fairly common in Nova Scotia. A Canada warbler was recorded within the mixedwood forest of the Project area during the 2006 field survey (although field surveys focused on the adjacent property, some effort was undertaken within the Hants County property during this year). Although generally associated with interior forest conditions, the observation was made within close proximity to the anthropogenic edges of the adjacent Panuke Quarry and the existing quarry within the Project area. Because this bird was heard singing in suitable nesting habitat, it has been classed as a possible breeder within the Project area. Canada warbler was not encountered during the 2010 breeding bird survey, and as such, it is not expected to currently occupy the site.

A number of other species of conservation concern have been recorded in the vicinity of the Project area. Bank swallow (*Riparia riparia*), gray catbird (*Dumetella carolinensis*), and common loon (*Gavia immer*) are considered to "may be at risk" by NSDNR and have all been recorded within the MBBA square in which the Project area is located. However, the MBBA is of limited usefulness because its data is recorded in 10 km X 10 km census squares, making it difficult to determine whether a particular species has been observed in close proximity to the Project area. Given that none of the aforementioned "may be at risk" species were encountered during any field visits to either the current Project area or the adjacent Panuke Quarry property, it is unlikely that they utilize the site. Similarly, a number of bird species ranked as "sensitive" by NSDNR; including barn swallow (*Hirundo rustica*), American bittern (*Botaurus lentiginosus*), black-backed woodpecker (*Picoides arcticus*), bobolink (*Dolichonyx oryzivorus*), tree swallow (*Tachycineta bicolor*), eastern kingbird (*Tyrannus tyrannus*), and eastern phoebe (*Sayornis phoebe*); have been recorded in the MBBA squares but are not expected to utilize the current site of interest because they were not recorded during any field surveys within or adjacent to the Project area and also because the habitat conditions available within this property are unsuitable for many of these taxa. Although two additional "sensitive" species; spotted sandpiper (*Actitis macularius*) and killdeer (*Charadrius vociferous*); had been classified as "probable" breeders during 2006 – 2007 surveys of the adjacent Panuke Quarry property neither are expected to utilize the current Project area due to limitations in the habitat conditions that are present. That is, spotted sandpipers are typically found in association with ponds, lakes, or

marshes and killdeer are associated with shores and grassy fields but none of these habitats are represented within the Project area.

An ACCDC modeling exercise, conducted in 2009 to help direct field surveys, identified a total of 30 Red or Yellow-listed avian species that have been recorded within 100 km of the Project area. Of these, seven are presently considered "species at risk" by either COSEWIC or the Province of Nova Scotia; including piping plover (*Charadrius melodus*), roseate tern (*Sterna dougallii*), American peregrine falcon (*Falco peregrinus anatum*), rusty blackbird (*Euphagus carolinus*), short-eared owl (*Asio flammeus*), bobolink, and whip-poor-will (*Caprimulgus vociferous*). However, the modeling exercise identified only two species, boreal chickadee (*Poecile hudsonica*) and whip-poor-will as being potentially present within the Project area. However, neither of these species was encountered during field surveys and they are therefore unlikely to utilize the site.

Mammals

Information regarding the presence of rare mammals and sensitive mammal habitat within the vicinity of the Project area was derived from field surveys and a review of the Nova Scotia significant habitat mapping data base (NSDNR 2007a). Results from field surveys include those conducted on the adjacent Panuke Quarry property during July 7 and August 8, 2006; and June 20 and August 18, 2007 (JWL 2008), as well as those made by a visit to the Project area on September 26, 2009. Whereas the 2007 surveys were restricted to the adjacent property, those conducted in 2006 also included areas within the Hants County quarry extension area. The field surveys provide a good indication of the presence of large mammal species in the Project area. Knowledge of the distribution of small mammals in the Project area is limited by their secretive nature. Fortunately, many small, rare mammals have very specific habitat requirements which can be used to predict areas where they are likely to be found.

Nine mammals were recorded in or adjacent to the Project area during the field surveys. These species are generally typical of woodland habitats and include American red squirrel (*Tamiasciurus hudsonicus*), eastern chipmunk (*Tamias striatus*), snowshoe hare (*Lepus americanus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), American black bear (*Ursus americanus*), raccoon (*Procyon lotor*), white-tailed deer (*Odocoileus virginianus*), and southern red-backed vole (*Myodes gapperi*). None of these species are Red or Yellow listed, or considered "at risk" by provincial or federal sources.

A total of six Red or Yellow-listed mammal species have been recorded within 100 km of the Project area. Two of these species, Canada lynx (*Lynx canadensis*) and moose (*Alces americanus*) are ranked as "endangered" by the Province of Nova Scotia and are considered at risk by NSDNR. The remaining species are all considered sensitive by NSDNR, and include eastern pipistrelle (*Perimyotis subflavus*), fisher (*Martes pennant*), long-tailed shrew (*Sorex dispar*), and southern flying squirrel (*Glaucomys volans*). Due to absence of appropriate habitat within the Project area and / or limitations in their range distribution, it is highly unlikely that the site would provide important habitat for any of these taxa.

Canada lynx is ranked as “endangered” by the province. Within Nova Scotia they live deep in coniferous forests near rocky areas, bogs and swamps. Although the lynx may have historically occupied parts of the mainland, it is now restricted to the Cape Breton Highlands and to areas of higher elevation in central and eastern Cape Breton (Parker 2001). The nearest ACCDC record of Canada lynx is 78 km from the Project area and was made in 1978. Due to the current absence of this species from the area, the property would not have potential to provide habitat to this species.

Moose are commonly associated with wilderness boreal and mixedwood habitats. Their preferred food are the twigs, stems and foliage of young deciduous trees and shrubs, as may be found within forest landscapes recently disturbed by fire, wind, disease or timber harvesting activities. In summer, moose prefer habitats interspersed with wetlands that allow access to submerge and emergent aquatic vegetation. Landscapes which support recently disturbed mixed forests for food and adjacent mature conifer cover for escape and shelter are preferred in winter (Parker 2003). The Project area is located approximately 50 km from the closest core moose distribution area on the Chebucto Peninsula (Parker 2003) and the closest observation of moose is approximately 19 km away. Whereas the clear-cut, mixedwood, and hardwood forests of the Project area could offer some suitable browsing habitat, the Project area is outside the range of moose populations in Nova Scotia and it is unlikely that they frequent the property. Furthermore, no evidence of moose was observed during the field surveys.

The eastern pipistrelle is a hibernating bat that reaches the northern limit of its range in Nova Scotia. They are considered sensitive within Nova Scotia and are ranked as “S1?” by the ACCDC indicating that they are extremely rare within the province, but that there is some uncertainty regarding their population status. This species typically hibernates in caves or abandoned mines from October to May. During the rest of the year it forages in open forests, along the edges of rivers and streams, and roost in caves, rock crevices, attics, and trees. This species is most vulnerable at its hibernation sites where large proportions of the regional population may gather in a single location. The Project area is several kilometers away from Windsor Group gypsum bedrock which could offer some potential hibernaculum sites and is approximately 6 km away from the nearest known abandoned underground mine (NSDNR 2006a). Although eastern pipistrelle has been recorded within approximately 2 km from the Project area and could frequent the Project for foraging opportunities, no suitable hibernation sites are believed to be present within or immediately adjacent to the site. As such, it is unlikely that Project will have an important interaction with this species. Furthermore, eastern pipistrelles are profound hibernators and are not easily aroused while hibernating. As such, individuals that might be hibernating in caves or mines near the study area are unlikely to be adversely affected by noise and vibration from blasting.

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. 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. Whereas the closest known fisher record is approximately 43 km away, 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 indicating that they are extremely rare within the province. 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 shrew is approximately 66 km from the Project area. Although some small areas of talus exist within the Project area, these are anthropogenic in nature (from previous quarry activities) and are devoid of vegetation. As such, it is unlikely that long-tailed shrews inhabit the site or that Project activities will interact with this species.

Southern flying squirrels are considered sensitive by NSDNR are ranked as “S2S3” by the ACCDC indicating that they are rare to uncommon within Nova Scotia. They are restricted to southwestern counties of the province where they are typically associated with pine and hardwood stands that provide suitable foraging and nesting habitat. The closest observation of this species to the property is 27 km away. Although the hardwood stands of the Project area do provide some potentially suitable habitat for this species, the site is outside the normal range of flying squirrel and it is unlikely that this species would inhabit the area.

A review of the NSDNR significant habitat mapping database (NSDNR 2007a) did not reveal the presence of any rare or sensitive mammal species in the immediate vicinity of the Project area or critical habitat such as deer wintering areas. All of the habitats present in the Project area are commonly encountered throughout the province and are unlikely to provide unique habitat for rare small mammal species.

Herpetiles

Information regarding amphibians and reptiles within the Project area was also collected during the field surveys. Results from field surveys include those conducted on the adjacent Panuke Quarry property during July 7 and August 8, 2006; and June 20 and August 18, 2007 (JWL 2008), as well as those made by a visit to the Project area on September 26, 2009. Whereas the 2007 surveys were restricted to the adjacent property, those conducted in 2006 also included areas within the current Project area.

Eight herpetile species were encountered during the surveys: American toad (*Bufo americanus*), common garter snake (*Thamnophis sirtalis*), mink frog (*Rana septentrionalis*), northern spring

peeper (*Pseudacris crucifer*), pickerel frog (*Rana palustris*), redback salamander (*Plethodon cinereus*), redbelly snake (*Storeria occipitomaculata*), and wood frog (*Rana sylvatica*). None of these species is considered to be uncommon, rare or sensitive in Nova Scotia by NSDNR or the ACCDC.

A review of the ACCDC data search indicates that three rare or sensitive herpetiles have been recorded within 100 km from the Project area: Blanding's turtle (*Emydoidea blandingii*), eastern ribbon snake (*Thamnophis sauritus* pop. 3), and wood turtle (*Glyptemys insculpta*). All of these herpetiles are considered “species at risk” by either COSEWIC or the Province of Nova Scotia. Due to absence of appropriate habitat within the Project area and / or limitations in their range distribution, it is highly unlikely that the site would provide habitat for any of these taxa.

Blanding’s turtle is listed as endangered under both SARA and the Nova Scotia Endangered Species Act. In addition, it is Red-listed by NSDNR and ranked as “S1” by the ACCDC indicating that they are extremely rare within the province. This species is typically found in still-water streams, swamps, marshes and bogs in south central Nova Scotia. Blanding’s turtles prefer water bodies with slow flowing water and muddy bottoms that support dense aquatic vegetation. Between early June and early July female Blanding’s turtles move to gravelly or sandy lake shores to lay their eggs. In the fall, Blanding’s turtles move to aquatic habitats where they hibernate underwater. The nearest known record of Blanding’s turtle is approximately 78 km from the current Project area of interest. Although two wetlands are present within the Project area, their surface water characteristics are not ideal for Blanding’s turtle and they are not connected via watercourses to other appropriate Blanding's turtle habitat. Additionally, the Project area is also located outside of the known range of Blanding’s turtle, which is restricted to the Mersey and Medway watersheds (The Blanding’s Turtle Recovery Team 2003).

The eastern ribbon snake is listed as a threatened species under SARA and the Nova Scotia Endangered Species Act. In addition, it is regarded as sensitive by NSDNR and is assigned a ranking of “S2S3” by the ACCDC indicating that it is rare to uncommon within the province. This species is associated with sluggish streams, marshes, swamps, bogs and lake shores and is typically found within 30 m of open water. They prefer areas that have a heavy cover of aquatic vegetation that provides cover for them and the amphibians and small fish that they feed on. The nearest known record of eastern ribbon snake is approximately 80 km from the Project area. The Project area is located outside of the known range of eastern ribbon snake in Nova Scotia, which is restricted to the Mersey, Medway, and Pleasant River watersheds (Smith 2002) and does not provide suitable habitat for this species.

Wood turtles are considered threatened under 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 in close proximity to the Project area (approximately 2 km) but are not likely to inhabit the Project site due to the absence of watercourses.

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 preferentially 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.

Five “sensitive” birds species, as identified by NSDNR, have been recorded as “possible” breeders within the Project area, including eastern wood-pewee, golden-crowned kinglet, gray jay, ruby-crowned kinglet, and yellow-bellied flycatcher. Although the populations of these species may be experiencing declines within Nova Scotia, this is attributable to a variety of interacting stressors taking place within both their winter and summer grounds, including habitat loss, fragmentation, and climate change. As such, no species-specific mitigative initiatives are currently recommended. However, the Project proponent is open to further discussions with NSDNR and NSE regarding mitigative measures for specific species should they be required.

The field surveys did not reveal the presence of any rare or sensitive mammal or herpetile species within the Project area and none are expected to inhabit the Project area due to inappropriate habitat conditions and/or limitations in range distributions. Furthermore, the habitats present in the Project area are common throughout the province and are unlikely to provide habitat for rare small mammal species. No critical areas for mammals such as deer wintering areas or critical herpetile habitats are known to exist within the Project area. Due to the proximity of Maple Brook to the Project area however, a 60 m buffer extending from the edge of Maple Brook to the edge of the Project area (Figure 3) has been incorporated into the site plan at the request of NSDNR in consideration of potential wood turtle habitat.

In summary, assuming recommended mitigative measures are applied significant Project-related effects on wildlife are not likely to occur.

5.5 WETLANDS

5.5.1 Description of Existing Conditions

Two wetlands are present on the property (Figure 3); both are mixed treed swamps, as identified by the Canadian Wetland Classification System (Warne and Rubec 1997). Information

for each wetland, obtained during a site visit on September 26 2009, is presented in the following sections.

Wetland 1:

Wetland 1 is a small (0.11 ha) marginal mixedwood treed swamp surrounded by immature mixed forest. The wetland receives surface water runoff from the surrounding upland forest following high precipitation or snowmelt events but does not have any prominent inflow or outflow channels. Peat depths are shallow within the swamp and average 15 – 20 cm in depth. The marginal nature of the wetland is expressed by the infusion of upland hummocks throughout its extent.

The swamp has a moderate tree cover provided by red maple, white ash, quaking aspen, and balsam fir. Balsam fir, as well as lesser amounts of red maple also forms a moderate shrub layer within the wetland. The cover of herbaceous vegetation is low and comprised of scattered forbs and graminoids, including brownish sedge, dwarf dogwood, whorled aster, and white-edge sedge. Moss coverage is also intermittent, and is dominated by peatmoss, stair-step moss, and red-stemmed moss.

The vegetation surveys conducted in the wetland revealed the presence of 32 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 2010; and NSDNR 2007b).

Relative to the surrounding upland forest, the wetland is of moderate value for wildlife. Although no herpetiles were observed within the wetland, the ephemeral waters of the wetland could provide some suitable amphibian breeding habitat. 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. During the 2009 site visit, evidence of both snowshoe hare and white-tailed deer were observed within the swamp.

The swamp receives water inputs from the surrounding upland habitats via surface water drainage but no well-defined inflow or outflow surface channels are present. Although no surface water was observed during the September survey, large amounts of water-stained (blackened) leaves throughout the wetland indicate that it is sometimes inundated. Following high precipitation or snow melt events, the wetland may provide some function in relation to flood water storage. In doing so, it may also contribute to water quality through a combination of physical processes and interaction with vegetation. However, the small size of the wetland limits its importance for providing these hydrological and biogeochemical functions within the watershed.

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

Wetland 2:

Wetland 2 is a small (0.16 ha) mixedwood treed swamp. Approximately half of the wetland is located within the Project area and has been recently clear-cut (within approximately 5 years). The wetland is located on a slight slope and receives surface water runoff from the surrounding upland habitat, particularly at its southern end. The swamp lacks any prominent inflow or outflow channels and has shallow peat depths (approximately 20 cm). The margins of the wetland are not well defined and upland hummocks are abundant throughout the wetland, comprising approximately 15 % of its area.

Due to recent tree harvesting practices, the wetland has two main vegetation types: an intact treed component and a cut-over section. The uncut half of the wetland has a moderate tree cover comprised predominantly of red maple. Balsam fir, white ash, and black spruce are also common species within the overstory. An intermittent shrub layer is formed by a variety of species including red maple, white ash, yellow birch (*Betula alleghaniensis*), American witch-hazel (*Hamamelis virginiana*), and red spruce. A well-developed herbaceous layer is comprised of a diversity of species, with fowl manna-grass, New York fern, three-seed sedge, softleaf sedge (*Carex disperma*), and dwarf red raspberry (*Rubus pubescens*) being particularly abundant. The cut-over section of the swamp is characterized by extensive coverage of cottongrass bulrush and an absence of overstory tree coverage. A number of other graminoids are also common within this portion of the wetland, including brownish sedge, rough bentgrass, and Canada manna-grass. Additionally, New York fern is also an important component of the herbaceous vegetation. A well-developed shrub layer is present within portions of the cut-over swamp and is comprised of a mixture of species, including red maple, quaking aspen, gray birch, red raspberry, and white ash.

The vegetation surveys conducted in the wetland revealed the presence of 79 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 2010; and NSDNR 2007b).

Relative to the surrounding upland forest, the wetland is of moderate value for wildlife. Although no herpetiles were observed within the wetland, it would provide some suitable amphibian breeding habitat. 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.

The swamp receives water inputs from the surrounding upland habitats via surface water drainage but no well-defined inflow or outflow surface channels are present. Although surface water was negligible at the time of visitation, patches of exposed and blackened substrate indicate that portions of the swamp are frequently inundated. The wetland may provide some function in relation to flood water storage following high precipitation or snow melt events. In doing so, it may also contribute to water quality through a combination of physical processes

and interaction with vegetation. However, the small size of the wetland limits its importance for providing these hydrological and biogeochemical functions within the watershed.

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

The Project has the potential to result in the complete or potential loss of the two wetlands located within the Project area. In Nova Scotia, wetlands are protected under the Activities Designation Regulations made pursuant to the provincial *Environment Act*. Any loss of wetland habitat either through direct infilling or indirectly through alteration of wetland hydrology requires preparation of a wetland evaluation to establish the functional attributes of the wetland and wetland alteration approval. If NSE grants permission to infill or alter the hydrology of any wetland in the Project area, it will be necessary to develop a compensation plan to replace the wetland functions lost as a result of damage to or loss of the wetland.

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 wetlands were performed late in the growing season (September) they were not necessarily adequate for assessing this function. As such, additional plant and wildlife surveys will be performed within the wetlands during spring / early summer.

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 watercourses that flow into to the wetlands or see them become repositories of significantly increased water flow, nutrients, or sediments. This will be accomplished through the use of flow retention structures and energy dissipation measures.

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

5.6 GROUNDWATER RESOURCES

Groundwater, an integral component of the hydrologic cycle, originates from percolation of rain, snowmelt, or surface water into the ground. This infiltrating water fills voids between individual grains in unconsolidated materials and fills fractures developed in consolidated materials. The upper surface of the saturated zone is called the groundwater table. The groundwater table intersects the surface at springs, lakes and streams where interaction between the groundwater and the surface water environment can occur. Groundwater flows through soil and bedrock from areas of high elevation (recharge areas) to areas of low elevation (discharge areas) where

it exits the sub-surface as springs, streams, and lakes. There is a dynamic interaction between groundwater resources and surface water resources in Nova Scotia. Groundwater generally sustains the base flow of springs, streams and wetlands during dry periods of the year. More rarely, surface water bodies can contribute to groundwater storage under specific hydrogeological conditions.

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

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

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

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

Vibration damage to a drilled or dug well is generally a function of the distance between the energy source and the receptor well, and the seismic properties of the intervening aquifer materials. With respect to rock type, risk of water well damage is greater for fractured crystalline bedrock than for overburden wells or soft bedrock (*e.g.,* sandstone or shale) wells. Based on 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 (Dave MacFarlane, pers. comm.).

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; it can extend 200 m in sand and gravel, and up typically 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 records in the Nova Scotia Well Drillers Logs Database. A field study to identify well types and locations of properties with water supply wells was not conducted for this EA. This investigation did not include any water well inspection, groundwater sampling and analysis, or groundwater depth measurements.

Project Location, Topography and Drainage

The proposed quarry extension is situated about 3 km south of the community of Five Mile Plains on the Panuke Road and west of the existing Panuke Quarry (Figure 1. The proposed quarry is approximately 700 m long by 300 m wide having an approximate area of 21 ha (Figure 1).

The site is located in the transition between the South Mountain highland and the Hants-Colchester lowland. Elevations in the Project area range from approximately 115 to 140 m above sea level. The quarry area slopes to the west and north from the proposed quarry site.

The nearest water courses include a tributary that drains Mill Lakes reservoir northwest to Lebreau Creek Brook thence northwest to the Avon River near Martock. Some maps show another brook, Sams Brook, north of the site that flows northeast to St. Croix River at Five Mile Plains (Figure 3). The Mill Lakes/Fall Brook reservoir and Water Supply Area is located 3 km to more than 5 km southwest and upstream of the Project. Due to the large distance separating project activities from this area, and inferred overland and groundwater flow directions, no impacts to the surface water supply are anticipated.

Surficial Geology

The surficial geology in the Project area (Figure 4) consists of ground moraine consisting of stony till plain and drumlins. These 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. These tills are often found in beds of fluvially stratified drift. Borehole logs from domestic water wells in the region indicate that the surficial geology nearest the site is commonly estuarine clay over poorly sorted outwash sand and gravel deposits. Thickness from well drilling logs ranges from 1 to 21 m, with a median in the order of 5.2 m (Table 5.2).

Bedrock Geology

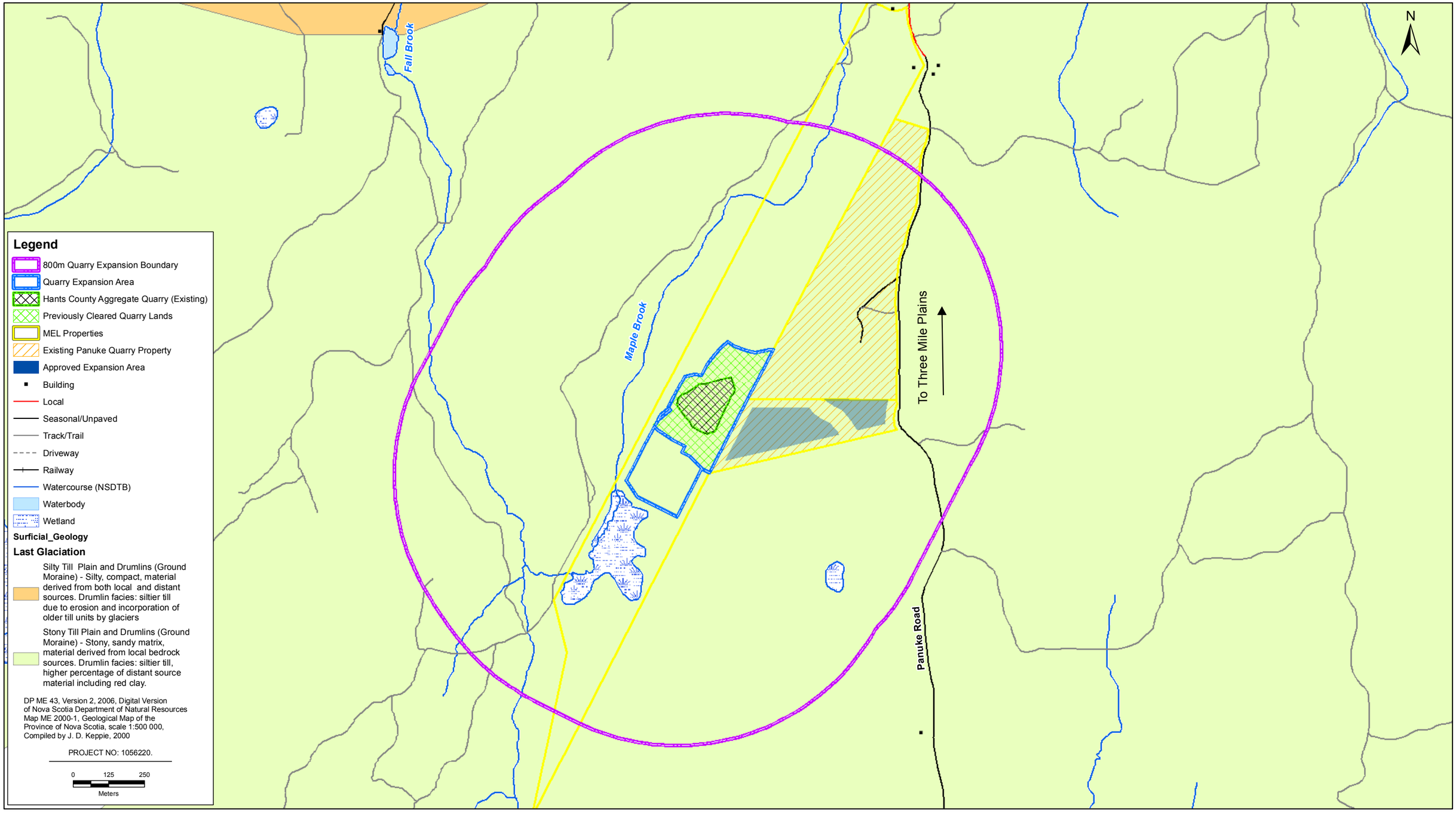
Bedrock underlying the site (Figure 5) consists of Cambrian-Ordovician aged Goldenville Formation of the Meguma Group. The Goldenville Formation comprises thickly stratified and resistant metamorphosed quartz sandstones (quartzite) interbedded with slate. The rocks have

distinct cleavage where they have been tightly folded (trending northeasterly). The permeability of these rocks to groundwater is through the numerous shallow fractures on this cleavage (Trescott 1969).

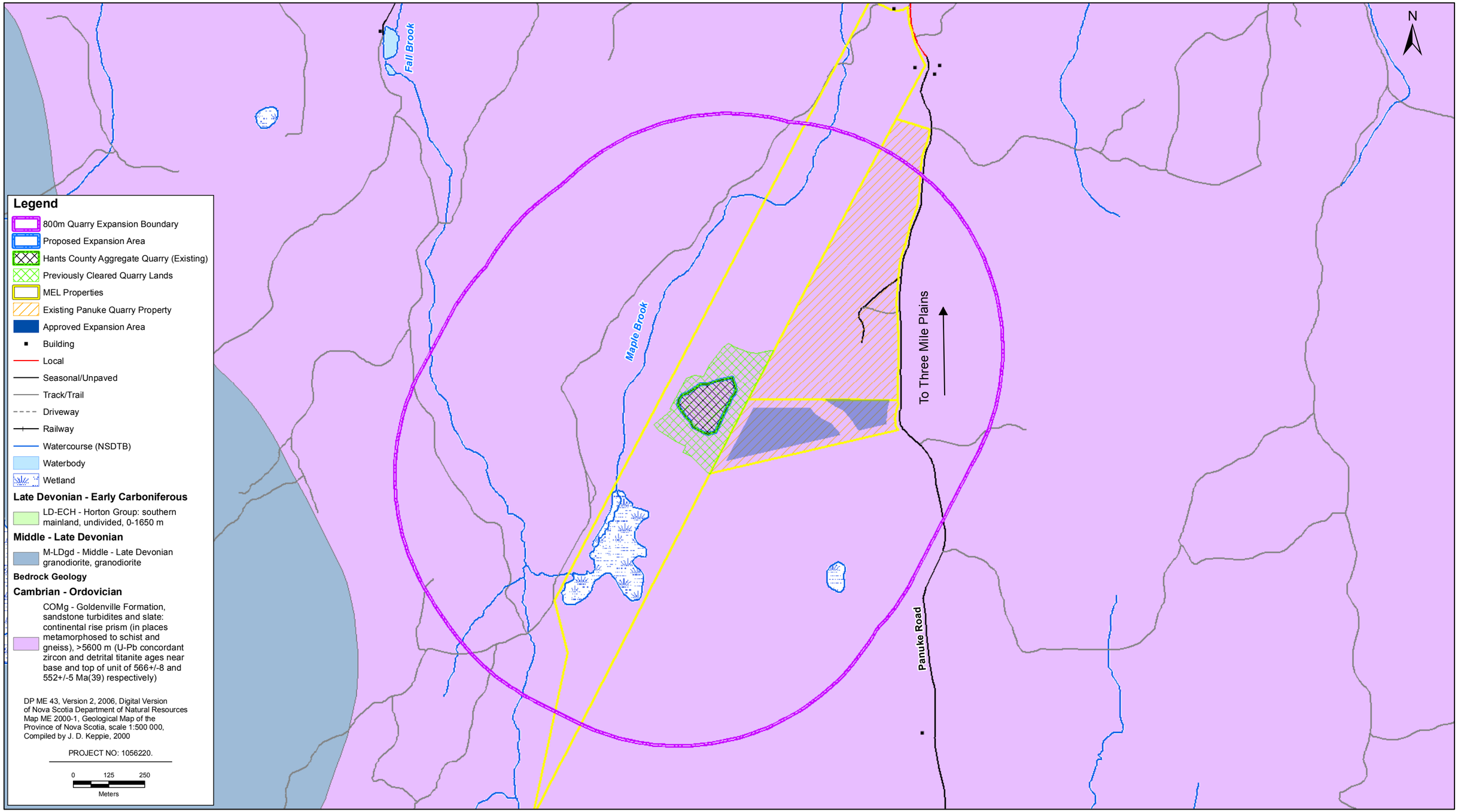
Approximately 1500 m north of the property boundary is the Late Devonian-Early Carboniferous Cheverie Formation of the Horton Group. The Cheverie Formation consists of fluvial sandstone, siltstone and conglomerate originating from the granites and quartzites of the metamorphic and igneous rock of the central interior. The Horton Group is underlain by the limestone and gypsum of the Windsor Group. A contact with Devonian aged granodiorite of the South Mountain batholith occurs about 600 m to the southwest of the quarry site. Many of the domestic water wells north and northwest of the Project area are constructed in these sedimentary bedrock units, while wells to the east and northeast are generally constructed in Goldenville Formation quartzite.

Groundwater Flow Patterns

Due to its situation with respect to the local topography, the Project is expected to lie within a local groundwater recharge area. Regional groundwater flow is inferred to be north and northwest from the South Mountain Highlands towards the Avon River and one of its principal tributaries, the St. Croix River. Locally, groundwater should follow the topography generally northwards towards wetlands and streams.



DATE: 07/06/2010	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **Figure 4**
PREPARED BY: G. MESHEAU		
MUNICIPAL ENTERPRISES LIMITED	**SURFICIAL GEOLOGY**	Stantec



DATE: 07/06/2010	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **Figure 5**
PREPARED BY: G. MESHEAU		
MUNICIPAL ENTERPRISES LIMITED	**BEDROCK GEOLOGY**	Stantec

Groundwater Resources

A water well field survey was not conducted as a part of this project. As such, review of available mapping information 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. No water wells are located within 800 m of the Project area (Figure 3). Water supplies for residences farther than 800 m from the Project area are located along Panuke Road, Highway #1, Windsor Back Road, Old Halifax Road and side roads located off these arterial roads. These water supplies are derived primarily from privately owned drilled and dug wells.

The closest residential water supply wells are associated with residences north of the property along Panuke Road and 200 m outside of the 800 m Project site buffer. One well log was retrieved, NSE Well Log No. 060165 at 462 Panuke Road. Recently drilled in 2006, this well is reportedly 55 m deep, has 6.1 m of steel 152 mm diameter well casing and has a reported air-lifted yield of 1.5 igpm. The lithology as reported on the well driller's log is approximately 3 m of sand and gravel overlying 52 m of shale.

To date, there have been no reported interactions between existing Panuke 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, a summary of domestic well records for the closest communities of Three Mile Plains and Five Mile Plains (located north of the project site), is provided in Table 5.2. None of these wells are located within 800 m of the Project. However, the conditions encountered within these wells are indicative of the overburden conditions and bedrock aquifers located on the Project site, and within the community of Three Mile Plains. The wells are grouped based on hydrostratigraphy to better compare hydraulic properties.

Table 5.2 Summary of Domestic Water Wells Records in Three Mile Plains, Nova Scotia

Horton Group	Well Depth (m)	Casing Length (m)	Estimated Yield (igpm)	Water Depth (m)	Overburden Thickness (m)
Minimum	3.7	3.7	0.5	1.2	1.2
Maximum	74.7	30.5	80.0	24.4	21.3
Average	28.7	13.6	15.6	9.1	9.2
Median	22.9	11.3	6.0	9.1	8.2
Number of Wells	8	8	8	5	6

Table 5.2 Summary of Domestic Water Wells Records in Three Mile Plains, Nova Scotia

Goldenville Formation	Well Depth (m)	Casing Length (m)	Estimated Yield (igpm)	Water Depth (m)	Overburden Thickness (m)
Minimum	6.9	6.1	1.5	1.8	3.0
Maximum	56.1	31.4	90.0	11.9	31.4
Average	34.7	11.8	27.8	5.0	17.2
Median	38.1	9.1	10.0	3.0	17.2
Number of Wells	7	7	7	4	2
Windsor Group	**Well Depth (m)**	**Casing Length (m)**	**Estimated Yield (igpm)**	**Water Depth (m)**	**Overburden Thickness (m)**
Minimum	15.2	8.5	1.0	1.5	2.7
Maximum	103.6	32.0	20.0	6.1	6.1
Average	37.6	15.7	7.7	3.8	4.4
Median	28.5	13.7	5.0	3.8	4.4
Number of Wells	8	8	8	2	2

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

Table 5.2 summarizes data for 2 dug wells (< 10 m deep) and 21 drilled wells. The depth to water table in the surrounding areas ranges from 1 to 24 m, with a median of 3 m. Based on 21 samples, drilled wells range in depth from 15 m to 104 m, averaging 32 m, with water tables of 1.5 to 24.4 m, mean 6.1 m and yield from 0.5 to 60, mean 6 igpm. Based on two samples, dug wells are typically 3.7 to 6.7 m deep, have short term yields of 80 to 90 igpm, and static water levels of 1.2 to 1.8 m below ground. Higher yields are associated with limestone (drilled wells) and overburden (dug wells). A review of 98 pumping tests for wells completed into the Goldenville formation in Nova Scotia indicates a geometric mean well yield of 4 igpm, from wells averaging 65.6 m in depth (NSDEL Pumping Test Inventory 2004).

Based on pumping test data (NSE Pumping Test Inventory), the hydraulic conductivity of the Goldenville bedrock is estimated to be in the order of 2.5E-5 cm/s (N= 32), which is an order of magnitude lower than either the Horton sandstone (3E-4 cm/s, N = 6) or the Windsor Group shales (7.8E-4 cm/s, N= 4). Groundwater seepage into the quarry would therefore be expected to be small in comparison to direct rainfall inputs.

Groundwater Quality

Water quality potential is determined from known water quality characteristics for each hydrostratigraphic unit. This includes naturally occurring water quality concerns such as hardness arsenic, uranium, salinity, iron and manganese. Except in localized mineralized zones in the Meguma terrain, quartzite bedrock is expected to provide water quality with most parameters within acceptable drinking water guidelines (Health Canada 2008). However, arsenic in excess of the 0.01 milligrams per litre (mg/L) health-based guideline can occur in the Goldenville bedrock aquifer, particularly along the crests of anticlines in designated Gold-Bearing areas. Elevated concentrations of iron and manganese in excess of respective aesthetic guidelines of 0.3 mg/L and 0.05 mg/L can occasionally occur within this formation.

Within the metamorphic Meguma Group bedrock (*i.e.,* Goldenville Formations), the waters are typically described as calcium bicarbonate and low in dissolved solids and hardness. Based on general knowledge of groundwater chemistry for these units throughout Nova Scotia, the Goldenville bedrock can locally exceed drinking water guidelines for arsenic, iron and manganese.

Just north of the Project, the groundwater of the Cheverie Formation (Horton Group) produces good quality, slightly alkaline, calcium bicarbonate groundwater low in dissolved solids, hardness and iron. However it is typically high in sulphate and dissolved solids when in association to the gypsum and limestone of the Windsor Group (Trescott 1969).

In addition to the above naturally-occurring water quality issues, 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 (Dave MacFarlane pers. comm.). To date, there has been no reported groundwater quality issues related to the existing Panuke Quarry located to the east of the proposed extension area.

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 if 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. It is our understanding that appropriate diversion of surface water runoff and in-pit control of rainfall accumulation with sump pits and controlled overflow will be provided.

Water Quality Effects

Changes in water quality may theoretically occur as a result of excavations in the recharge area of the wells. Potential impacts include: temporary siltation from blasting, oil and nitrate from blasting operations, lubricant compounds, and other chemical releases within the quarry area. A possible long term impact of well water quality is decreased pH or increased dissolved solids from attenuation of acidic drainage from exposed sulfide-rich bedrock, if present.

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

In Nova Scotia, acid rock drainage is most commonly associated with slate from the Halifax Formation of the Meguma Group and coal bearing shales. Bedrock underlying the Hants County Aggregate and Extension area consists of Goldenville Formation sandstone. In general, Goldenville Formation is 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 mineralized zones if encountered in the proposed quarry.

Mitigation of Effects

Due to distance to the closest well users (> 800 m), significant impacts on groundwater supplies are not anticipated due to natural attenuation primarily by dilution and dispersion along the groundwater pathways. Short-term turbidity impacts caused by blasting vibration, though highly unlikely given the distance to offsite wells, would likely involve a temporary disruption and could be mitigated by provision of bottled water to affected residents. In the unlikely event of persisting long-term degraded water quality, or a well yield loss event, the proponent will replace or repair any water supply well found to be adversely affected by their quarry operation to the satisfaction of the owner. 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. As previously discussed, no residential water wells are located within 800 m of the Project and therefore the above potential impacts to offsite wells are not anticipated. In summary, significant Project-related effects on groundwater resources are not likely to occur.

5.7 ARCHAEOLOGICAL AND HERITAGE RESOURCES

5.7.1 Description of the Existing Environment

Background Research

Background research was conducted using the records at the Public Archives of Nova Scotia, the Nova Scotia Museum, as well as those available on the Internet. Maps consulted included those by Anson (1808), Wentworth (1827), A.F. Church (1871) and Faribault (1909).

The Nova Scotia Museum's Archaeological Site's Database shows no recorded pre-Contact archaeological sites within the study area.

The assessment of heritage resource potential within the proposed extension area incorporated sources that included archaeological site records at the Nova Scotia Museum and archival resources. The potential for a site to contain First Nations archaeological resources is generally determined by the presence of resources that the Mi'kmaq people depended upon, such as food and water, as well as proximity to watercourses that were large enough to be used as a transportation route or were used to access such a route. Given the location of the study area the potential for it containing pre-Contact archaeological resources should be considered as low. The nearest watercourse, Maple Brook, is a minor one and is located outside the quarry extension area. There do not appear to be any other features or resources within the Project area that would have attracted First Nation's settlement. It is much more likely that the Mi'kmaq settled along the Avon and St. Croix rivers to the north and the St. Croix River/Panuke Lake system to the south.

There are no recorded historic archaeological sites or heritage resources within or near the study area. There are no obvious buildings, areas of cultivation, or other settlement features evident on the modern aerial photos.

There is very little historical evidence of settlement within or close to the Project area. While land grants in the area were awarded to Joshua Mauger and others in 1759, settlement in the area really did not begin until the nineteenth century. The 1802 Anson map is interesting as it shows a short section of road that became the north end of Panuke Road, running off of what is now Highway 1. Unfortunately, it appears as if the Project area is just off the map to the southeast. Similarly, the 1827 Wentworth map stops just west of Panuke Road. The 1871 map by A.F. Church finally shows Panuke Road, basically as it appears today, running all of the way to Panuke Lake. The map does show relatively dense settlement on the northern half of the road, about 13 houses, but only a single house in the south half, on the banks of Panuke Lake. Finally, the 1909 Geological Survey of Canada map shows 26 buildings in the north half of Panuke road, but nothing in the south half.

Based on the background research the historical archaeological potential for the Project area should be considered low. The research showed that the north end of Panuke Road was subject

to moderate settlement and growth from the early to the end of the nineteenth century but that there was no historic settlement or significant activities within the Project area.

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

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

The Project area has low potential for identifiable human use in the pre-Contact and historic periods. No archaeological/heritage resources or areas of elevated heritage potential were identified in the Project area. Therefore, development and operation of the proposed quarry are not expected to have any adverse environmental effects on heritage resources.

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

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

5.8 ATMOSPERHIC ENVIRONMENT

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

5.8.1 Description of Existing Conditions

Air Quality

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

Ambient air quality is monitored in Nova Scotia with a network of 13 sites, operated by NSE and Environment Canada. Motor vehicles, electrical power generation, pulp and paper processing and oil refining are the major local sources of air pollutants in the province Common air

pollutants monitored regularly are SO_2, total particulate matter (TPM), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), particulate matter less than 10 microns in diameter (PM_{10}), carbon monoxide (CO), ground-level ozone (O_3), nitrogen dioxide (NO_2), hydrogen sulphide (H_2S) and total reduced sulphur (TRS). The closest NSE monitoring site to the Project site is located at Aylesford Mountain on Mountain Brow Road, Kings County. In 2005 and 2006 ozone (O_3) was the only contaminant measured. The annual average for 2005 and 2006 was 33 ppb and 35 ppb respectively (Environment Canada 2008b).

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 within a distance of 5 km. 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.

In particular, quarrying activities potentially contributing to the production of airborne particulates are:

- Blasting can result in a concentrated plume of particulate matter, but the volume and time duration of such plumes are constrained. Even when blasts result in a visible plume, the contribution to 24-hour averages, as in the Air Quality Regulations, will be negligible. Much of the material in the initial plume is larger than the aerodynamic diameter of particles that

can remain suspended in the air, and deposit within a relatively short distance (*e.g.,* 100 m) of the blast site;

- Crushing is a mineral extracting operation that involves the generation of particulate emissions. Uncontrolled processing operations like these can produce nuisances and/or exceedances of particulate standards;
- Material handling activities can result in the generation of particulate matter primarily through the vertical drop of material movement. As the fine material passes through the air, the finest material may become windblown and travel downwind;
- Storage piles and exposed areas are often left uncovered due to the need for frequent material transfer, which can lead to considerable dust generation. Dust emissions can take place during several points in the storage cycle, including material loading onto the pile, disturbances by strong wind currents, and removing loads from the pile;
- Particulate emissions can occur whenever vehicles travel over both paved and unpaved surfaces; and
- Although there are also emissions of combustion gases and products of incomplete combustion from the exhaust of the on-site vehicles and equipment, these are considered nominal.

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

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

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

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

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

Sound Quality

Quarrying activities will produce noise from equipment operation and blasting. Blasting operations associated with the proposed extension will be conducted in accordance with current operations at the quarry as permitted by NSE (Approval No. 2001-019700-A02), in accordance with the Pit and Quarry Guidelines (NSE 1999),with a frequency similar to past operations at the

site and during daytime hours only. Blasting will be conducted in accordance with the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). It is understood that additional blast monitoring activities and/or reporting may be required by NSE.

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

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

Summary

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

5.9 SOCIO-ECONOMIC ENVIRONMENT

5.9.1 Description of the Existing Environment

Population and Employment

Hants County Aggregate Quarry is located in Hants County, southwest of Windsor. The quarry is located in a rural setting along a local road with a low distribution of residential development extending from the eastern boundary of the proposed extension area, approximately 3 km to Trunk 1 (Figure 1). The population in the general area (*i.e.,* Hants County) is 41,182. The population in this area has increased by 1.7 % between 2001 and 2006 (Statistics Canada 2006). The employment rate in the County is 58.6% while the unemployment rate is 7.9% (Statistics Canada 2006). Sales and service occupations make up the largest proportion of experienced labour force with approximately 24.1% of experienced labour, followed by trades, transport and equipment operators (23.1%), and business, finance and administration occupations (16.1%) (Statistics Canada 2006).

The majority of the aggregates from the quarry to date have been sold to customers in the West Hants Municipality, local customers, and NSTIR, predominantly for construction projects. The closest town to the Project area is Windsor, where the population is 3,709, which is a 1.8% decrease since 2001 (Statistics Canada 2006). The employment rate in the Windsor is 47.8% while the unemployment rate is 8.0%. The sales and service industry consists of the largest percentage of the total experience labour force, comprising 30.4% of total experienced labour

force, followed by business, finance and administration occupations (18.1%) and trades, transport and equipment operators and related occupations (14.0%) (Statistics Canada 2006).

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

Land Use

Mining

A review of the NSDNR Abandoned Mine Openings Database (2006b) indicates that there is one Mine Shaft within a 10 km radius of the boundaries of the Project property.

The status of this shaft is not known. However, none are in close proximity to the Project property and no interaction is predicted between the mine shaft and the proposed quarry extension.

Agriculture

The Project is not located in a region where conflict with current and future agricultural practices is anticipated. The districts which are considered very important with regards to agriculture are Upper Falmouth and Avondale-Poplar Grove, while the Hants County Aggregate is located in Three Mile Plains.

Forestry

A large part of the southern and north-eastern part of the municipality is Crown land or land owned by large forestry companies. The forested lands provide local employment, wildlife habitat and outdoor recreation opportunities, and potential future water supply sources are located in these areas (West Hants Municipal Planning Strategy 2007). The area in which Hants County Aggregate is located is zoned as general resource, which includes forest harvesting (Windsor-West Hants Joint Planning Advisory Committee).

Recreation and Tourism

West Hants has a large amount of parkland dedicated to public recreational use, including provincial parks and municipally owned parkland and facilities. In addition, there are a number of commercial recreation sites, including Martock ski hill and various golf courses and campgrounds. Hants County Aggregate Quarry is not located adjacent to these sites.

Transportation

Various products (*i.e.,* various aggregate sizes) are 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 estimated truck traffic will be consistent with current truck volume at the existing quarry and will only increase, for a short period of time, if a large aggregate supply contract were awarded.

A transportation assessment was not conducted in support of this environmental registration. Such a study was not deemed necessary given that the Project is not anticipated to result in any significant increase in the volume of truck traffic on public roads compared to current levels. However, a transportation assessment and discussion of potential impacts was conducted by Atlantic Road and Traffic Ltd. in 2007 in support of an environmental registration for Panuke Quarry (JWL 2008). Since the existing Hants County Aggregate quarry and the existing Panuke Quarry are located adjacent to one another and accessed by the same roads, this previously conducted transportation assessment is also applicable for the currently proposed Project. A description of the existing conditions in the area, as per the 2007 study (JWL 2008), is included in the following paragraphs.

Road Descriptions

MEL has been operating the Panuke Quarry for over five years. The quarry is located on the west side of Panuke Road about three kilometers south of the Trunk 1 intersection. There is a railroad crossing with warning signals on Panuke Road immediately south of Trunk 1. The first 2.5 km section from Trunk 1 is paved (6.4 m wide pavement) with a yellow center line and gravel shoulders. The remaining approximately 0.5 km to the quarry entrance is a gravel road. While the 6.4 m wide pavement is adequate for the traffic volumes and vehicles using the road, additional care with vehicle tracking is required at a curve at the MacLeod Court intersection, as well as at reverse curves at the south end of the paved section.

The paved section of the road is of a residential character with driveways and several minor road intersections. There are approximately three residential driveways on the north end of the gravel section just south of the end of pavement. The posted speed limit on the paved section of Panuke Road is 50 km/h, in keeping with the residential character of the road.

Panuke Road intersects with the south side of Trunk 1 in Three Mile Plains. Trunk 1, which was the main highway between Halifax and Windsor previous to construction of Highway 101 about 30 years ago, has a rural cross section, including two paved lanes, gravel shoulders, and open ditches. The Panuke Road intersection is located on a relatively flat section of roadway and has adequate sight distances for both approaches for the 70 km/h posted speed limit on Trunk 1.

Traffic Volumes

While traffic volume data is not available for Panuke Road, a site visit indicated that volumes are light, possibly in the order of 500 to 1000 vehicles per day (vpd). This suggests a two-way peak hour volume of about 50 to 100 vehicles per hour (vph).

Traffic volumes on Trunk 1 just east of Panuke Road have increased from 1060 vehicles per day Annual Average Daily Traffic (AADT) in 1971 to 2040 vpd in 2007. Hourly volumes obtained by traffic count machines in 2002, 2004, and 2007, indicate 2007 AM peak hour volumes of about 100 vph and PM peak hour volumes of about 215 vph. Regression analysis of historical data indicates a low annual growth rate of about 25 vehicles per day per year for Trunk 1 volumes at this location. In 2017, the AADT volume is projected to be about 2550 vpd.

Collision Data

The relative 'safety' of an intersection is generally evaluated by review of collision data for reported collisions at or near the intersection being studied. A review of collision data for Trunk 1 did not indicate any history of collisions at the Panuke Road intersection from 2002 to 2007. Since sight distances are adequate and there have not been any reported collisions at the Trunk 1 / Panuke Road intersection, there is nothing to suggest any existing safety problems at the intersection.

There were two reported property damage collisions on Panuke Road, one in 2002 involving a four wheeler striking a vehicle backing into a driveway, and another in 2006 that occurred when an automobile exited a private driveway without yielding to another passenger vehicle traveling on the road.

Quarry Traffic

The current and projected production rate for the Hants County Aggregate quarry is approximately 60,000 to 100,000 tonnes per year. The current and anticipated operating schedule is 20 hours per day during periods of rock crushing and 10 hrs a day otherwise, weather permitting, with an average of 2000 truck loads shipped each year.

Since the quarry has been operating for over five years, and since the proposed Project is not expected to change production rates or affect the existing aggregate transport truck volumes, there should not be any noticeable impacts to the level of performance of Panuke Road as a result of the quarry extension.

Human Health

Human health related aspects and potential effects on environmental health include potential impacts on air quality (*i.e.,* particulate emissions). Air quality is addressed in Section 5.8.

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

Population and Employment

The quarry produces valuable products that support development and infrastructure, and the growth of the region's economy. The direct and indirect employment associated with current operations at Hants County Aggregate may be considered a beneficial to the regional economy. Employment levels at the quarry are not anticipated to change as a result of the Project. Project-related employment effects may therefore be considered neutral.

The Project will result in an overall positive effect on the regional economy. Quarries are an important component of the natural resource sector of the economy and provide essential raw materials to the province's construction industry. The availability of local supply to the market place encourages a more stable price for aggregate. In some cases (*i.e.,* markets in close proximity to quarries) the overall price for aggregates is lower since cost of aggregate largely reflects the distance it has to be hauled. This, in turn, can significantly reduce costs of construction, which, in the case of public infrastructure such as highways, communities, public works agencies, and taxpayers, should result in financial benefits (NSDNR 2006b).

Another interpretation of Project-related economic effects is that they may be considered neutral. This is because the market that Panuke Quarry is supplying is not new, the products are not new, and the demand for aggregate in the local market is currently being met by existing quarries, including the existing Panuke Quarry.

Amalgamation of the two existing quarry operations will provide business development opportunities for MEL (*e.g.,* diversification of products and customers). The Project will enable MEL to produce various aggregates for NSTIR projects in addition to producing asphalt for general contracts. As an Atlantic Canadian company operating locally, the business benefits gained by MEL due to the Project can promote regional benefits. Potential future benefits may include additional local employment opportunities as well as increased contributions to provincial corporate income tax.

Land Use

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

Quarrying activities will produce noise from equipment operation and blasting. The proposed extension area is located greater than 800 m from the nearest residence. 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 Hants County Aggregate Quarry, in accordance with the Pit and

Quarry Guidelines (NSEL 1999) and with a frequency similar to past operations at the site. The existing Industrial Approval for Panuke Quarry (Approval No. 2001-019700-A02) will be amended to incorporate the combined operations of the amalgamated Hants County and Panuke quarries. 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. A blast design plan and monitoring program will be developed for the application for Industrial Approval amendment.

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

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

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

Transportation

The following points summarize the key findings of the transportation assessment that was conducted by Atlantic Road and Traffic Ltd. in 2007 in support of an environmental registration for Panuke Quarry (JWL 2008). These findings would also be representative of the traffic from the existing Hants County Aggregate Quarry at the time of the study.

- The Panuke Road intersection is on a level section of Trunk 1 with adequate sight distances;
- Daily and peak hourly volumes on Panuke Road are estimated to be low;
- Traffic counts have indicated that daily and peak hourly volumes on Trunk 1 are low to moderate;
- Review of collision data does not indicate any history of collisions at the Panuke Road / Trunk 1 intersection; and
- There have only been two property damage collisions, neither involving heavy trucks, on Panuke Road from 2002 to 2007.

In the spring of 2007 various improvements were made by MEL to the eastern boundary of the Quarry, including the installation of a guardrail and security fence along the western side of the Panuke Road and the eastern slope of the quarry was covered with common material and graded to a stable slope of 2:1 and hydroseeded in efforts to ensure the safety of nearby individuals.

The Project is not anticipated to result in a significant increase in truck traffic on public roads above that associated with the existing Hants County Aggregate Quarry and Panuke Quarry operations. Future hauling practices will remain consistent with current practices. There should not be any noticeable impacts to the level of performance of the road network as a result of this Project.

Recreation and Tourism

Hants County Aggregate Quarry is not located adjacent to any major municipal recreation facilities or commercial recreation areas so there will be little to no impact on tourism and recreation in the area.

Human Health

Human health related issues are discussed in Section 5.8 Air Quality. The health and safety of nearby residences is not expected to be affected by the Project.

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

5.10 OTHER UNDERTAKINGS IN THE AREA

5.10.1 Description of the Existing Environment

The Proponent is not aware of any active pit operations licensed to operate within a 10 km radius of the Project. In addition to the adjacent Panuke Quarry, the Proponent is aware of two active quarry operations licensed to operate within a 10 km radius of the Hants County Aggregate. Both Williams and Alva Construction Limited, operate quarries in the region between Five Mile Plains and St. Croix. All operations are currently functioning without any issues, in terms of noise, dust, emissions, traffic, *etc.* Since the proposed extension of Panuke Quarry's operation through acquisition of Hants County Aggregate does not include an increase in production, significant adverse Project-related effects in conjunction with other undertakings in the area are not likely to occur, assuming the effective application of mitigative measures.

6.0 EFFECTS OF THE PROJECT ON THE ENVIRONMENT

Activities associated with the proposed quarry extension and operation will be conducted in accordance with terms and conditions of the existing Industrial Approval for the Panuke Quarry operation, as well as future amendments to the Approval (including an amendment to incorporate extension and amalgamation of the Hants County Aggregate quarry), and the Pit and Quarry Guidelines.

Environmental effects of the quarry extension will include the loss of some habitat within the proposed revised quarry extension area. The Proponent has redesigned the Project to avoid interactions with the watercourse identified onsite. Field surveys conducted to date indicate that this area does not include unique habitat or known rare or sensitive species; therefore, these effects are not anticipated to be significant.

There are no structures located within 800 m of quarry activities. Minor, localized impacts on air quality can be expected through the formation of airborne particulate matter. These impacts are readily controlled through standard mitigative measures (*e.g.,* dust suppression) and follow-up monitoring as necessary.

Assuming the mitigative measures specified in this report are implemented, and the quarry is operated according to existing provincial guidelines and approvals, no significant adverse residual environmental or socio-economic effects are likely. Continued operation of the quarry will result in economic benefits, including employment and ongoing business opportunities.

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

7.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

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

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

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

8.0 OTHER APPROVALS REQUIRED

As stated in Section 3.4, the Proponent is required to register this Project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. Other relevant provincial regulations include the Activities Designation Regulations, which requires an amendment to the existing Panuke Quarry Industrial Approval from NSE for amalgamation and extension of the Hants County Aggregate operation as well as approval to alter wetlands; 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). No municipal approvals are required.

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 (*e.g.*, harmful alteration of fish habitat or onsite storage of explosives) 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

Dave MacFarlane Principal Hydrogeologist, Stantec Consulting Ltd. November 2009.

12.0 Appendices

APPENDIX A Registry of Joint Stocks and Industrial Approval
APPENDIX B Hants County Aggregate Quarry Extension Hydrology Study
APPENDIX C Project Information Bulletin and Letters
APPENDIX D Aquatic Photo Appendix
APPENDIX E Vascular Plants Potentially Present in the Study Area
APPENDIX F Vascular Plants Recorded in Study Area
APPENDIX G Breeding and Population Status of Birds Recorded in the Study Area and the Breeding Bird Atlas Square
APPENDIX H Response to Government Review Comments

APPENDIX A
Registry of Joint Stocks and Industrial Approval

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

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PROFILE - MUNICIPAL ENTERPRISES LIMITED - as of: 2010-03-26 01:33 PM

Company/Society Name:	MUNICIPAL ENTERPRISES LIMITED
Registry ID:	1422616
Type:	N.S. Limited Company
Nature Of Business:	
Status:	Active
Jurisdiction:	Nova Scotia
Registered Office:	1800-1801 HOLLIS ST HALIFAX NS Canada B3J 3N4
Mailing Address:	1800-1801 HOLLIS ST HALIFAX NS Canada B3J 3N4
Previous Name:	MUNICIPAL CONTRACTING LIMITED

PEOPLE

Name	Position	Civic Address	Mailing Address
Raphael M. Potter	Director	927 Rocky Lake Drive Bedford NS B4A 3Z2	
Carl B. Potter	Director	927 Rocky Lake Drive Bedford NS B4A 3Z2	
Eric Desbiens	Senior Vice President	927 Rocky Lake Drive	

		Bedford NS B4A 3Z2	
Raphael M. Potter	Secretary	927 Rocky Lake Drive Bedford NS B4A 3Z2	
Carl B. Potter	President	927 Rocky Lake Drive Bedford NS B4A 3Z2	
Cecil G. Vance	General Manager	927 Rocky Lake Drive Bedford NS B4A 3Z2	
David A. Wood	Vice President, Finance	927 Rocky Lake Drive Bedford NS B4A 3Z2	
Carl Vincent	Comptroller	927 Rocky Lake Drive Bedford NS B4A 3Z2	
Sondra Clegg	Assistant Secretary	927 Rocky Lake Drive Bedford NS B4A 3Z2	
ALAN G. HAYMAN	Recognized Agent	1801 HOLLIS STREET STE 1800 Halifax NS B3J 3N4	1801 HOLLIS STREET STE 1800 Halifax NS B3J 3N4

ACTIVITIES

Activity	Date
Change of Directors	2009-07-21
Annual Renewal	2009-07-06
Annual Statement Filed	2009-07-06
Change of Directors	2008-07-17

Annual Renewal	2008-06-05
Annual Statement Filed	2008-06-05
Special Resolution	2008-03-20
Special Resolution	2008-03-20
Filed Document	2008-03-20
Change of Directors	2008-02-01
Change of Directors	2007-11-27
Annual Renewal	2007-06-14
Annual Statement Filed	2007-06-14
Change of Directors	2006-09-26
Annual Statement Filed	2006-06-27
Annual Renewal	2006-06-20
Special Resolution	2006-06-16
Filed Document	2006-02-03
Special Resolution	2006-01-17
Filed Document	2005-06-30
Annual Renewal	2005-06-15
Annual Statement Filed	2005-06-14
Special Resolution	2005-04-25
Special Resolution	2004-09-08
Annual Renewal	2004-06-09
Annual Statement Filed	2004-06-09
Annual Renewal	2003-06-10
Annual Statement Filed	2003-06-10
Special Resolution	2003-01-07
Special Resolution	2003-01-07
Special Resolution	2002-07-08
Annual Renewal	2002-06-28
Annual Statement Filed	2002-06-28
Change of Directors	2002-04-03

Special Resolution	2001-09-06
Annual Renewal	2001-07-24
Annual Statement Filed	2001-07-24
Annual Statement Filed	2000-06-26
Annual Renewal	2000-06-14
Special Resolution	2000-06-13
Annual Renewal	1999-06-22
Annual Statement Filed	1999-06-21
Annual Renewal	1998-06-17
Annual Statement Filed	1998-06-17
Change of Directors	1997-10-21
Annual Renewal	1997-07-02
Annual Statement Filed	1997-07-02
Filed Debenture Supplement	1997-04-21
Filed Debenture Supplement	1997-04-21
Filed Debenture Supplement	1997-04-21
Special Resolution	1996-10-04
Annual Statement Filed	1996-07-11
Registered Office Change	1995-08-01
Special Resolution	1995-08-01
Annual Report Filed	1995-07-18
Agent Filed	1983-04-28
Name Change	1982-06-14
Change of Directors	1982-01-26
Court Order Filed	1981-07-31
Registered	1981-07-31
Amalgamated	1981-07-31

RELATED REGISTRATIONS

This Company ...	
ROCKY LAKE QUARRY LIMITED	Amalgamated From
CARL B. POTTER LIMITED	Amalgamated From
MUNICIPAL SPRAYING & CONTRACTING LIMITED	Amalgamated From
CARL B. POTTER	Registered
ROCKY LAKE QUARRY	Registered
DEXTER ASPHALT PLANT	Registered
MUNICIPAL GROUP OF COMPANIES	Registered
SOUTH SHORE DEVELOPMENT PARTNERSHIP	Registered

Danny C.

NOVA SCOTIA
Environment
Environmental Monitoring and Compliance

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Our File Number: 92100-30-019700-A02

Mr. Cecil Vance
Municipal Enterprises Limited
927 Rocky Lake Rd
Bedford, NS
B4A 3Z2

Dear Mr. Vance:

RE: Approval to Construct, Operate and Reclaim
Panuke Road Quarry Expansion
Approval No. 2001-019700-A02
PID # 45270493 & 45336963

Enclosed please find amendment for Industrial Approval # 2001-019700-A02 to construct, operate and reclaim the proposed quarry expansion at 700 Panuke Rd, Three Mile Plains, Hants County, Nova Scotia.

Strict adherence to the attached terms and conditions is imperative in order to validate this approval.

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

Should you have any questions, I can be reached at Central Region, Bedford Office at (902) 424-2560.

Yours truly,

Bernie J Matlock, P. Eng.
Regional Engineer

cc D. Feldman
S. Dockerty

Eimas #: 2001-019700-A02

NOVA SCOTIA
Environment

APPROVAL

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

APPROVAL HOLDER:	Municipal Enterprises Limited
SITE PID:	45270493 & 45336963
APPROVAL NO:	2001-019700-A02
EXPIRY DATE:	September 9, 2011

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

Construction, operation and reclamation of a Quarry, and associated works, at or near 700 Panuke Rd, Three Mile Plains, Hants County in the Province of Nova Scotia.

Administrator Don Jollow

Effective Date September 19, 2008

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Environment

Approval Holder:	Municipal Enterprises Limited
Project:	Quarry Expansion
Site:	700 Panuke Rd, Three Mile Plains, Hants County PID # 45270493 & 45336963
Approval No:	2001-019700-A02
File No:	92100-30-019700
Map Series:	21 A/16
Grid Reference:	E414055 N4976410

Reference Documents:

- Application dated July 2, 2008 and attachments including a report entitled *"Revised Application for Amendment to Industrial Approval No. 2001-019700 -A01 Under Activities Designation Regulations for Proposed Quarry Expansion Operations at Panuke Quarry"* prepared by Jacques Whitford, Project No.1014939.01 August 2008.
- Environmental Assessment, Final Report, Registration, Panuke Quarry, Expansion Project, Project No. 1014939 by Jacques Whitford on behalf of Municipal Enterprises Limited.
- Environmental Assessment Approval with terms and conditions signed by the Minister April 7, 2008.

1. **Definitions**

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

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

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

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

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

Nova Scotia Environment
Environmental Monitoring and Compliance Division
Central Region, Bedford Office,
Suite 224, 1595 Bedford Highway,
Bedford, Nova Scotia, B4A 3Y4.

Phone: (902) 424-7773
Fax: (902) 424-0597

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

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

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

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

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

2. Scope of Approval

a) This Approval (the "Approval") relates to the Approval Holder and their application and supporting documentation, as listed in the reference documents above, to construct, operate and reclaim the Facility, situated at or near 700 Panuke Rd, Three Mile Plains, Hants County (the "Site").

b) The Facility shall be constructed, operated and reclaimed as outlined in the application for Industrial Approval dated July 2, 2008, reference documents and supporting documentation unless otherwise indicated by the terms and conditions of this Approval.

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

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

3. **General Terms and Conditions**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

4. **Construction of Facility**

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

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

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

Clear Flows (Normal Background Conditions):

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

High Flow (Spring Freshets and Storm Events)

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

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

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

5. **Particulate Emissions (Dust)**

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

Annual Geometric Mean 70 µg/m^3

Daily Average (24 hr.) 120 µg/m^3

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

c) The Approval Holder shall complete a minimum of three baseline particulate monitoring events which include upwind and downwind monitoring stations along the property boundary prior to commencement of construction or operation of the Facility expansion. The baseline measurements will be conducted so as to include existing regional particulate emission sources (eg., existing adjacent quarry activity).

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

f) Where it is the opinion of the Department that the Approval Holder exceeds limits established in Condition 5 (a) the Approval Holder will be required to implement a corrective action plan which may include additional ambient air monitoring.

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

6. **Sound Levels**

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

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

b) The Approval Holder shall complete baseline noise monitoring events for each period of the day at three monitoring stations along the property boundary of the Site. Monitoring shall be completed prior to commencement of construction or operation at the Facility expansion. The baseline measurements will be conducted so as to include existing regional noise sources (eg., existing adjacent quarry activity).

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

d) Where it is the opinion of the Department that the Approval Holder exceeds limits established in Condition 6 (a) the Approval Holder will be required to implement a corrective action plan which may include additional noise monitoring. The Approval Holder shall implement immediate corrective actions to mitigate noise if so directed by the Department.

7. **Surface Water**

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

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

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

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

i) **Total Suspended Solids**

Clear Flows (Normal Background Conditions):

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

High Flow (Spring Freshets and Storm Events):

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

ii) **pH**

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

iii) **Monitoring Locations**

1) The Approval Holder shall sample at the following locations identified on Figure B-4:

SW-1 (Compliance Point) Discharge from Settling Pond prior to release to unnamed brook.

SW-2 (Compliance Point) Discharge from Settling Pond prior to release to the unnamed brook.

Station A upstream on unnamed brook

iv) **Sampling Frequency**

1) The Approval Holder shall sample at the following frequency: Weekly for Station SW-1,SW2 and Station A and within 24 hours following a rainfall event (ie.> 25 mm).
(Monitoring of Station SW-2 is only required when the active area of the Facility is on the west side of the brook.)

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

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

g) The Approval Holder shall implement immediate corrective action or conduct liquid effluent or surface water monitoring to mitigate surface runoff if Site runoff exceeds the discharge limits established in Condition 7(d) or if so directed by the Department.

h) The Approval Holder shall establish four (4) surface water monitoring stations identified on Figure B4 as:

A - Upstream on Unnamed Brook
B - Downstream on Unnamed Brook
SW-1 Discharge from Settling Pond prior to release to the unnamed brook.
SW-2 Discharge from Settling Pond prior to release to the unnamed brook.

i) The Approval Holder shall monitor Station B for total suspended solids and pH Within 24 hours following a rainfall event (ie.>25 mm).

j) The Approval Holder shall conduct baseline monitoring at stations A, B and SW-1 for the parameters listed in Appendix I prior to commencement of disturbance in the Facility expansion area.

k) The Approval Holder shall monitor Station A, Station B, SW-1 and SW-2 semi-annually for nitrate, and sulphate.

l) A quarterly summary of results of surface water and effluent monitoring shall be submitted to the Department.

m) Prior to installing a culvert or crossing on the unnamed brook for the purpose of quarry access, the Approval Holder shall notify and/or obtain the appropriate approval from the Department.

8. **Groundwater**

a) The Approval Holder shall establish three (3) groundwater monitoring stations which shall be identified as follows:

MW-1 Situated in the buffer zone adjacent to the access road between the unnamed watercourse and the workings to the west of the unnamed watercourse.

MW-2 Situated in the buffer zone adjacent the to the access road between the unnamed watercourse and the workings to the east of the unnamed watercourse.

MW-3 South of the quarry working face along the property boundary

b) Groundwater monitoring stations shall be monitored for the parameters identified in Appendix I, total dissolved solids, temperature and total petroleum hydrocarbon;

i) on initial development of the expansion area,
ii) annually, thereafter

c) Groundwater monitoring stations shall be monitored for static water level on a quarterly basis.

d) The Approval Holder shall conduct additional monitoring or mitigative work to correct adverse environmental impacts if so directed by the Department.

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

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

g) An annual summary of results of groundwater monitoring shall be submitted to the Department by February 15 of each year.

9. **Separation Distances**

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

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

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

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

b) The Approval Holder shall not blast within:

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

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

10. **Blasting**

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

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

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

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

e) The Approval Holder shall ensure that all blasts are monitored for concussion and ground vibration to ensure that the limits in Table 1 are not exceeded:

Table 1

Blasting Limits

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

f) The monitoring station for blasting shall be as indicated in Table 1. Additional monitoring stations for blasting may be specified as required by the Department.

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

11. **Rehabilitation**

a) The Approval Holder shall submit a revised financial security to the Department within 60 days of the date of approval. This security shall be in the value of $70,000 and in a form acceptable to the Department.

b) The Approval Holder shall submit a Facility development and rehabilitation plan to the Department for review by June 9, 2011. The plan shall indicate the details of Site disturbance, status of progressive reclamation and anticipated Facility development for the upcoming three year period. The rehabilitation

plan shall include the estimated total cost for labour, equipment, supplies and services of a third party contractor to undertake the following activities:

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

c) The Approval Holder shall post financial security which shall be no less than that identified in Condition 11(a) and subject to change based on estimates calculated using the rehabilitation plan and factors in item 11 (b) above. The value of the final security shall be approved by the Department and reviewed in accordance with the revised rehabilitation plan.

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

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

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

12. **Site Specific Conditions**

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

b) The Approval Holder shall collect and analyse two samples of bedrock for acid generating potential prior to advancement within the proposed expansion area of the Facility.

c) The Approval Holder shall be required to sample and analyse aggregate for acid generating potential when new geological structures become evident during quarry operations or when specified by the Department.

d) The Approval Holder shall be required to manage and dispose of any potentially acid generating rock in accordance with the Sulphide Bearing Materials Disposal Regulations.

e) The Approval Holder shall contour, stabilize and re-vegetate all areas of the existing active area which are situated within 30 metres of the unnamed watercourse. This work shall be completed by December 1, 2008.

f) The Approval holder shall designate a company contact in writing responsible for communications related to this Approval.

13. **Complaint Resolution**

a) The Approval Holder shall have standard procedures to address complaints associated with the Facility which would include but not be limited to;

(i) Immediately investigate the cause of the complaint and undertake immediate and appropriate action, if necessary, to correct the problem.

(ii) The Approval holder shall record all complaints and document the date, time, name, address and telephone number of the individual lodging the complaint. The record shall also state any cause and the action taken to correct a problem.

(iii) Records referenced in condition 13(a)(ii) shall be maintained for a minimum two (2) years and made available to the Department upon request.

14. **Contingency Plan**

a) The Approval Holder shall maintain a contingency/emergency response plan for the Facility. This plan is to meet the requirements of the Nova Scotia Department of Environment Contingency Planning Guidelines, as amended from time to time. The plan is to include:

i) general procedures for routine (equipment break-down, upset conditions, maintenance, etc.) or major emergencies within the Facility, and

ii) a plan for dealing with emergency issues including but not limited to fires, explosions, spills and releases.

b) The Approval Holder shall ensure that the contingency/emergency response plan for the Facility is reviewed and updated on a yearly basis.

c) A copy the contingency/emergency response plan is to be maintained on Site at all times for inspection by staff of the Department. All employees shall be trained in the implementation of the contingency plan.

15. **Community Liaison Committee (CLC)**

The Approval Holder shall be required to establish a community liaison committee (CLC) if so directed by the Department.

Appendix I

Total alkalinity
Dissolved chloride
Colour
Hardness
Nitrate & nitrite
Nitrite
Ammonia (Ammonia nitrogen)
Total organic carbon
Orthophosphate
pH
Reactive silica
Dissolved sulphate
Turbidity
Conductivity
Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Manganese
Molybdenum
Nickel
Selenium
Silver
Strontium
Thallium
Tin
Titanium
Uranium
Vanadium
Zinc

APPENDIX B
Hants County Aggregate Quarry Extension Hydrology Study

Hants County Aggregate Quarry
Hydrology Study

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

Municipal Enterprises Ltd.
P.O. Box 48100
Bedford, NS B4A 3Z2

File: 121510261

March 2010

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1.0 Introduction

1.1 GENERAL

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

Objectives

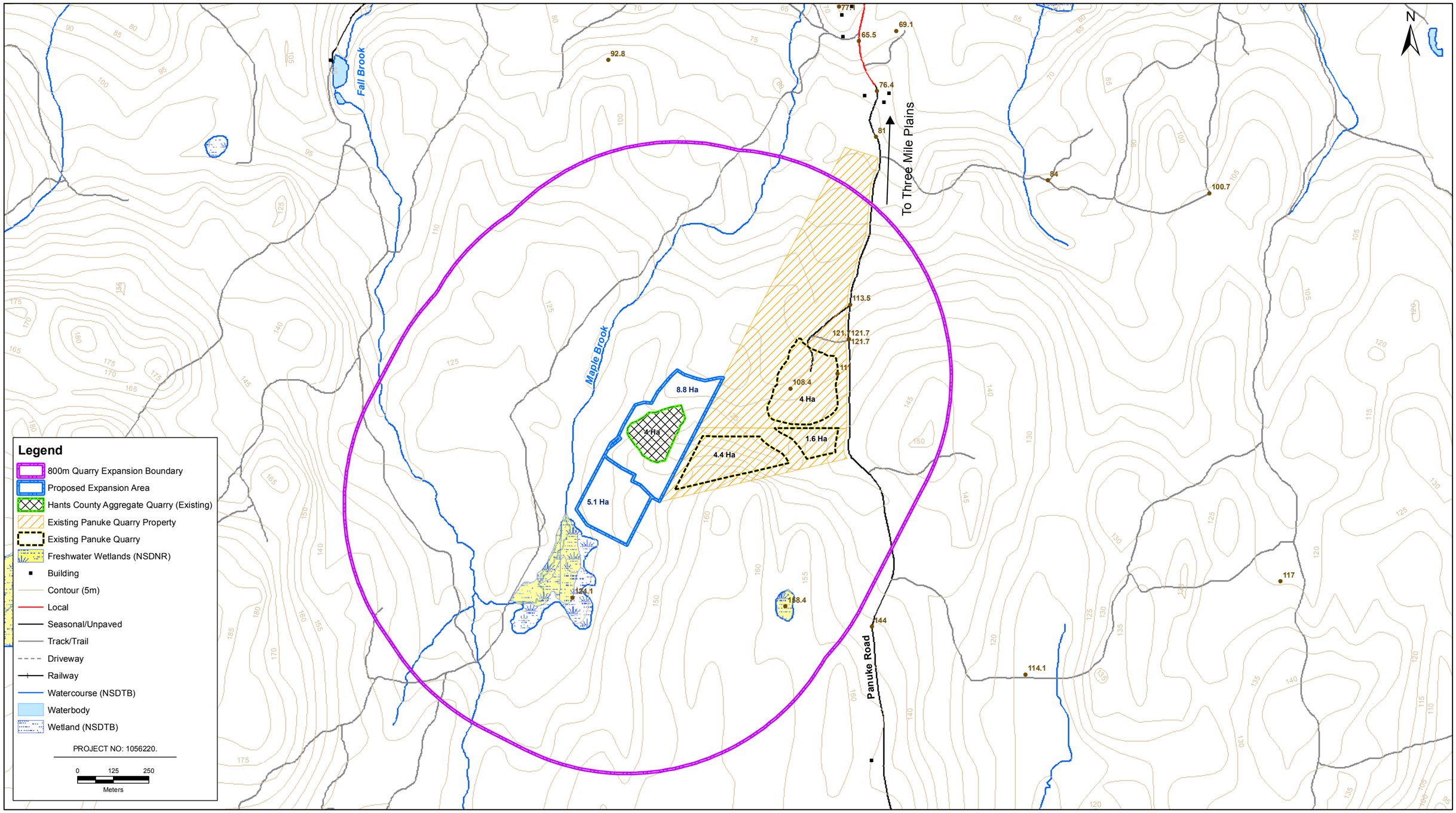
The main objectives of this hydrologic assessment are:

- Estimate the total change in surface water runoff amounts for the pre and post-development conditions;
- Estimate the total capacity of the required flow retention/siltation facilities (*i.e.,* retention pond) for the ultimate level of quarry extension; and
- 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.

1.2 SITE DESCRIPTION AND BACKGROUND

The proposed quarry extension land (referred thereafter as the “site”) is located approximately 8 km south of the town of Windsor, in Hants County, Nova Scotia. The proposed extension is situated around the area of the existing Hants County Quarry which covers approximately 3.9 Ha. The property identification number (PID) is 45007176. The total area of the proposed extension is 13.9 Ha extending from NE to SW and parallel to the property boundaries.

The Site is irregular in shape with its longest dimension extending from NE to SW. As indicated previously, the existing quarry encompasses an area of 3.9 Ha and has been operating for the past 35 years. As the operation progresses, the organic layer at the site is removed and stockpiled for future reinstatement. The aggregates from the quarry are extracted by blasting, crushing and stockpiling of material on site (overburden and bedrock) and are primarily offered to the local construction market. It is expected that the operation of the proposed quarry extension will be the same as the existing quarry. The existing quarry boundary, the proposed extension area and other main features of the area are shown in Figure 1.1.

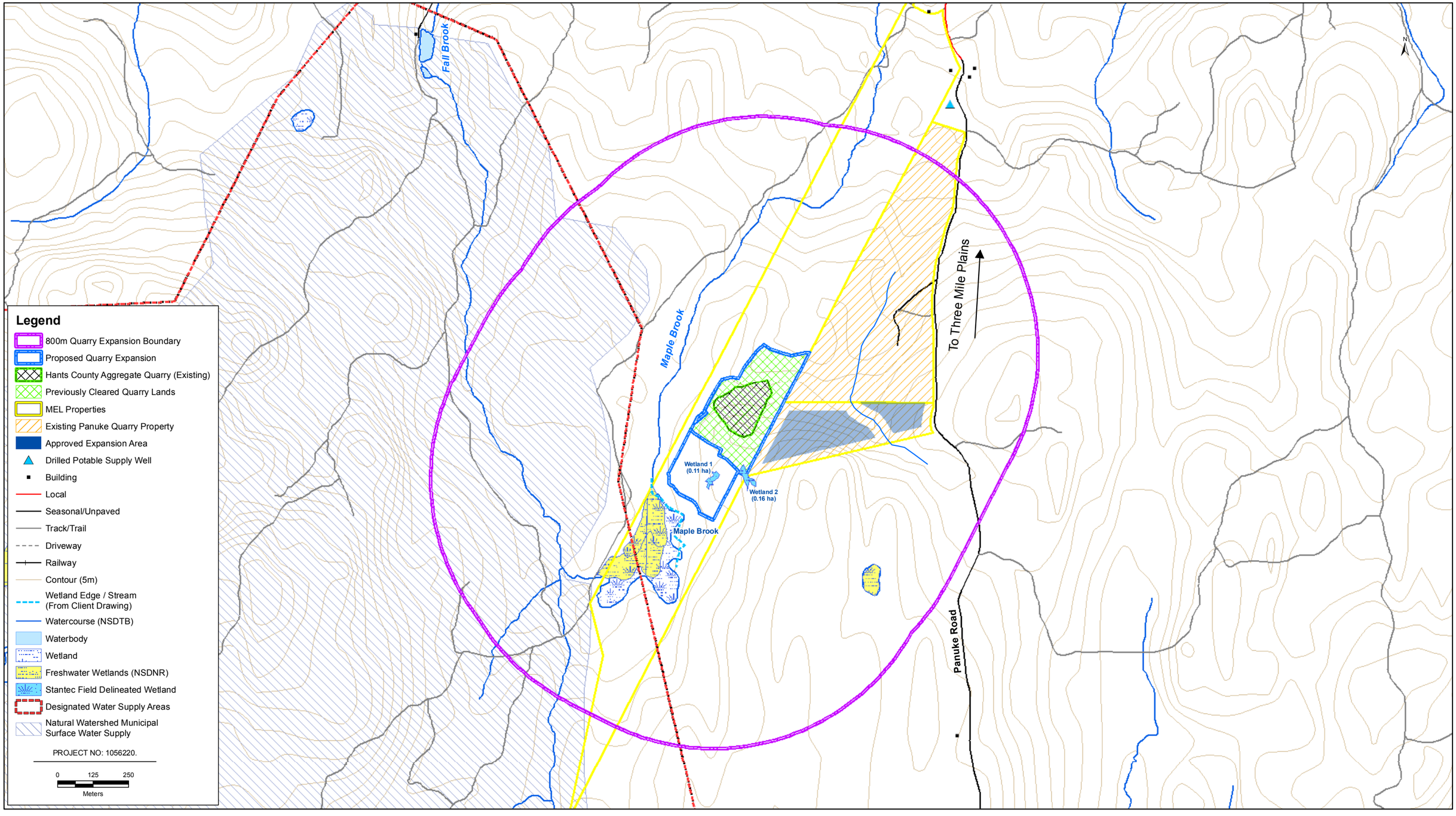


DATE: 07/06/2010	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **Figure 1.1**
PREPARED BY: G. MESHEAU		
MUNICIPAL ENTERPRISES LIMITED	**PROJECT LOCATION AND PROPOSED EXTENSION AREA**	Stantec

The existing topography for the entire site slopes to the north towards Maple Brook. Surface runoff is directed to one settling pond prior to been discharged to a naturally vegetated area where it is infiltrated. During a site visit conducted by Stantec representatives on October 7, 2009, the presence of a watercourse was confirmed within the property (Maple Brook). According to the available GIS mapping, Maple Brook is located approximately 30 m away from the edge of the proposed quarry extension boundary. At the time, the watercourse exhibited clear flowing water with no apparent barriers to fish passage outside the proposed project extension boundary. A desktop review of the available GIS mapping, specifically the watercourse layer indicated that Maple Brook is likely connected to tributaries that eventually discharge to the St. Croix River.

The site is intended to be developed over the next years until complete extension is achieved. It is our understanding that the site will be expanded gradually to the southwest until the entire proposed development boundary is reached.

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



DATE: 25/06/2010	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **Figure 1.2**
PREPARED BY: G. MESHEAU		
MUNICIPAL ENTERPRISES LIMITED	**HYDROLOGICAL FEATURES**	Stantec

2.0 METHODOLOGY

2.1 MEAN ANNUAL SITE RUNOFF ESTIMATION

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

2.2 FLOW RETENTION AND SILTATION TREATMENT SIZING

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

The parameters required for calculations were obtained from different sources. Annual precipitation data was obtained from climate normals from Station 8206415 (Windsor Martock) operated by Environment Canada. Station 8206415 is located approximately 5.5 km to the west 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 8202800 (Kentville), operated by Environment Canada. Station 8202800 is the nearest station with available data and is located approximately 35 km to the northwest of the site.

2.3 RESULTS

2.3.1 Mean Annual Site Runoff Estimation

Based on climate normals (1971-2000) from station 8206415 (Windsor Martock), the average total annual precipitation at the site is in the order of 1308.2 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 626 mm, or 48% of the average annual precipitation. Infiltration is assumed to be in the order of 15% of the average annual precipitation based on the hydrologic soil group, vegetation cover and average surface topography at the site combined with previous experience with similar sites in Nova Scotia (David MacFarlane, personal communication, June 22nd 2009). The annual infiltration is therefore in the order of 196.2 mm.

The remaining 37% of the average annual precipitation can contribute to surface runoff to the site which corresponds to 484 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 50 years) it is advisable to account for climate change effects, and therefore an extra 10% increase in mean annual precipitation was assumed (Jacques Whitford 2008). Therefore, the annual effective precipitation at the site is assumed to be 638.8 mm.

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

Table 2.1 Pre and Post Development Site Runoff Volumes

Scenario	Area (Ha)	Effective annual Precipitation (mm)	Runoff Volume (m^3)	Mean annual Flow (L/s)
Existing condition	3.9	484.0	18,876.0	0.59
Proposed Extension	13.9	638.8	88,793.2	2.81

Therefore, the expected increase in the average annual site runoff due to the proposed quarry extension is in the order of 69,917.2 m3 or a 370% increase from the existing condition.

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: 7.6 mm/hr Imperviousness: 60%
Clark Unit Hydrograph Routing Method	Concentration Time (Tc): 1.2 hr

Table 2.2 Summary of Hydrologic Parameters used in HEC-HMS

Parameter	Quarry Extension Phase
Included Storms	6 hour 1:25 year return period 6 hour 1:100 year return period
Subcatchment Area	0.139 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

Scenario	Area (Ha)	Flow Path Length (m)	Slope (m/m)	Concentration Time (min)
Quarry Extension	13.9	600	0.002	72

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

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

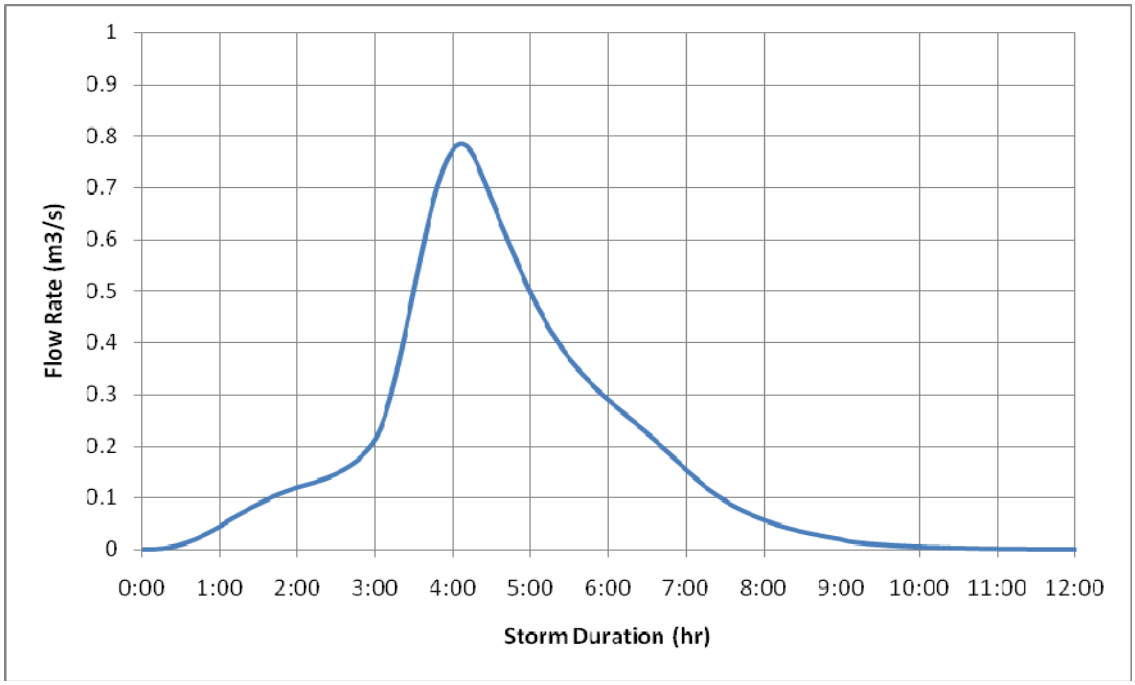
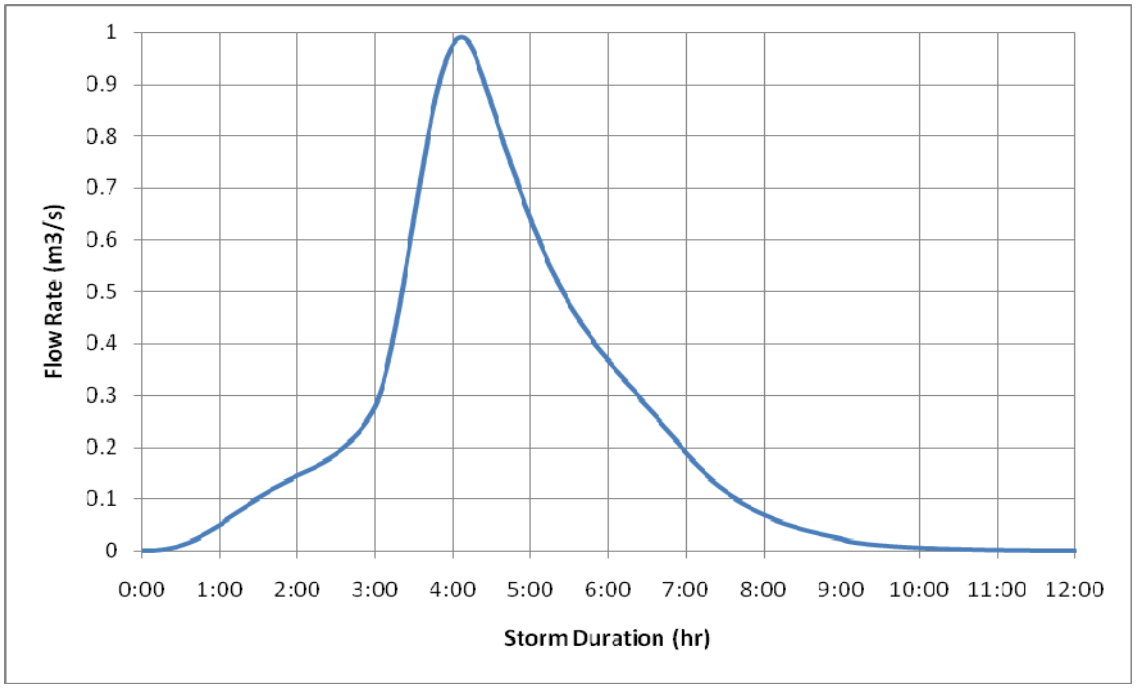


Figure 2.2 Flow Hydrograph for the 1:100 Year Rainfall Event for Full Quarry Extension



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

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

Extension stage	Return Period	Peak Flow (m^3/s)	Volume (m^3)
Full quarry extension (proposed)	1:25	0.78	7,790
	1:100	0.98	9,850

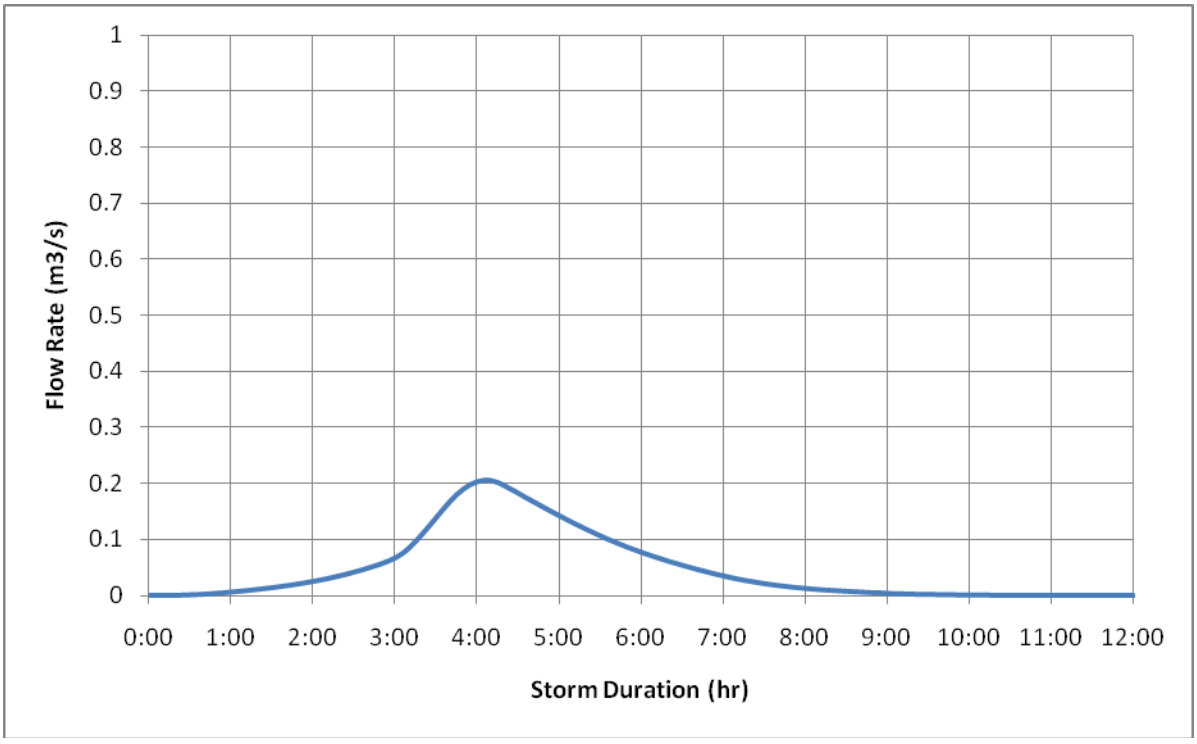
It is recommended to size the flow retention structures to retain the volume from the 1:25 year rainfall event. Therefore, the total volume of retention storage for the site for the ultimate level of quarry extension should be in the order of 7,790 m3. This volume is only expected after the site has 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 0.98 m3/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 0.20 m3/s.

Drawdown of water levels from the 1:25 year rainfall event detention storage level to the permanent pool retention level should be estimated based on the detention time that will improve water quality. A recommended drawdown period of 24 hours is expected to decrease suspended sediment concentrations by as much as 80%. Based on the low flow threshold of 24 hour discharge for runoff events equal or smaller than the 1:25 year rainfall event, the mean discharge capacity should be 0.09 m3/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 69,917.2 m3 from the existing condition. As mentioned previously, there are a number of identified wetlands on the site that are not indicated on provincial mapping, it is assumed that the full development of the site as a quarry operation will result in partial and/or total removal of the field identified wetlands from the site. Although it has not been quantified, the elimination of

these wetlands may also increase peak flows by reducing storage capacity. However, this effect is considered negligible when compared to other factors that influence flow routing and peak flow generation.

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

The Nova Scotia Department of Environment 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 Hants Quarry extension project.

The existing annual site runoff volume for the site is estimated to be in the order of 18,876 m3. The expected total increase in the mean annual runoff for the site resulting from the proposed extension is in the order of 88,973.2 m3 or a 370% increase from the existing condition.

The flow retention structures for the proposed quarry extension should be able to accommodate a volume of 7,790 m3 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 7,790 m3 can have approximate dimensions of 45 m x 45 m x 4 m.

The outlet structures for the retention pond should be able to accommodate a discharge of 0.20 m3/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 90 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 Municipal Enterprises 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.

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

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 Pit & Quarry Guidelines. May 1999.

APPENDIX C
Project Information Bulletin and Letters

Municipal Enterprises Limited
Hants County Aggregates Project
Project Information Sheet

Project Overview

Municipal Enterprises Limited is proposing to combine the operations of the Hants County Aggregates Quarry in Panuke, Hants County, Nova Scotia, with the existing Panuke Quarry (refer to Figure 1). The current operation at Hants County Aggregates is approximately 4 hectares in area. The proposed extension of the existing Hants County Aggregates Quarry will incorporate land north, south and southwest of the existing quarry to increase the total size of the operation to approximately 13.9 hectares. Blasting, crushing and stockpiling of aggregate currently takes place at the Hants County Aggregate site and this is not expected to change. The quarried material at this site is primarily used for Nova Scotia Transportation and Infrastructure Renewal (NSTIR) projects, but after amalgamation with Panuke Quarry the intent is that the Hants County Aggregates site will be used for both NSTIR contracts and general contracts. The existing Panuke quarry is approximately 4 hectares in area and has an approval extension area of 6 ha. It is primarily used as a source of aggregate in the making of asphalt. The proposed activities will take place over a period of time until the material is exhausted. Based on current estimates there are over 1 million tonnes of rock reserves on both properties.

Proposed project activities will be consistent with current quarry operations. Aggregate production includes drilling and blasting, which is conducted by a licensed blasting contractor. Blasting takes place approximately one to three times per year. After blasting, portable crushing equipment is brought to the site to process the blasted rock. Various products (*i.e.*, various aggregate sizes) are 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 estimated truck traffic will be consistent with current truck volume at the existing quarry.

The anticipated average production rate is approximately 60,000 to 100,000 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 quarry will be open nine months of the year, however the portable crushing equipment is only on site two to three times a year for duration of ten days to two week. This proposed schedule is consistent with the current operating schedule.

Environmental Assessment Process

Municipal Enterprises 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 Consulting Ltd., on behalf of Municipal Enterprises 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 Document Components

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

- Rare and sensitive flora;
- Wildlife;
- Surface water resources
- Groundwater resources;
- Wetlands;
- Archaeological and heritage resources;
- Atmospheric environment (includes dust and noise); and
- Socio-economic environment.

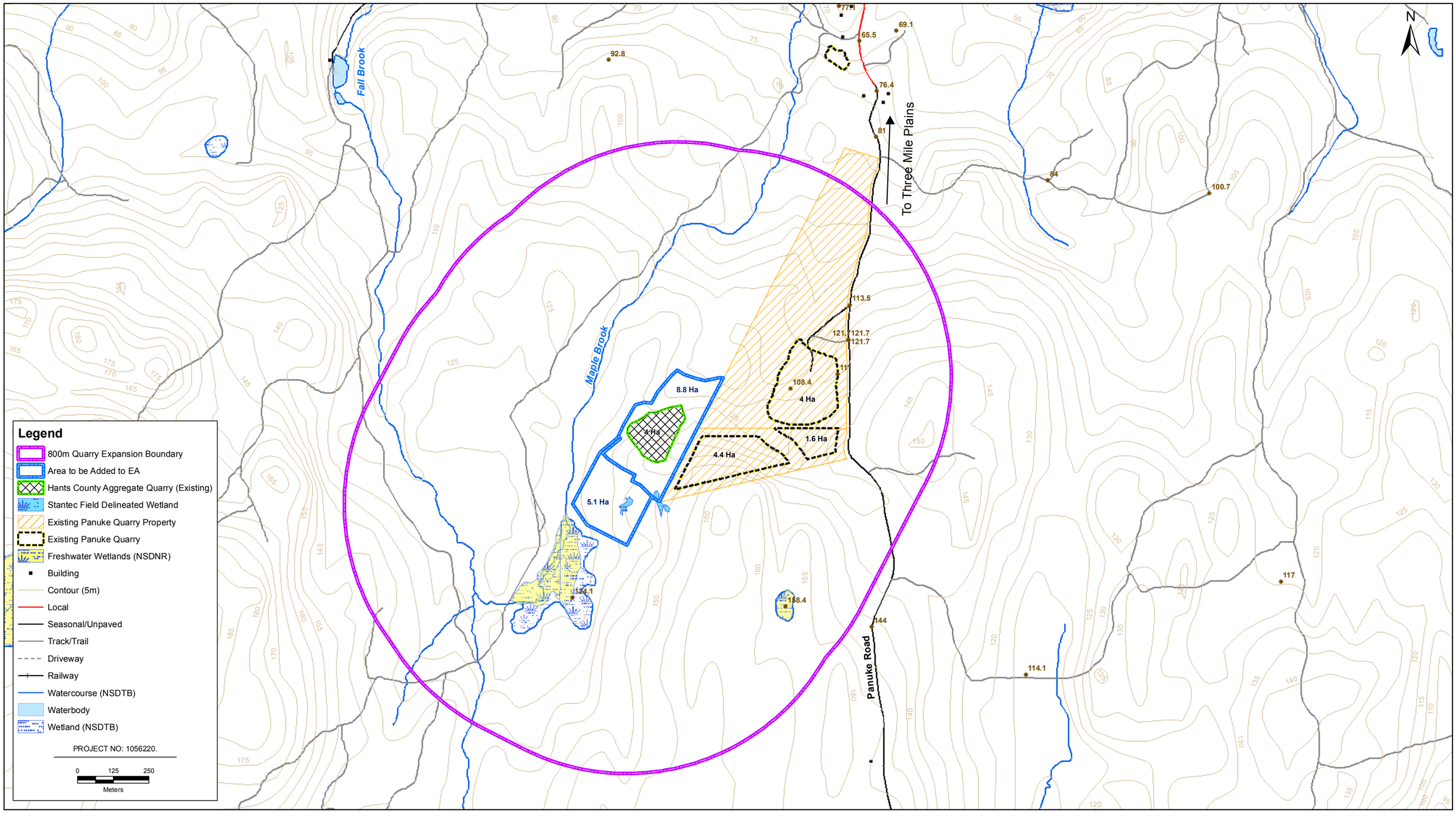
Potential effects of quarry activities on these components will be addressed in the registration document. To date, no sensitive features have been identified onsite; however, field investigations are ongoing. Assuming the implementation of standard mitigative measures and government guidelines and approvals,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

Contacts

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

Mr. Danny Clifton
Municipal Enterprises Limited
P.O. Box 48100 RPO Mill Cove, Bedford, NS B3A 3Z2
Tel: (902) 456-4582 / E-mail: dclifton@dexter.ca

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



DATE: 29/01/2010	Environmental Assessment of Hants County Aggregate Extension Project	FIGURE NO.: **Figure 1**
PREPARED BY: G. MESHEAU	**PROJECT LOCATION**	Stantec
MUNICIPAL ENTERPRISES LIMITED		

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

February 11, 2010
File: 121510261

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

Attention: **Mrs. Grace Conrad**

Dear Mrs. Conrad:

Reference: **Municipal Enterprises Limited Quarry Extension Project**

This letter is to inform you of a proposed Project near the community of Panuke, Hants County, Nova Scotia.

The Project consists of combining two existing quarries along Panuke Road in Panuke, Hants County, NS. The developer, Municipal Enterprises Limited, is proposing to combine the Hants County Aggregates Quarry with the existing Panuke Quarry. Municipal Enterprises Limited 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 11, 2010
File: 121510261

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

Attention: Ms. Janice Maloney

Dear Ms. Maloney:

Reference: Municipal Enterprises Limited Quarry Extension Project

This letter is to inform you of a proposed Project near the community of Panuke, Hants County, Nova Scotia.

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robert.federico@stantec.com

Cc. Gillian Asche, SCL

Attachment

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3 Spectacle Lake Drive
Dartmouth NS B3B 1W8
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Fax: (902) 468-9009

February 11, 2010
File: 121510261

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: Municipal Enterprises Limited Quarry Extension Project

This letter is to inform you of a proposed Project near the community of Panuke, Hants County, Nova Scotia.

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Sincerely,

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Cc. Gillian Asche, SCL

Attachment

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

February 11, 2010
File: 121510261

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

Attention: Mr. Joe B. Marshall

Dear Mr. Marshall:

Reference: Municipal Enterprises Limited Quarry Extension Project

This letter is to inform you of a proposed Project near the community of Panuke, Hants County, Nova Scotia.

The Project consists of combining two existing quarries along Panuke Road in Panuke, Hants County, NS. The developer, Municipal Enterprises Limited, is proposing to combine the Hants County Aggregates Quarry with the existing Panuke Quarry. Municipal Enterprises Limited 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.

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

Cc. Gillian Asche, SCL

Attachment

APPENDIX D
Aquatic Photo Appendix

Photo 1: Downstream, cobble substrate section of assessment area

Photo 2: Downstream, cobble-substrate section of assessment area

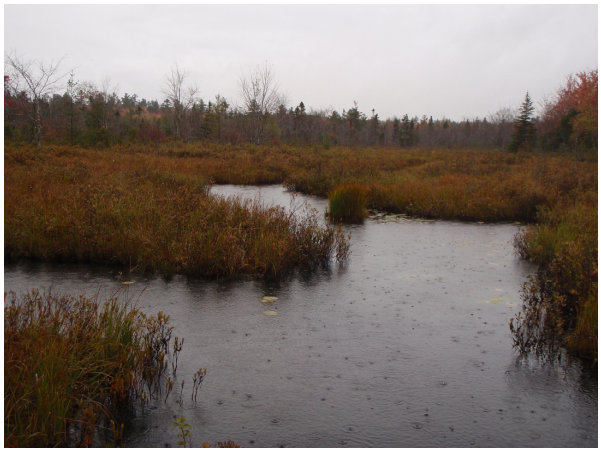
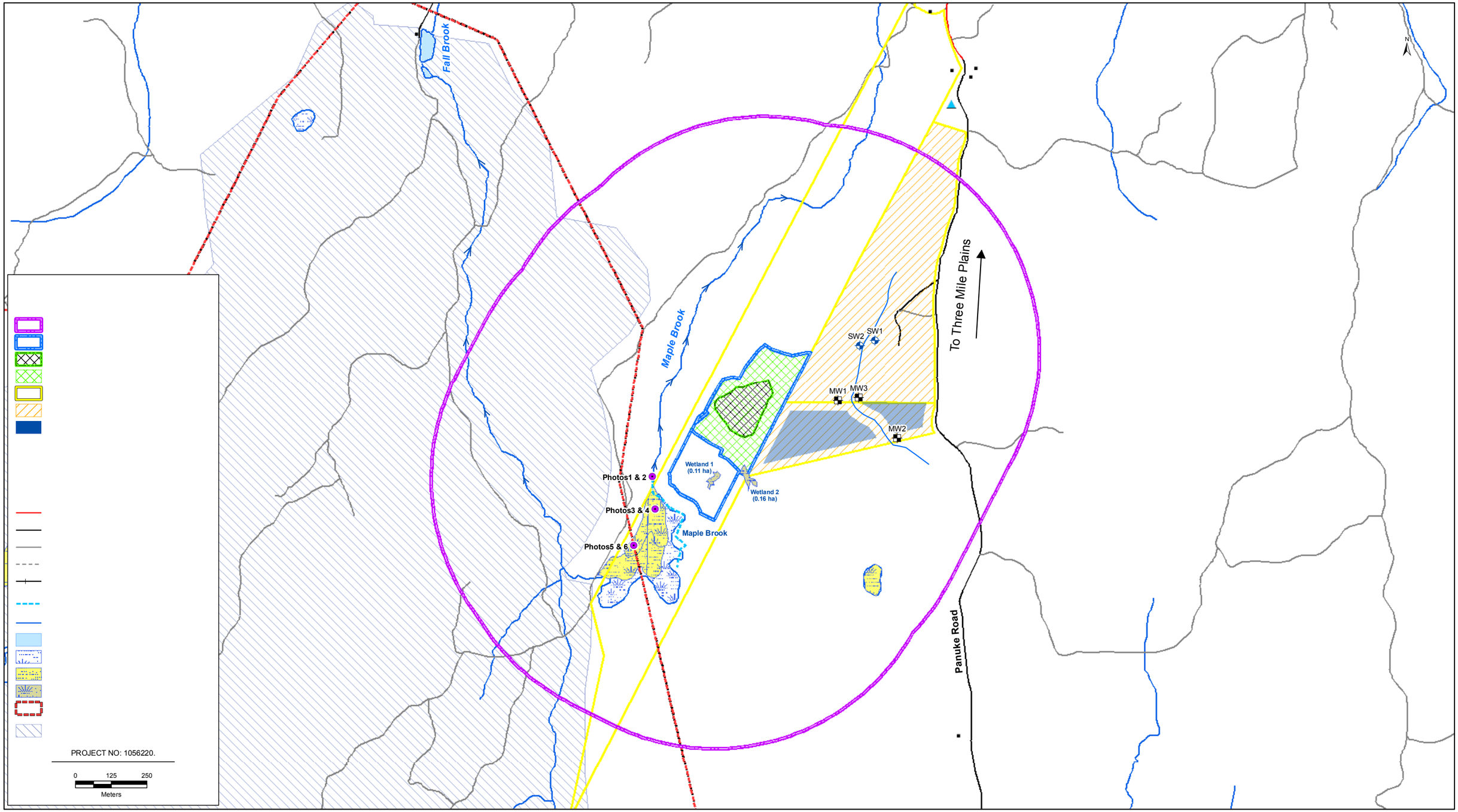


Photo 3: Upstream section of assessment area, looking upstream towards open wetland riparian zone

Photo 4: Upstream section of assessment area looking downstream towards mixed forest riparian zone

Photo 5: Furthest upstream section of assessment area ; stream narrows considerably in wetland

Photo 6: Furthest upstream section of assessment area; stream narrows considerably in wetland.



PREPARED BY:	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **APPENDIX D**
MUNICIPAL ENTERPRISES LIMITED	**AQUATIC PHOTO LOCATIONS**	Stantec

APPENDIX E
Vascular Plants Potentially Present the Study Area

Table E-1 Rare and Sensitive Plants Identified During the Modelling Exercise as Being Potentially Present in the Study Area

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank
White Snakeroot	*Ageratina altissima*	Woods, thickets.	July to October.	S1	May Be At Risk
Triangle Grape-Fern	*Botrychium lanceolatum*	Rich, wooded hillsides.	July and August. Can be identified until early October if sporophore is present.	S2S3	Sensitive
Least Grape-Fern	*Botrychium simplex*	Usually on lakeshores or the mossy edges of streams or waterfalls although it has been reported in a wide variety of habitats.	Late May and June	S2S3	Sensitive
Large Toothwort	*Cardamine maxima*	Rich most often calcareous moist rocky slopes and deciduous woods.	May but identifiable at least into June and July.	S1	May Be At Risk
Small-Flower Bitter-Cress	*Cardamine parviflora*	Dry woods, shaded or exposed ledges, and in sandy soils.	April to August	S2	Sensitive
Chestnut-Colored Sedge	*Carex castanea*	Swamps and wet meadows, cliff crevices and ledges.	Not given for NS, Summer. Seeds (perigynia) required for identification.	S2	May Be At Risk
Bristly Sedge	*Carex comosa*	Swamps and shallow water.	June to August	S2	Sensitive
Cloud Sedge	*Carex haydenii*	Swamps.	July to September	S1	May Be At Risk
A Sedge	*Carex houghtoniana*	Sandy soils and roadside banks.	Seeds (perigynia) required for identification. Can be identified from May through September.	S2?	Sensitive
Porcupine Sedge	*Carex hystericina*	Swamps, swales, and along brooks.	June to October	S2	May Be At Risk
Woolly Sedge	*Carex pellita*	Swamps and bogs, often in wooded areas.	May to July	S1	May Be At Risk
Plantain-Leaved Sedge	*Carex plantaginea*	Dry, hardwood hillsides.	April to June	S1	May Be At Risk
Swan Sedge	*Carex swanii*	Boggy pastures, dry peaty barrens, forests, clearings, and the edges of woods.	Early summer	S2S3	Sensitive
Slender Sedge	*Carex tenera*	Meadows, woodlands, and moist, dry openings.	Late May to August	S1S2	Sensitive
Blue Cohosh	*Caulophyllum thalictroides*	Deciduous and intervale forest.	April to early June, can be identified when not in flower.	S2	May Be At Risk
Purple Clematis	*Clematis occidentalis*	Rocky, often calcareous slopes, and open woodlands.	May to June	S1	May Be At Risk

Table E-1 Rare and Sensitive Plants Identified During the Modelling Exercise as Being Potentially Present in the Study Area

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank
Hemlock Parsley	*Conioselinum chinense*	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast.	August to October	S2	Sensitive
Squaw-Root	*Conopholis americana*	Associated with oaks and other deciduous trees.	April to July	S1S2	May Be At Risk
Showy Tick-Trefoil	*Desmodium canadense*	Open woods, thickets and river banks.	Late July to early September, can be identified when not in flower.	S1	May Be At Risk
Large Tick-Trefoil	*Desmodium glutinosum*	Rich deciduous woods or intervales	June and July	S1	May Be At Risk
Eastern Leatherwood	*Dirca palustris*	Rich deciduous or mixed woods.	On or about May 20, appearing before the leaves.	S1	May Be At Risk
Ovate Spikerush	*Eleocharis ovata*	Muddy shores and ditches.	Flowers/Fruit May to October	S2?	Sensitive
Joe-Pye Thoroughwort	*Eupatorium dubium*	Rocky shores, swamps and damp thickets.	August and September, can be identified when not in flower.	S2	May Be At Risk
Nodding Fescue	*Festuca subverticillata*	Rich deciduous forested slopes and alluvial woods.	June and July (early)	S1	May Be At Risk
False Mermaid-Weed	*Floerkea proserpinacoides*	Deciduous ravine slopes, river margins, and intervale forests.	Late May to late June. Can be identified when not in flower.	S2	Sensitive
Black Ash	*Fraxinus nigra*	Low ground, damp woods and swamps.	May and June. Can be identified without flowers.	S2S3	Sensitive
Green Ash	*Fraxinus pennsylvanica*	Near lakes or ponds, or in other low-lying areas.	May	S1	May Be At Risk
Northern Bedstraw	*Galium boreale*	The edges of woods and in grassy places, such as pastures.	June to August	S2	May Be At Risk
Downy Rattlesnake-Plantain	*Goodyera pubescens*	Woodland and thickets. Usually found in dry or moist coniferous or mixed woods, often in a sandy substrate with oak or white pine.	July and August	S2	May Be At Risk
Dwarf Rattlesnake-Plantain	*Goodyera repens*	Under conifers, growing with very few other plants.	July and August	S3	Sensitive
Clammy Hedge-Hyssop	*Gratiola neglecta*	Usually in wet or muddy places.	May to October (fruit in August)	S1S2	Sensitive
Round-Lobe Hepatica	*Hepatica nobilis*	Dry, usually mixed deciduous forest.	Early May	S1	May Be At Risk
Golden-Heather	*Hudsonia ericoides*	Dry, rocky, and sandy barrens. Recently disturbed areas or on open sandy soils.	Late May to early July	S2	Sensitive
Larger Canadian St. John's Wort	*Hypericum majus*	Wet or dry open soil.	July to September	S1	May Be At Risk

Table E-1 Rare and Sensitive Plants Identified During the Modelling Exercise as Being Potentially Present in the Study Area

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank
Dudley's Rush	*Juncus dudleyi*	Damp soil and open places.	Summer	S2?	Sensitive
Blunt-Fruited Sweet-Cicely	*Osmorhiza depauperata*	Moist woods and clearings.	Late June and July	S1	May Be At Risk
Slender Mountain-Ricegrass	*Piptatherum pungens*	Dry woods and clearings in sandy soils.	May and June	S2	Sensitive
Southern Rein-Orchid	*Platanthera flava*	Sand or gravelly beaches, wet peat, and lake or river margins. Bogs, swamps, and meadows.	May to August	S2	Sensitive
Large Round-Leaved Orchid	*Platanthera macrophylla*	Rich old deciduous or mixed woods.	August	S2	Sensitive
Field Milkwort	*Polygala sanguinea*	Poor or acidic fields, damp slopes, and open woods or bush.	Late June to October	S2S3	Sensitive
Cursed Crowfoot	*Ranunculus sceleratus*	Marshes, ditches, swampy meadows.		S1S2	May Be At Risk
Cut-Leaved Coneflower	*Rudbeckia laciniata*	Swales, the edges of swamps, or in gullies - in small colonies.	August, can be identified when not in flower.	S2	Sensitive
Willow Dock	*Rumex salicifolius*	Rich alluvial thickets and swamps.	Likely mid July to October but this annual is detectable with or without flowers.	S2	Sensitive
Black Snake-Root	*Sanicula odorata*	Rich, alluvial woods and along intervales.	July to August	S1	May Be At Risk
Hairy Goldenrod	*Solidago hispida*	Woods and forest edges.	Summer and fall	S1?	May Be At Risk
Case's Ladies'-Tresses	*Spiranthes casei*	Acid, sandy soils, roadsides and open barrens.	September	S2	Sensitive
Lindley's Aster	*Symphyotrichum ciliolatum*	Open fields, lawns and the edges of woods.	August and September	S2S3	Sensitive
Northern White Cedar	*Thuja occidentalis*	Lakesides and swamps or old pastures.	Can be identified throughout the year.	S1S2	At Risk
Heart-Leaved Foam-Flower	*Tiarella cordifolia*	Rich deciduous and mixed woods.	Flowers mid -May to mid-June. Identifiable year round.	S2	Sensitive
Northern Bog Violet	*Viola nephrophylla*	Cool mossy bogs, the borders of streams, and damp woods.	May to July	S2	Sensitive

APPENDIX F
Vascular Plants Recorded in the Study Area

Table F-1 Population Status of Vascular Plants Recorded in Study Area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	Wetland 1	Wetland 2
Balsam Fir	*Abies balsamea*	S5	Secure	Present	Present
Striped Maple	*Acer pensylvanicum*	S5	Secure		Present
Red Maple	*Acer rubrum*	S5	Secure		Present
Sugar Maple	*Acer saccharum*	S5	Secure		Present
Mountain Maple	*Acer spicatum*	S5	Secure		Present
Common Yarrow	*Achillea millefolium*	S5	Secure		
White Baneberry	*Actaea pachypoda*	S4	Secure		
Colonial Bentgrass	*Agrostis capillaris*	SNA	Exotic		
Perennial Bentgrass	*Agrostis perennans*	S4S5	Secure	Present	Present
Rough Bentgrass	*Agrostis scabra*	S5	Secure		Present
Speckled Alder	*Alnus incana*	S5	Secure		
Pearly Everlasting	*Anaphalis margaritacea*	S5	Secure		
Sweet Vernal Grass	*Anthoxanthum odoratum*	SNA	Exotic		
Bristly Sarsaparilla	*Aralia hispida*	S5	Secure		
Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		Present
Lady-Fern	*Athyrium filix-femina*	S5	Secure		Present
Yellow Birch	*Betula alleghaniensis*	S5	Secure		Present
Paper Birch	*Betula papyrifera*	S5	Secure		
Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
Heart-Leaved Paper Birch	*Betula papyrifera var. papyrifera*	S5	Secure		Present
Gray Birch	*Betula populifolia*	S5	Secure		Present
Devil's Beggar-Ticks	*Bidens frondosa*	S5	Secure		
Bearded Short-Husk	*Brachyelytrum septentrionale*	S5	Secure		
Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure	Present	Present
Black Sedge	*Carex arctata*	S5	Secure		Present
Brownish Sedge	*Carex brunnescens*	S5	Secure	Present	Present
Hoary Sedge	*Carex canescens*	S5	Secure		Present
Fibrous-Root Sedge	*Carex communis*	S5	Secure		
Fringed Sedge	*Carex crinita*	S5	Secure		Present
White-Edge Sedge	*Carex debilis*	S5	Secure		Present
Softleaf Sedge	*Carex disperma*	S5	Secure		Present
Little Prickly Sedge	*Carex echinata*	S5	Secure		
Long Sedge	*Carex folliculata*	S5	Secure	Present	
A Sedge	*Carex gynandra*	S5	Secure		
Bladder Sedge	*Carex intumescens*	S5	Secure	Present	Present
Bristly-Stalk Sedge	*Carex leptalea*	S5	Secure		
Finely-Nerved Sedge	*Carex leptonervia*	S5	Secure		
Shallow Sedge	*Carex lurida*	S5	Secure		Present
Black Sedge	*Carex nigra*	S5	Secure		Present
New England Sedge	*Carex novae-angliae*	S5	Secure		
Pale Sedge	*Carex pallescens*	S5	Secure		

Table F-1 Population Status of Vascular Plants Recorded in Study Area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	Wetland 1	Wetland 2
Necklace Sedge	*Carex projecta*	S5	Secure	Present	
Pointed Broom Sedge	*Carex scoparia*	S5	Secure		Present
Stalk-Grain Sedge	*Carex stipata*	S5	Secure		Present
Fireweed	*Chamerion angustifolium*	S5	Secure		
Virginia Virgin-Bower	*Clematis virginiana*	S5	Secure		
Clinton Lily	*Clintonia borealis*	S5	Secure	Present	Present
Goldthread	*Coptis trifolia*	S5	Secure	Present	Present
Dwarf Dogwood	*Cornus canadensis*	S5	Secure	Present	Present
Beaked Hazelnut	*Corylus cornuta*	S5	Secure	Present	Present
Pink Lady's-Slipper	*Cypripedium acaule*	S5	Secure		Present
Poverty Oat-Grass	*Danthonia spicata*	S5	Secure		
Wild Carrot	*Daucus carota*	SNA	Exotic		
Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure	Present	Present
Panic Grass	*Dichanthelium acuminatum*	S5	Secure		
Northern Witchgrass	*Dichanthelium boreale*	S5	Secure		
Starved Witchgrass	*Dichanthelium depauperatum*	S4S5	Secure		
Northern Bush-Honeysuckle	*Diervilla lonicera*	S5	Secure		
Parasol White-Top	*Doellingeria umbellata*	S5	Secure	Present	Present
Mountain Wood-Fern	*Dryopteris campyloptera*	S5	Secure		
Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		Present
Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		Present
Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure	Present	Present
Marginal Wood-Fern	*Dryopteris marginalis*	S5	Secure		
a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed	Present	
Wild Mock-Cucumber	*Echinocystis lobata*	SNA	Exotic		
Least Spike-Rush	*Eleocharis acicularis*	S5	Secure		
Slender Spike-Rush	*Eleocharis tenuis*	S5	Secure		
Trailing Arbutus	*Epigaea repens*	S5	Secure		
Hairy Willow-Herb	*Epilobium ciliatum*	S5	Secure		
Linear-Leaved Willow-Herb	*Epilobium leptophyllum*	S5	Secure		Present
Fireweed	*Erechtites hieraciifolia*	S5	Secure		Present
Large-Leaf Wood-Aster	*Eurybia macrophylla*	S5	Secure		
Rough-Leaved Aster	*Eurybia radula*	S5	Secure		Present
Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		Present
American Beech	*Fagus grandifolia*	S5	Secure		
Hair Fescue	*Festuca filiformis*	SNA	Exotic		
Red Fescue	*Festuca rubra*	S5	Secure		
Virginia Strawberry	*Fragaria virginiana*	S5	Secure		Present
White Ash	*Fraxinus americana*	S5	Secure	Present	Present
Brittle-Stem Hempnettle	*Galeopsis tetrahit*	SNA	Exotic		

Table F-1 Population Status of Vascular Plants Recorded in Study Area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	Wetland 1	Wetland 2
Sweet-Scent Bedstraw	*Galium triflorum*	S5	Secure		
Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
Teaberry	*Gaultheria procumbens*	S5	Secure		
Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		Present
Fowl Manna-Grass	*Glyceria striata*	S5	Secure		Present
Checkered Rattlesnake-Plantain	*Goodyera tesselata*	S4	Secure		
Northern Oak Fern	*Gymnocarpium dryopteris*	S5	Secure		
American Witch-Hazel	*Hamamelis virginiana*	S5	Secure		Present
American Water-Pennywort	*Hydrocotyle americana*	S5	Secure		
Canadian St. John's-Wort	*Hypericum canadense*	S5	Secure		
Black Holly	*Ilex verticillata*	S5	Secure	Present	Present
Narrow-Panicled Rush	*Juncus brevicaudatus*	S5	Secure		
Soft Rush	*Juncus effusus*	S5	Secure		Present
Slender Rush	*Juncus tenuis*	S5	Secure		Present
Sheep-Laurel	*Kalmia angustifolia*	S5	Secure	Present	Present
Twinflower	*Linnaea borealis*	S5	Secure		
Indian-Tobacco	*Lobelia inflata*	S5	Secure		
Perennial Ryegrass	*Lolium perenne*	SNA	Exotic		
American Fly-Honeysuckle	*Lonicera canadensis*	S5	Secure		Present
Birds-Foot Trefoil	*Lotus corniculatus*	SNA	Exotic		
Hairy Woodrush	*Luzula acuminata*	S5	Secure		
Common Woodrush	*Luzula multiflora*	S5	Secure		
Stiff Clubmoss	*Lycopodium annotinum*	S5	Secure		
Running Pine	*Lycopodium clavatum*	S5	Secure		
Treelike Clubmoss	*Lycopodium dendroideum*	S5	Secure		
Hickey's Clubmoss	*Lycopodium hickeyi*	S4?	Secure		
Tree Clubmoss	*Lycopodium obscurum*	S4S5	Secure		
American Bugleweed	*Lycopus americanus*	S5	Secure		
Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		Present
Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure	Present	Present
Solomon's-Plume	*Maianthemum racemosum*	S4S5	Secure	Present	
Green Adder's-Mouth	*Malaxis unifolia*	S4S5	Secure		
Indian Cucumber-Root	*Medeola virginiana*	S5	Secure		
American Cow-Wheat	*Melampyrum lineare*	S5	Secure		
Partridge-Berry	*Mitchella repens*	S5	Secure		
Naked Bishop's-Cap	*Mitella nuda*	S5	Secure		Present
Indian-Pipe	*Monotropa uniflora*	S5	Secure		
Whorled Aster	*Oclemena acuminata*	S5	Secure	Present	Present
Sensitive Fern	*Onoclea sensibilis*	S5	Secure		Present
One-Side Wintergreen	*Orthilia secunda*	S5	Secure		

Table F-1 Population Status of Vascular Plants Recorded in Study Area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	Wetland 1	Wetland 2
Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure	Present	Present
Interrupted Fern	*Osmunda claytoniana*	S5	Secure		Present
Royal Fern	*Osmunda regalis*	S5	Secure		
Old Witch Panic-Grass	*Panicum capillare*	SNA	Exotic		
Northern Beech Fern	*Phegopteris connectilis*	S5	Secure		Present
Meadow Timothy	*Phleum pratense*	SNA	Exotic		
White Spruce	*Picea glauca*	S5	Secure		
Red Spruce	*Picea rubens*	S5	Secure		
Eastern White Pine	*Pinus strobus*	S5	Secure		
Nipple-Seed Plantain	*Plantago major*	SNA	Exotic		
Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		Present
Hooker Orchis	*Platanthera hookeri*	S3	Secure		
Large Roundleaf Orchid	*Platanthera orbiculata*	S3	Secure		
Grove Meadow Grass	*Poa alsodes*	S4	Secure		
Downy Solomon's-Seal	*Polygonatum pubescens*	S4S5	Secure		Present
Fringed Black Bindweed	*Polygonum cilinode*	S5	Secure		
Arrow-Leaved Tearthumb	*Polygonum sagittatum*	S5	Secure		
Rock Polypody	*Polypodium virginianum*	S5	Secure		
Christmas Fern	*Polystichum acrostichoides*	S5	Secure		Present
Large-Tooth Aspen	*Populus grandidentata*	S5	Secure		
Quaking Aspen	*Populus tremuloides*	S5	Secure	Present	Present
Old-Field Cinquefoil	*Potentilla simplex*	S5	Secure		
Tall Rattlesnake-root	*Prenanthes altissima*	S5	Secure		Present
Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure	Present	Present
Self-Heal	*Prunella vulgaris*	S5	Secure		
Fire Cherry	*Prunus pensylvanica*	S5	Secure		Present
Choke Cherry	*Prunus virginiana*	S5	Secure		
Bracken Fern	*Pteridium aquilinum*	S5	Secure	Present	Present
Shinleaf	*Pyrola elliptica*	S5	Secure		
Northern Red Oak	*Quercus rubra*	S5	Secure		
Rhodora	*Rhododendron canadense*	S5	Secure		
Rambler Rose	*Rosa multiflora*	SNA	Exotic		
Allegheny Blackberry	*Rubus allegheniensis*	S5	Secure		Present
Smooth Blackberry	*Rubus canadensis*	S5	Secure		
Bristly Dewberry	*Rubus hispidus*	S5	Secure		Present
Red Raspberry	*Rubus idaeus*	S5	Secure		Present
Dwarf Red Raspberry	*Rubus pubescens*	S5	Secure		Present
Bebb's Willow	*Salix bebbiana*	S5	Secure		
Black-Girdle Bulrush	*Scirpus atrocinctus*	S5	Secure		Present
Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		Present
Mad Dog Skullcap	*Scutellaria lateriflora*	S5	Secure	Present	

Table F-1 Population Status of Vascular Plants Recorded in Study Area

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	Wetland 1	Wetland 2
Strict Blue-Eyed-Grass	*Sisyrinchium montanum*	S5	Secure		
Canada Goldenrod	*Solidago canadensis*	S5	Secure		Present
Downy Goldenrod	*Solidago puberula*	S5	Secure		
Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		Present
Common Sowthistle	*Sonchus oleraceus*	SNA	Exotic		
American Mountain-Ash	*Sorbus americana*	S5	Secure		
Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure	Present	
Rosy Twistedstalk	*Streptopus lanceolatus*	S5	Secure		Present
Farewell-Summer	*Symphyotrichum lateriflorum*	S5	Secure	Present	Present
New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
Common Dandelion	*Taraxacum officinale*	SNA	Exotic		
Canadian Yew	*Taxus canadensis*	S5	Secure		
New York Fern	*Thelypteris noveboracensis*	S5	Secure	Present	Present
Northern Starflower	*Trientalis borealis*	S5	Secure	Present	Present
Red Clover	*Trifolium pratense*	SNA	Exotic		
White Clover	*Trifolium repens*	SNA	Exotic		
Painted Trillium	*Trillium undulatum*	S5	Secure	Present	
Eastern Hemlock	*Tsuga canadensis*	S4S5	Secure		
Colt's Foot	*Tussilago farfara*	SNA	Exotic		
Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		Present
Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
Gypsy-Weed	*Veronica officinalis*	S5	Exotic		
Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		Present
Smooth White Violet	*Viola blanda*	S5	Secure	Present	
Marsh Blue Violet	*Viola cucullata*	S5	Secure		Present
Smooth White Violet	*Viola macloskeyi*	S5	Secure		
Woolly Blue Violet	*Viola sororia*	S5	Secure		

APPENDIX G
Breeding and Population Status of Birds Recorded in the Study Area and the Breeding Bird Atlas Square

Table G-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	2006-2007 Survey Status	2009-2010 Survey Status
Alder Flycatcher	*Empidonax alnorum*	S5B	Secure	Not observed	Not observed	Possible
American Bittern	*Botaurus lentiginosus*	S3S4B	Sensitive	Possible	Not observed	Not observed
American Black Duck	*Anas rubripes*	S5	Secure	Confirmed	Not observed	Not observed
American Crow	*Corvus brachyrhynchos*	S5	Secure	Possible	Not observed	Possible
American Goldfinch	*Carduelis tristis*	S5	Secure	Probable	Probable	Possible
American Redstart	*Setophaga ruticilla*	S5B	Secure	Not observed	Possible	Not observed
American Robin	*Turdus migratorius*	S5B	Secure	Confirmed	Probable	Possible
American Woodcock	*Scolopax minor*	S4S5B	Secure	Not observed	Possible	Not observed
Bald Eagle	*Haliaeetus leucocephalus*	S4	Secure	Possible	Not observed	Not observed
Bank Swallow	*Riparia riparia*	S3B	May Be At Risk	Confirmed	Not observed	Not observed
Barn Swallow	*Hirundo rustica*	S3B	Sensitive	Confirmed	Not observed	Not observed
Barred Owl	*Strix varia*	S5	Secure	Not observed	Possible	Not observed
Belted Kingfisher	*Megaceryle alcyon*	S5B	Secure	Confirmed	Not observed	Not observed
Black-and-white Warbler	*Mniotilta varia*	S4S5B	Secure	Confirmed	Possible	Possible
Black-backed Woodpecker	*Picoides arcticus*	S3S4	Sensitive	Possible	Not observed	Not observed
Blackburnian Warbler	*Dendroica fusca*	S4B	Secure	Not observed	Possible	Possible
Black-capped Chickadee	*Poecile atricapilla*	S5	Secure	Confirmed	Probable	Possible
Black-throated Blue Warbler	*Dendroica caerulescens*	S5B	Secure	Not observed	Possible	Possible
Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure	Probable	Possible	Possible
Blue Jay	*Cyanocitta cristata*	S5	Secure	Probable	Not observed	Probable
Blue-headed Vireo	*Vireo solitarius*	S5B	Secure	Probable	Probable	Possible
Bobolink	*Dolichonyx oryzivorus*	S3S4B	Sensitive	Possible	Not observed	Not observed
Brown Creeper	*Certhia americana*	S5	Secure	Not observed	Possible	Not observed
Canada Warbler	*Wilsonia canadensis*	S3B	At Risk	Not observed	Possible	Not observed
Cedar Waxwing	*Bombycilla cedrorum*	S5B	Secure	Probable	Possible	Probable
Chestnut-sided Warbler	*Dendroica pensylvanica*	S5B	Secure	Possible	Not observed	Not observed
Chipping Sparrow	*Spizella passerina*	S4S5B	Secure	Confirmed	Not observed	Not observed

Table G-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	2006-2007 Survey Status	2009-2010 Survey Status
Common Grackle	*Quiscalus quiscula*	S5B	Secure	Probable	Not observed	Not observed
Common Loon	*Gavia immer*	S3B,S4N	May Be At Risk	Probable	Not observed	Not observed
Common Merganser	*Mergus merganser*	S5	Secure	Confirmed	Not observed	Not observed
Common Nighthawk	*Chordeiles minor*	S3B	At Risk	Confirmed	Possible	Not observed
Common Raven	*Corvus corax*	S5	Secure	Probable	Possible	Not observed
Common Yellowthroat	*Geothlypis trichas*	S5B	Secure	Confirmed	Not observed	Probable
Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure	Observed	Probable	Possible
Double-crested Cormorant	*Phalacrocorax auritus*	S5B	Secure	Probable	Not observed	Not observed
Downy Woodpecker	*Picoides pubescens*	S5	Secure	Probable	Possible	Not observed
Eastern Kingbird	*Tyrannus tyrannus*	S3S4B	Sensitive	Probable	Not observed	Not observed
Eastern Phoebe	*Sayornis phoebe*	S3S4B	Sensitive	Probable	Not observed	Not observed
Eastern Wood-Pewee	*Contopus virens*	S3S4B	Sensitive	Confirmed	Possible	Possible
European Starling	*Sturnus vulgaris*	SNA	Exotic	Probable	Not observed	Not observed
Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive	Probable	Not observed	Possible
Gray Catbird	*Dumetella carolinensis*	S3B	May Be At Risk	Possible	Not observed	Not observed
Gray Jay	*Perisoreus canadensis*	S3S4	Sensitive	Possible	Not observed	Possible
Great Blue Heron	*Ardea herodias*	S4B	Secure	Probable	Not observed	Not observed
Hairy Woodpecker	*Picoides villosus*	S5	Secure	Not observed	Confirmed	Possible
Hermit Thrush	*Catharus guttatus*	S5B	Secure	Probable	Probable	Possible
Killdeer	*Charadrius vociferus*	S3S4B	Sensitive	Probable	Probable	Not observed
Least Flycatcher	*Empidonax minimus*	S4B	Secure	Probable	Probable	Possible
Magnolia Warbler	*Dendroica magnolia*	S5B	Secure	Possible	Possible	Possible
Merlin	*Falco columbarius*	S5B	Secure	Probable	Not observed	Not observed
Mourning Dove	*Zenaida macroura*	S5	Secure	Confirmed	Not observed	Possible
Northern Flicker	*Colaptes auratus*	S5B	Secure	Probable	Possible	Not observed
Northern Goshawk	*Accipiter gentilis*	S3S4B	Secure	Probable	Not observed	Not observed
Northern Parula	*Parula americana*	S5B	Secure	Not observed	Not observed	Possible

Table G-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	2006-2007 Survey Status	2009-2010 Survey Status
Osprey	*Pandion haliaetus*	S5B	Secure	Probable	Not observed	Not observed
Ovenbird	*Seiurus aurocapillus*	S5B	Secure	Probable	Probable	Probable
Palm Warbler	*Dendroica palmarum*	S5B	Secure	Not observed	Not observed	Observed
Pileated Woodpecker	*Dryocopus pileatus*	S5	Secure	Not observed	Possible	Not observed
Purple Finch	*Carpodacus purpureus*	S4S5	Secure	Not observed	Not observed	Possible
Red-breasted Nuthatch	*Sitta canadensis*	S4S5	Secure	Probable	Not observed	Possible
Red-eyed Vireo	*Vireo olivaceus*	S5B	Secure	Confirmed	Probable	Possible
Red-tailed Hawk	*Buteo jamaicensis*	S5	Secure	Confirmed	Possible	Not observed
Red-winged Blackbird	*Agelaius phoeniceus*	S4S5B	Secure	Probable	Not observed	Not observed
Ring-necked Duck	*Aythya collaris*	S5B	Secure	Probable	Not observed	Not observed
Ring-necked Pheasant	*Phasianus colchicus*	SNA	Exotic	Probable	Not observed	Not observed
Rock Dove	*Columba livia*	SNA	Exotic	Confirmed	Not observed	Not observed
Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive	Confirmed	Possible	Possible
Ruby-throated Hummingbird	*Archilochus colubris*	S5B	Secure	Probable	Not observed	Possible
Ruffed Grouse	*Bonasa umbellus*	S4S5	Secure	Probable	Not observed	Not observed
Savannah Sparrow	*Passerculus sandwichensis*	S4B	Secure	Confirmed	Not observed	Not observed
Song Sparrow	*Melospiza melodia*	S5B	Secure	Possible	Not observed	Probable
Sora	*Porzana carolina*	S4S5B	Secure	Confirmed	Not observed	Not observed
Spotted Sandpiper	*Actitis macularius*	S3S4B	Sensitive	Possible	Probable	Not observed
Swainson's Thrush	*Catharus ustulatus*	S4S5B	Secure	Probable	Possible	Possible
Tree Swallow	*Tachycineta bicolor*	S4B	Sensitive	Possible	Not observed	Not observed
Veery	*Catharus fuscescens*	S4B	Secure	Confirmed	Not observed	Not observed
White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure	Possible	Confirmed	Probable
Winter Wren	*Troglodytes troglodytes*	S5B	Secure	Confirmed	Possible	Not observed
Yellow Warbler	*Dendroica petechia*	S5B	Secure	Confirmed	Not observed	Not observed
Yellow-bellied Flycatcher	*Empidonax flaviventris*	S3S4B	Sensitive	Not observed	Not observed	Possible
Yellow-bellied Sapsucker	*Sphyrapicus varius*	S4S5B	Secure	Possible	Confirmed	Not observed

Table G-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	2006-2007 Survey Status	2009-2010 Survey Status
Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure	Possible	Confirmed	Not observed

APPENDIX H
Response to Government Review Comments

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
1	P. Nearing, NSE	It is stated that ***"Fuel oil is stored on site in temporary above ground storage containers."*** This section notes ***"There is one above ground diesel tank on site."*** Suggest this be clarified. Also suggest providing additional details as to location (also show on map), age of the tank(s), type of construction, containment available, inspection details, frequency of filling, incident reports (in particular any that had the potential to impact surface water and/or groundwater), after hours security at the site, spill response plan, location of existing monitoring wells (if they exist) in the area, any test results from the monitoring wells, etc..	There is one above ground fuel storage tank that was installed approximately three years ago and is equipped with a containment berm The tank is located across from the weight scales at the Panuke Quarry site. This tank is a backup fuel supply to enable the operation to continue should regular fuel delivery be disrupted. Section 2.6 in the EA document has been clarified.
2	P. Nearing, NSE	It is indicated that ***"Refueling of equipment will be conducted on-site on a regular basis, under contract by a tanker truck."*** If refueling is carried out by a tanker truck, what is the purpose of the on-site storage tank?	Yes refueling of equipment is conducted on-site on a regular basis under contract by a tanker truck. See response for Comment No. 1.
3	P. Nearing, NSE	The statement is made, ***"In the event of a leak or spill during refueling, maintenance, or general equipment operation, immediate action will be taken to stop and contain the spilled material."*** A further statement is made ***"A Spill Contingency Plan will be developed in support of the application for amendment to the existing Industrial Approval. "*** Presumably the plan will also address spills resulting from normal operation of the storage tank. Please confirm. Are spill response equipment/materials currently available at the site and if so are they tested/inspected on a regular basis? Are employees trained in their use? It is suggested the spill response plan contain elements related to training of personnel and agreement(s) with local agencies The agreement should ensure that the initial response to any incident (those involving equipment and materials related to the quarry operation, but occurring outside the quarry boundary), is handled by the closest response group. This will ensure timely response to spills which have the potential to impact surface water and/or groundwater.	The spill response plan will address spills resulting from normal operation of the storage tank and will be consistent with such planning currently in place and approved for the Panuke Quarry site. Comment acknowledged.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
4	P. Nearing, NSE	This paragraph states ***"Due to its location with respect to the local topography, the Project is expected to lie within a local groundwater recharge area. Regional groundwater flow is inferred to be north and northwest from the South Mountain Highlands towards the Avon River and one of its principal tributaries, the St. Croix River. Locally, groundwater should follow the topography generally northwards towards wetlands and streams."*** Has this been confirmed based on surveys of the existing groundwater monitoring wells or by other means? If not, will any field verification be carried out?	The groundwater evaluation did not include any water well or monitoring well inspections or measurements. Local shallow groundwater is expected to follow topography. Field verification of groundwater flow direction for the quarry extension is not considered necessary since the closest groundwater users are located greater than 800 metres away from the quarry extension area.
5	P. Nearing, NSE	This paragraph notes ***"Acid generating bedrock is not expected; however should a mineralized zone be encountered the rock will be tested for acid generating potential."*** Are employees knowledgeable/trained to identify mineralized zones, which could be acid generating? Who will test for acid generating potential? Suggest this be included in the Industrial Approval application.	Comment acknowledged. Because there is a potential to encounter a mineralized zone, we recommend including a sulphide bearing material monitoring program with the Approval application.
6	P. Nearing, NSE	The Approval document notes various surface water sampling locations under Section 7. Groundwater, items d) and h). These are identified as • A - Upstream of Unnamed Brook • B - Downstream of Unnamed Brook • SW-1 • SW-2 The approval document notes various groundwater sampling locations under Section 8 Groundwater. These are identified as • MW-1 • MW-2 • MW-3 Suggest all sample locations and monitoring wells be shown on a map for clarity and to enable evaluation of their future use for the quarry extension project. Comments regarding any problems with the monitoring wells should be provided.	The locations of the surface water sampling and groundwater monitoring wells have been displayed on Figure 3.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
7	P. Nearing, NSE	The listing for figure 1.2 reads ***"Hydrologic Survey"*** and the title on the figure reads ***"Hydrological Survey"***. The two titles should match. The figures listed as ***"3.1, 3.2, 3.3"*** should read ***"2.1, 2.2, 2.3".***	The figure titles have been corrected.
8	P. Nearing, NSE	The statement is made ***"The estimated truck traffic will be consistent with current truck volume at the existing quarry and will only increase, for a short period of time, if a large aggregate supply contract were awarded."*** Suggest documenting the current and predicted truck volume in this section of the Report.	As stated in Section 5.9.1. there was no traffic study conducted as part of this EA. The results of a study conducted in 2007, for the Panuke Quarry Extension EA, however are provided.
9	P. Nearing, NSE	It is noted that ***"Surface runoff and quarry drainage are collected on the quarry floor, which has the capacity to hold a significant quantity of water."*** Suggest defining "significant quantity of water" in more numerical terms, in particular in relation to 1:25 and 1:100 year storm events.	The capacity of the quarry floor is not considered part of the primary stormwater management system, which is designed to convey excess runoff and attenuate peak flows. However, the intention was to indicate that the quarry itself has capacity to act as a secondary containment which adds an extra level of conservatism.
10	P. Nearing, NSE	This section notes that ***"In the unlikely event that overflow, in the event of a significant rain fall, exceeds final effluent discharge limits as determined through monitoring, contingency measures may include pumping of sediment laden water to vegetated areas (away from watercourses) or through filter bags for additional filtration and/or use of additional filtration devices or structures."*** Is equipment (water test kits, pumps, filter bags, etc.) for this purpose currently available at the site and if so are they inspected/tested on a regular basis? Are employees trained in their use? Suggest the stormwater management plan, which will be submitted during the Industrial Approval application process, incorporate these details.	According to the Pit and Quarry Guidelines the maximum TSS concentration allowed in any grab sample to leave the property (towards any stream or beyond property boundaries) is 50 mg/L in one sample and a maximum arithmetic monthly average of 25 mg/L. The detention ponds are designed with the primary objective of decreasing suspended sediment concentrations, at the same time proper monitoring should be conducted and remedial actions taken in the event that these parameters are exceeded. Equipment and training is provided as part of the operational activities of the quarry. The stormwater management plan, to be conducted as part of the Part V Application, will also cover these issues in greater detail.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
11	P. Nearing, NSE	It is noted that ***"Since Maple Brook falls outside the PWA boundaries, it is not affected by the land use restrictions enforced within the PWA. Fall Brook is the next closest watercourse that does fall with the PWA. The surface water carried by Maple Brook is not known to connect with Fall Brook either within or downstream of the Project Property area (Figure 3)."*** From Figure 3 it appears that Fall Brook and Maple Brook are connected via the wetland situated to the south and southwest of the project area. Suggest the interaction between the wetland and both streams should be further investigated and assessed, especially in light of the stream boundary shown, as derived from the client drawing. Further suggest the stream boundary be confirmed through field verification and shown on the maps in the report, for clarity. Drainage patterns and direction seem unclear from text and maps in the report. The large wetland abutting the project area seems to drain in two directions including toward the PWA. Text in the Groundwater section (page 5.25) indicates the "Water Supply Area is located …**<u>generally</u>** upstream of the project area" – suggesting that some of the water supply area is downstream of the project area. Clarity of actual drainage patterns is crucial to protecting the municipal supply. Given the close proximity of the proposed operation to nearby watercourses and the Municipal Water supply PWA drainage divide, it would be prudent and advisable not only to clarify flow directions and linkages between the two identified streams through the wetland, but to ensure no off-site influences from the operations to either of the watercourses nearby or the linking wetland area. An alteration of the linking wetland could change flow direction and therefore increase the risk of impacts to the municipal water supply through the PWA. Such impacts must be prevented.	The wetland in question is located upstream of the Project Property. Typically, potential interactions are assessed in terms of potential downstream effects, thus the Surface Water Resources VEC concluded that the surface water was not known to connect within or downstream of the Project Property. If Project activities are to in the future, spread further south, then the connection between the two streams and the wetland would need to be identified. Revision has been made to the Hydrology Report text to reflect the Water Supply Area as being located upstream of the project area. The flow directions of Maple Brook and Fall Brook have been added to Figure 3.
12	P. Nearing, NSE	It is indicated that ***"Key in-situ water quality results are outlined for each watercourse, as well."*** Suggest this be reworded as only Maple Brook was assessed – or include results for other watercourses.	The text in Section 5.2 has been updated.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
13	P. Nearing, NSE	The statement is made in reference to Maple Brook ***"It is expected the watercourse eventually drains into the St. Croix River through one of several potential tributaries to that river, although connectivity to these downstream tributaries was not confirmed."*** This section states ***"It was also found during the site visit that the watercourse has a direct connection with tributaries that eventually feed the St. Croix River."*** The second statement is in a paragraph which initially mentions Maple Brook, Does this statement relate to Maple Brook or some other watercourse? Please clarify.	The statement in question refers to Maple Brook, and the connectivity with the St. Croix River was assessed using GIS mapping. The text in Section 1.2 of Appendix B has been modified to reflect this.
14	P. Nearing, NSE	• The table (Table 5.1) identifies Maple Brook as a tributary to the St. Croix River. This should be clarified in conjunction with the above item. • The measured DO values appear to be somewhat low based on the measured water temperature. Please comment. • Baseline water analysis would be useful for Maple Brook, Fall Brook and the large wetland to the south and southeast of the project property.	Table 5.1 has been updated. The DO probe was calibrated to manufacturer's specifications prior to use. The DO values recorded are not indicative of anoxic or hypoxic conditions and are anticipated to adequately support aquatic life. The surface water data collected during the field assessment for the current EA provides single-point-in-time baseline conditions for DO and pH. There is limited value in collecting a single point in time water chemistry sample so far in advance of potential quarry extension activities given the highly variable nature of the majority of the parameters included in a general chemistry and metals scan. Additional monitoring can be considered if/when quarry activities are planned to approach the watercourse or even closer to when quarry extension begins (*e.g.* a week - month before activities).

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
15	P. Nearing, NSE	It is stated that ***"The nearest water courses include a tributary that drains Mill Lakes reservoir northwest to Lebreau Brook thence northwest to the Avon River near Martock. Some maps show another brook north of the site that flows northeast to St. Croix River at Five Mile Plains (Figure 1). The Mills Lakes/Fall Brook reservoir and Water Supply Area is located 3 km to more than 5 km southwest and generally upstream of the project."*** • For clarity it is suggested that the features mentioned in the paragraph (*e.g.* Lebreau Brook) be shown/identified on the maps presented in the report. • Please define ***"generally upstream"*** as this term is vague and could lend itself to misinterpretation. If there is uncertainty then field verification should be carried out.	Map has been updated to show Lebreau Creek Brook and Sams Brook. The text in Section 5.6.1 has been revised to reflect the Mill Lakes/Fall Brook reservoir and Water Supply Area is located upstream of the project. The term 'generally' has been removed.
16	P. Nearing, NSE	The statement is made ***"Therefore, the expected increase in the average annual site runoff due to the proposed quarry extension is in the order of 69,917.2 m^3 or a 470% increase from the existing condition."*** The % increase should be confirmed as it appears to be 370.	The increase amount is 370 % of the existing condition. The text in Section 2.3.1 of Appendix B has been updated.
17	P. Nearing, NSE	The text indicates the model estimates are for 6 hours but the hydrographs (Figures 2.1 & 2.2) appear to show flow for more than 6 hours. Please comment on the discrepancy and the potential impact on runoff retention/control facilities.	The model estimations are based on a 6 hour hyetograph (6 hour precipitation input) and on a 12 hour hydrograph which is approximately the time that takes the water to reach the detention facilities (i.e. the water flow continues after precipitation is finished). No negative impacts on the runoff detention/control facilities are expected.
18	P. Nearing, NSE	The statement is made***" It is recommended to size the flow retention structures to retain the volume from the 1:25 year rainfall event."*** Please provide the rationale for selecting the 1:25 year rainfall event versus the 1:100 year rainfall event for sizing the flow retention structure.	The storage ponds are designed to fully capture the 1:25 year storm and allow some time for peak flow attenuation before any water is discharged into the receiving environment. The excess runoff created by larger storms (including the 1:100 year storm) will be controlled with the appropriate discharge features (orifice and a weir). The orifice will release runoff in a controlled manner to achieve the 24 hour drawdown requirement while the weir will only act to avoid overtopping of the pond(s) by excess runoff. The requirement to fully capture the 1:25 year storm and manage the 1:100 year storm using discharge features is quite common. One of the main reasons for taking this approach is to maintain a feasible volume for the ponds.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
19	P. Nearing, NSE	The following statements are made: • ***"Based on Figure 2.3, the weir structure should be sized as a minimum to convey 0.20 m^3/s."*** • ***"A recommended drawdown period of 24 hours is expected to decrease suspended sediment concentrations by as much as 80%. Based on the low flow threshold of 24 hour discharge for runoff events equal or smaller than the 1:25 year rainfall event, the mean discharge capacity should be 0.09 m^3/s."*** • The 0.20 m^3/s flow is considerable higher than the mean discharge flow of 0.09 m^3/s. If the outlet weir is to be designed for the 1:100 year storm excess peak flow, should not the storage capacity be designed for the runoff volume of the same magnitude storm event to ensure suspended sediment concentrations are kept as low as possible?	The storage capacity of the detention pond is designed to fully capture the 1:25 year storm and manage the 1:100 year storm. The pond(s) requires two outlets (an orifice and an emergency weir). The orifice controls the release of water to comply with the 24 hour drawdown requirement while the weir maintains a safe water level by releasing the excess surface runoff. In the case of the 1:100 Y storm, the pond(s) will store water for the first few hours (approximately 6 to 8 hours) only releasing a controlled amount by the orifice, by the time the pond is reaching full capacity some of the volume in the pond(s) will be available again because the orifice discharges continuously, any extra excess will exit the pond using the emergency weir, this approach ensures that a large percentage of the water will be detained and released in a controlled manner. Also, even though it is impossible to treat all surface runoff all the time, this approach ensures that the most common events will receive full treatment while the larger events associated with lower probabilities can be controlled while providing partial treatment.
20	P. Nearing, NSE	Page number is missing (Appendix B Section 5.0).	The page number has been added.
21	Matthew Brufatto, NSE	I have no specific comments on this environmental assessment as there are no anticipated hazardous materials at the site other than those normally used for vehicles and machinery.	Comment acknowledged.
22	Andrew Cameron	There are no agricultural concerns with this proposal.	Comment acknowledged.
23	Kurt McAllister, DFO	What will be the minimum buffer between Maple Brook and the proposed quarry?	The minimum buffer between Maple Brook and the proposed quarry will be 60 m.
24	Kurt McAllister, DFO	As the proposed pit will be in close proximity to the wetland and the watercourse, has the potential interaction on surface water quantity been studied? As the quarry floor will be below the elevation of the wetland and Maple Brook, will surface water have the potential to seep through the factures into the quarry, potentially causing a decrease in surface water for these systems?	The potential effects of a gradient differential between adjacent waterbodies and the proposed quarry floor are very difficult to predict. Even though seepage thru cracks from Maple Brook towards the quarry floor is possible, the hydraulic conductivity of the materials (i.e. rock and soil) that separate both will prevent large amounts of water from escaping the stream.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
25	Kurt McAllister, DFO	Related to the above, 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.
26	Andrew Murphy, NSE	The Air Quality Branch has reviewed the draft environmental assessment registration document for the proposed Hants County Aggregate project by Municipal Enterprises Limited. We do not believe that the quarry expansion will have a significant negative effect on local air quality. However, we suggest that the proponent identify specific opportunities for dust suppression techniques for rock crushing operations.	Comment acknowledged. Dust suppression opportunities will be identified in the EMP, as part of the Part V Application.
27	Angela Swaine, NSTIR	TIR has reviewed the Draft Registration Report for the Hants County Aggregate Quarry Extension Project. TIR has no comments on the Project at this time.	Comment acknowledged.
28	Stephen Zwicker, Environment Canada	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, *Environmental 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.
29	Heather MacMillan, Nova Scotia Tourism, Culture and Heritage	The proposed quarry expansion is in a remote location and there are no existing tourism operations in the area. From a tourism perspective, the main areas of interest regarding the proposed expansion are trucking traffic, visual aesthetics, noise, and a consideration of whether the expansion would negatively affect tourism in the region. It does not appear that the proposed extension will have any negative impact from a tourism perspective. We are also not aware of any future tourism development planned for the area.	Comment acknowledged.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
30	Bernard Matlock, NSE	The draft EA report outlines a proposal for both the combination two existing and nearby quarries into one larger quarry and the expansion of the two quarries with what appears to be an additional 9.9 hectare area encompassing the Hants County Aggregate quarry. The report is misleading or unclear. It repeatedly tends to address the quarry extension simply as an expansion of the existing 3.9 Hants County Aggregate quarry, but is truly a quarry expansion which will encompass a total area of at least 23.9 hectares including both the Panuke Road quarry and the Hants County Aggregate quarry.	MEL is proposing to combine the operations of the Hants County Aggregates Quarry with the existing Panuke Quarry. The current operation at Hants County Aggregates is 3.9 ha in area. The proposed extension of the existing Hants County Aggregates Quarry will incorporate land north, south and southwest of the existing quarry to increase the total size of the operation to approximately 13.9 ha (not including the adjacent Panuke quarry). The existing Panuke quarry is approximately 4.0 ha in area and has an approved extension area of 6 ha. The combined operations will cover an area of 23.9 ha. Text has been added to Section 2.1 for clarification
31	Bernard Matlock, NSE	Pg 2.1 identifies the community as Panuke and Pg 2.3 identifies the community as Windsor, but I believe it is officially Three Mile Plains, Hants County.	Comment acknowledged and the text has been updated.
32	Bernard Matlock, NSE	The report does not identify the current footprint of the approved Panuke Road quarry operated by Municipal Enterprises Ltd.	Comment acknowledged and the EA report figures have been updated.
33	Bernard Matlock, NSE	The report fails to identify the small unnamed brook in the project area which flows south to north through the Panuke Road quarry site and is located immediately adjacent to the existing disturbed Panuke Road quarry. None of the report plans or narrative recognizes it.	The unnamed stream falls outside of the current proposed Project boundaries. The location of this stream has however been added to the figures for convenience.
34	Bernard Matlock, NSE	The report fails to identify building features which are situated on the active Panuke Road quarry site.	**There are two structures located on the Panuke Road Quarry site which are not evident in the Project mapping. They include the scale house and a structure located in the southeast corner of the property. There are no structures on the Hants County Aggregate Quarry site.**
35	Bernard Matlock, NSE	The proposed expansion lies in an elevated area. What are the anticipated visual impacts from the entire quarry disturbance?	While a visual impact assessment has not been conducted for the expanded Hants County quarry, it is noted that the current Hants County quarry has little or no visibility from the Panuke Road and is located across a viewshed that is currently affected by the Panuke quarry.
36	Bernard Matlock, NSE	Pg. 2.9 NSE suggests reclamation slopes of a minimum 2.5:1 on site with a minimum 2:1 for rock slopes.	Comment acknowledged and the text has been updated.
37	Bernard Matlock, NSE	Pg. 5.4 Maple Brook watercourse survey should include a map which identifies the location where photos in Appendix D were taken.	Comment acknowledged and a map has been added to Appendix D.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
38	Bernard Matlock, NSE	What are the anticipated radiation levels in the area of the site and associated with product aggregate?	Based on the bedrock type (Goldenville Formation) and review of the Nova Scotia Department of Health, "*Potential Occurrence – Radon Gas in Nova Scotia"* map, little or no radiation levels are expected in the area of the site. According to the Potential Occurrence - Radon Gas in Nova Scotia, the site is located in an area described to have little or no uranium, thorium or other naturally occurring radioactive elements in the soil. Because the presence of radioactive elements in soil is associated with the underlying bedrock, little to no issues associated with potential radiation are inferred for this location.
39	Bernard Matlock, NSE	The report should detail the potential impact which the quarry extension will have on the hydraulic characteristics and chemistry of Maple Brook, the wetland to the south of the extension and the unnamed brook within the Panuke Road quarry.	In terms of potential impacts to the chemistry of Maple Brook refer to Section 5.2.2. The proposed quarry expansion is expected to increase site runoff due to a decrease in evapotranspiration and infiltration amounts. All runoff originating from site will be controlled using detention ponds and other methods to minimize any potential effects on downstream receptors. No major changes in the hydraulic characteristics of Maple Brook are expected since the contribution from the site is small when compared to the contribution of the entire catchment area, and the detention ponds are designed to control and minimize the discharge of runoff from the site that could cause detrimental effects downstream of the quarry. The wetland to the south is located upstream of the site and therefore receives runoff from upper sections of the watershed, hence it is unlikely that the proposed quarry expansion will affect the wetland. An ideal way to ensure that Maple Brook and the adjacent wetland maintain their normal conditions is to conduct site inspections combined with flow monitoring.
40	Bernard Matlock, NSE	Pg. 5.11 suggests the company consider including the results of the proposed spring/summer 2010 plant survey in the final EA report.	The results of the 2010 plant survey have been included in the final EA report.
41	Bernard Matlock, NSE	Pg. 5.20 suggests the company consider including the results of the proposed June 2010 bird survey in the final EA report.	The results of the June 2010 bird survey have been included in the final EA report.
42	Bernard Matlock, NSE	Pg. 5.23 should make mention of the NSE approval requirements for wetlands alteration.	The text in Section 5.5.2 has been updated.
43	Bernard Matlock, NSE	Pg. 5.31 The report was lacking in identification of potential surface water impacts, mitigation and monitoring as outlined in Section 5.6.2 for groundwater.	Section 5.2 has been updated.
44	Bernard Matlock, NSE	Proposed reclamation plans should consider protection of Maple Brook and the small unnamed stream.	Reclamation plans will consider protection of Maple Brook and the small unnamed stream.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
45	Bernard Matlock, NSE	The Hydrology Study also does not consider the unnamed stream.	The Hydrology Study assessed the property within which the Hants County Quarry is located. The unnamed stream is not located within these boundaries.
46	Bernard Matlock, NSE	It is strongly advised that the quarry proposal meet the separation distance of 30 metres from Maple Brook to be consistent with the Pit and Quarry Guidelines. Pg. 1.3 identifies it as only 22 metres.	Comment acknowledged and the text has been updated.
47	Bernard Matlock, NSE	The report should consider the cumulative environmental impact resulting from added pit and quarry activity in the Panuke Road district.	There will be no added activity in the Panuke Road district as both quarries are already in operation and neither quarry is increasing their production levels.
48	Sarah MacKay, NS Department of Natural Resources	It is unclear which Appendix in the report provides a list of plants found on site during field surveys. The last paragraph on page 5.9 indicates that this list is given in Appendix F; however, Appendix F lists birds. The cover page for Appendix E indicates "vascular plant (sic) recorded in the study area", but the title of table E-1 states "...plants potentially in project area". Elsewhere on page 5.9 (second last paragraph); this is how Appendix E is described. It appears as though the cover page for Appendix E needs to be revised; references to this appendix in the report, including the Table of Contents, should be reviewed.	The appendix titles and references have been revised.
49	Sarah MacKay, NS Department of Natural Resources	A similar issue exists for Appendix G, which is given as "Plants Recorded within Wetlands". See title for Table G-1	See response to comment no. 48.
50	Sarah MacKay, NS Department of Natural Resources	The geo-locations of all RED and Yellow species (under the General Status of NS Wildlife) are to be provided as described in the "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document". Although not required at this time, DNR requests a table of geo-locations for species ranked between S1-S3S4, by the Atlantic Canada Conservation Data Centre if such information was obtained during field surveys.	This information will be provided to NSDNR under a separate cover.
51	Sarah MacKay, NS Department of Natural Resources	The actual list of plants observed in the study area is either missing or mislabeled the report. DNR requests this list be provided. Some of the plants (*e.g.*, Actaea pachypoda, Maianthemum racemosum, Polygonatum pubescens, and Polystichum acrostichoides) in Table G-1 indicate the presence of moderately rich to rich forest habitat. Inc. DNR is expanding the scope of our reviews of EAs to assess status of ecosystems, *e.g.* uniqueness and rarity. The information from General Status and S1-S3S4 species will be assessed with information on species assemblages and biophysical parameters. These data will assist in evaluation of the project and whether there are unique or uncommon ecosystems within the project area.	Refer to Appendix F for a list of plants present in the Study Area.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
52	Sarah MacKay, NS Department of Natural Resources	DNR suggests a minimum buffer of 60 meters on Maple Brook to maintain wood turtle habitat. Although this watercourse does not exist in the project area (as stated on pages 5.19-5.20), the Maple Brook riparian zone, and embedded wood turtle habitat values, extends through the southwestern corner.	A 60 m buffer on Maple Brook has been incorporated into the Project, as presented in Figure 3.