APPENDIX A

Registry of Joint Stocks and Industrial Approval

1014439

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

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PROFILE - MUNICIPAL ENTERPRISES LIMITED - as of: 2007-11-15 09:43 AM

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	111 SHORE DRIVE BEDFORD NS B4A 2E2	
CECIL G. VANCE	Director	25 JAMES STREET FALL RIVER NS B2T 1H7	
CARL B. POTTER	Director	111 SHORE DRIVE BEDFORD NS B4A 2E2	
CECIL G. VANCE	GENERAL MANAGER	25 JAMES STREET FALL RIVER NS B2T 1H7	
SONDRA CLEGG	ASSISTANT SECRETARY	111 HONEYSUCKLE ROAD MIDDLE SACKVILLE NS B4E 3J9	
RAPHAEL M. POTTER	SECRETARY	111 SHORE DRIVE BEDFORD NS B4A 2E2	
CARL B.		111 SHORE DRIVE	

POTTER	PRESIDENT	BEDFORD NS B4A 2E2	
HUGH SMITH	VICE PRESIDENT	221 SHORE DRIVE BEDFORD NS B4A 2E7	
DAVID A. WOOD	VICE PRESIDENT, FINANCE	71 HALFWAY DRIVE HAMMONDS PLAINS NS B4B 1M8	
CARL VINCENT	COMPTROLLER	12 BONN DRIVE HAMMONDS PLAINS NS B4B 1T2	
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

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
Special Resolution	1995-08-01
Registered Office Change	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
Registered	1981-07-31
Amalgamated	1981-07-31
Court Order Filed	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

NOVA SCOTIA
Department of Environment and Labour
Suite 224, Sunnyside Mall
1595 Bedford Highway
Bedford NS B4A 3Y4
Tel: (902) 424-7773
Fax: (902) 424-0597

File:92100-30-BED-019700

March 19, 2002

Mr. Alan G. Hayman
Burchell Green Hayman Parish
1801 Hollis Street
Suite 1800
PO Box 548
Halifax, Nova Scotia
B3J 2R7

Dear Mr Hayman:

RE: Amendment of Industrial Approval No. 2001-019700
Quarry - Panuke Road
Municipal Enterprises Limited

Enclosed, please find amendment number 2001-019700-A01, for the Quarry at Panuke Road, Three Mile Plains, Hants County, Nova Scotia.

This amendment revises the due dates in clause 11 of the approval as detailed in your letter of February 18, 2002. In addition we have taken the opportunity to change the name of the Approval Holder to Municipal Enterprises Limited and to revise the rehabilitation section to reflect the actual receipt date for the interim security and to indicate a submission date for a final security.

Please ensure that this approval is forwarded to your client, Municipal Enterprises Limited.

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

Should you have any questions, please contact me at the Central Region Office in Bedford at 424-8183.

Yours Truly

Stephen Westhaver

Steve Westhaver
Engineer

cc: N. Bennett

File:2001-019700-A01_Amendment_Municipal_Panuke

NOVA SCOTIA
Department of Environment and Labour

APPROVAL

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

APPROVAL HOLDER: Municipal Enterprises Limited.

APPROVAL NO: 2001-019700-A01

EFFECTIVE DATE: March 12, 2002

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

Administrator
Date Signed Mar 19/07

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Department of Environment and Labour

Project:	Municipal Enterprises Limited Quarry Panuke Road Three Mile Plains, Hants County
Approval No:	2001-019700-A01
File No:	92100-30-019700
Map Series:	21A/16
Grid Reference:	E414,000 N4,976,200
PID # :	45270493

Reference Documents:

- Application from G.E. Johnson Trucking Limited dated March 23, 2001 and attachments.
- Letter and attachments dated September 5, 2001 from John Franklin, P.Eng.
- Letter dated February 18, 2002 from Burchell Green Hayman Parish

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 the Nova Scotia Department of Environment and Labour located at the following address:

Nova Scotia Department of Environment and Labour
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 the Nova Scotia Department of Environment and Labour.

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 the application and supporting documentation, as listed in the reference documents above, to construct and operate the Facility, situated at or near Panuke Road, Three Mile Plains, Hants County (the "Site").

b) The Facility shall be constructed and operated as outlined in the application for industrial approval from G.E. Johnson Trucking Limited dated March 23, 2001, letter from John Franklin, P.Eng., dated September 5, 2001 and supporting documentation.

c) The Site shall not exceed the area as outlined in the application and supporting documentation. The area indicated in the application is 200 m by 200 m for a total of 40,000 square meters (approximately 3.99 hectares).

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;
ii) Regulations pursuant to the above Act;
iii) Any future amendments to the Act and regulations

b) Nothing in this Approval relieves the Approval Holder of the responsibility for obtaining and paying for all licences, permits, approvals or authorizations necessary for carrying out the work authorized to be performed by this Approval which may be required by municipal by-laws or provincial or federal legislation. The Minister does not warrant that such licences, permits, approvals or other authorizations will be issued.

c) No authority is granted by this Approval to enable the Approval Holder to construct the Facility on lands which are not in the control or ownership of the Approval Holder. It is the responsibility of the Approval Holder to ensure that such a contravention does not occur. The Approval Holder shall provide, to the Department, proof of such control or ownership upon expiry of any relevant lease or agreement. Failure to retain said authorization will result in this Approval being null and void.

d) 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.

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

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

g) (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.

h) 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.

i) 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.

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

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

l) 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.

m) All samples required by this Approval shall be analysed by a laboratory that is:

   i) Accredited by the Standards Council of Canada; or

   ii) Accredited by another agency recognized by the Nova Scotia Department of Environment and Labour to be equivalent to the Standards Council of Canada; or

   iii) Maintaining an acceptable standard in a proficiency testing program conducted by the Canadian Association for Environmental Analytical Laboratories for all parameters being reported; or

   iv) Maintaining an acceptable standard in a proficiency or performance testing in another program considered acceptable to the Nova Scotia Department of Environment and Labour for all parameters being reported

n) 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.

o) 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.

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

4. **Particulate Emissions (Dust)**

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

Annual Geometric Mean	70 $\mu g/m^3$
Daily Average (24 hr.)	120 $\mu g/m^3$

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

c) Site access road(s) shall be maintained to minimize dust generation. The use of used oil is <u>not</u> permitted.

d) Monitoring of particulate emissions shall be conducted at the request of the Department. The location of the monitoring station(s) for particulate will be established by the Administrator and may include point(s) beyond the property boundary of the quarry.

e) When requested, suspended particulate matter shall be measured by the high volume method as described in report No. E.P.S. 1-AP-73-2.

5. **Sound Levels**

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

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

b) Monitoring of sound levels shall be conducted at the request of the Department. The location of the monitoring station(s) for sound will be established by the Administrator and may include point(s) beyond the property boundary of the quarry.

6. **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. The Nova Scotia Department of the Environment "Erosion and Sedimentation Control Handbook For Construction Sites" shall serve as the reference document for all erosion control measures. These measures are minimum requirements and 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 retain 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) All erosion and sedimentation control devices shall be installed prior to any excavation of material.

d) The Approval Holder shall sample during or immediately following rain events or as a minimum weekly and ensure the liquid effluent levels in Table 1 are met:

Table 1

Final Effluent Discharge Limits

Parameters	Maximum in a Grab Sample	Monthly Arithmetic Mean	Monitoring Frequency	Monitoring Station
Total Suspended Solids	50 mg/l	25 mg/l	Weekly/Rain Events	Discharge from settling pond SW-1
pH	5 - 9	6 - 9	Weekly/Rain Events	Discharge from settling pond SW-1

e) If it becomes necessary to drain the Site, the wastewater shall be drained to settling ponds for appropriate treatment to meet the suspended solids limits outlined in Table 1.

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

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

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

7. **Groundwater**

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

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

8. **Separation Distances**

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

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

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

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

b) The Approval Holder shall not blast within:

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

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

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

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

**Note: Subject to the conditions in item 11 of this approval.

9. **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. The design shall be sent to the Department for review prior to any blasting.

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 NSDEL 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.

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

Table 2

Blasting Limits

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

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

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

10. Rehabilitation

a) The interim security posted on February 8, 2002, shall not exceed one (1) year unless otherwise agreed in writing by the Administrator.

b) The Approval Holder shall submit a rehabilitation plan to the Department for review by September 1, 2002. The rehabilitation plan shall be revised and updated every three years thereafter and submitted for review. The rehabilitation plan shall include the estimated total cost for labour, equipment, supplies and services of a third party contractor to undertake the following activities:

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

c) On or before February 8, 2003, the Approval Holder shall post a final security which shall be calculated using the rehabilitation plan and factors in item b) above. The final security shall be revised every three years in accordance with the revised rehabilitation plan.

d) The Approval Holder shall rehabilitate the Site within twelve (12) months of abandonment and in accordance with the rehabilitation plan submitted by the Approval Holder in 10 (b) or other terms as specified by the Department,

e) The Nova Scotia Department of Environment and Labour 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.

11. 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 existing product storage which is within 30 meters of the water course shall be removed by July 31, 2002. Confirmation that material has been removed shall be forwarded to the Department by August 31, 2002.

c) The existing disturbed area within 30 meters of the watercourse shall be rehabilitated by July 31, 2002. Confirmation that area has been rehabilitated shall be forwarded to the Department by August 31, 2002.

APPENDIX B

Panuke Quarry Hydrology Study

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

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

November 22, 2007 071494

Ms. Angela Swaine, Project Manager
Jacques Whitford Environment Limited
3 Spectacle Lake Drive
Dartmouth, NS B3B 1W8

Attention: Ms. Angela Swaine

Dear Ms. Angela Swaine:

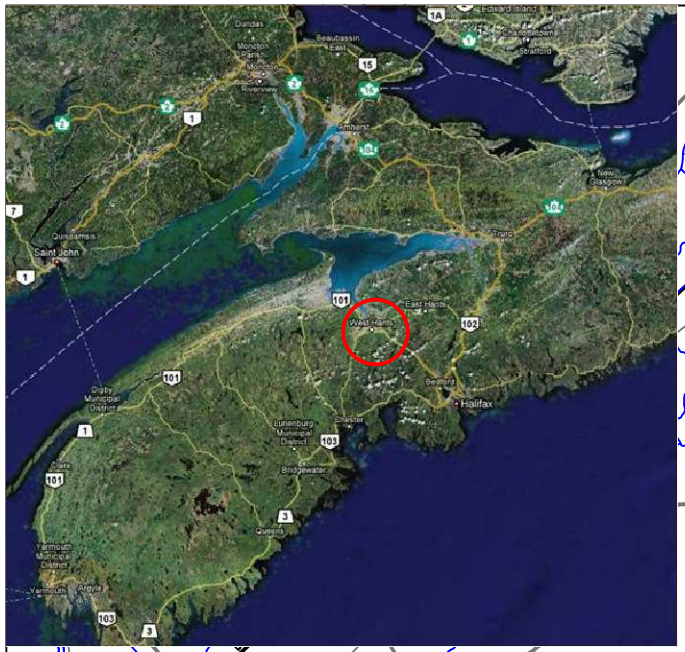
Re: Panuke Quarry Hydrology

Hydro-Com Technologies, acting at the request of Ms. Angela Swaine of Jacques Whitford Environment Limited, has performed a hydrologic review of the Panuke Quarry, Hants County, Nova Scotia. The objectives of the hydrologic review were to determine the potential hydrologic effects of the proposed quarry site expansion on nearby watercourses and wetlands, and to identify appropriate mitigation and monitoring to minimize any detrimental effects. This report has been prepared solely for the project described above and contains a description of our methodologies and our findings.

1.0 Project Description

The Panuke Road Quarry is located along the Panuke Road, approximately 5 km southeast of Windsor, Nova Scotia (see Figure 1 for the quarry location). The existing quarry area is presently on a wedge-shaped property (PID no. 45270493), that is not near any residential development.

Municipal Enterprises Limited (MEL) has been operating a quarry for over five years at its facility on Panuke Road, Municipality of West Hants, Nova Scotia (Municipal Enterprises Limited, 2007). The quarried quartzite is primarily used for local construction such as road building. MEL owns land adjacent to its existing quarry site and is in the process of applying to the Nova Scotia Department of Environment and Labour (NSEL) to amend its existing permit to allow the company to blast, crush, and stockpile aggregate on this adjoining parcel of land (PID 45336963). The proposed activities on this adjacent property will be developed in various phases over the next five years depending on market demand. Approximately 10 hectares (25 acres) of land will be developed over that time. The anticipated average production rate will remain the same unless there is a significant contract awarded to the company. Production is now at the rate of approximately 60 000 tons per year.



HIGHWAY 101

RTE. 1

QUARRY SITE #1

QUARRY SITE #2

SEE FIGURE 2 FOR DETAILS

MILL LAKES

PANUKE LAKE

WINDSOR, NS AREA

PANUKE ROAD
QUARRY

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

Scale: 1 : 50 000	Job no.: 071494
Date: November, 2007	Drawing no.: FIGURE 1

2.0 Objectives

Based on our discussions, the objectives for this assignment are as follows:

- describe the existing surface water drainage patterns and hydrology,
- estimate quantities of surface runoff from the site for the currently proposed ultimate level of quarry development,
- evaluate the potential impacts of the quarry expansion on nearby wetlands and on downstream flows in watercourses for the currently proposed ultimate level of quarry development, and
- estimate the size and design discharge capacity of the required flow retention/siltation treatment structures for the currently proposed ultimate level of quarry development.

3.0 Methodology

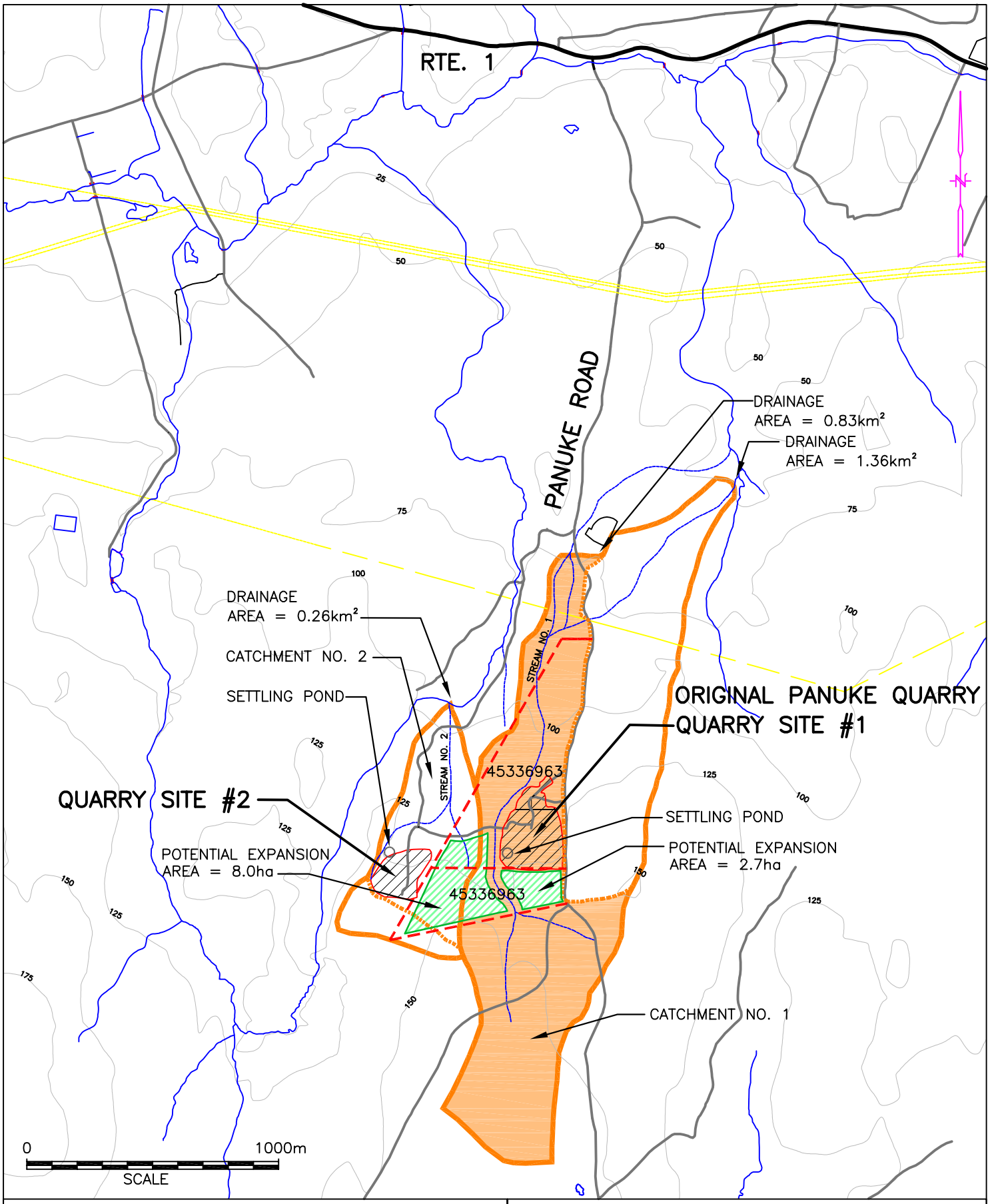
The methodologies that were used to satisfy the above objectives were as follows:

- drainage basin areas were delineated and measured from 1:10 000 scale topographic mapping with a five-metre contour interval (NS 1:10 000 digital mapping),
- a field inspection was carried out October 17 and 18, 2007 for a more detailed delineation of drainage and to ascertain possible effects of that drainage on downstream watercourses,
- existing information was reviewed and summarized including climatic normals for nearby stations and hydrologic information from previous studies,
- peak flows were estimated by prorating single station frequency results from nearby hydrometric stations,
- the monthly and annual volumes of runoff were estimated using a proration of mean annual and monthly flows from a nearby hydrometric station, and
- the size and design discharge capacity of the required flow retention/siltation treatment structures were determined using the Rational Method and the HEC-1 runoff model.

4.0 Existing Surface Water Drainage Patterns

The general layout of the existing and proposed quarry areas, as well as the general site topography and surface drainage patterns is shown on Figure 2. The surface drainage patterns were defined based on a review of 1:10 000 scale digital mapping and a site inspection performed on October 17 and 18, 2007 by Mr. Brian Burrell and Mr. Troy Doyle of Hydro-Com Technologies. During the site inspection, culverts and streams surrounding the project site were inspected, and the following observations were made:

1. There are two quarry operations within the project area: the Panuke quarry (hereafter referred to as quarry no. 1) and a second nearby quarry operation located due west of the Panuke Quarry run by MEL under a lease from Hants County Aggregates Limited (hereafter referred to as quarry no. 2). Although the two quarries are in close proximity to each other and are connected by an access road, it is our understanding that the requested expansion to the quarrying operations is limited exclusively to quarry no. 1 and will be completely within the limits of PID 45336963 and 45270493.
2. A forest stream (identified as stream no. 1 on Figure 2) flows between the original Panuke quarry site (quarry no. 1) and nearby quarry operations (quarry no. 2) to the west. On the dates of the inspection, this stream at a location just south of quarry no. 1



LEGEND

- WATERBODY
- LOCAL UNPAVED ROAD
- LOCAL PAVED ROAD
- ARTERIAL HIGHWAY
- COLLECTOR HIGHWAY
- WATERSHED BOUNDARY
- DYKES AND DAMS
- PIT
- TRANSMISSION LINES
- PROPERTY LINE
- CUT LINE

WINDSOR, NS AREA

PANUKE ROAD QUARRY

Scale: 1 : 20 000	Drawing no.: FIGURE 2
Date: November, 2007	Drawn by: M. L.

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

had flowing water (estimated approx. 5 m wide channel, depth of flow less than 0.2 m, pools and riffles) in a well defined valley. The forest stream flows generally northerly in a forested buffer area just to the west of quarry no. 1 and then though a 24-inch (0.61 m) diameter circular concrete culvert under the access road between the two quarries.

3. Shallow ditching along Panuke Road carries flow from the majority of land to the east of Panuke Road in an adjacent drainage catchment. Near the junction of Panuke Road with a forest road that runs southwest, a few hectares of land drain across the Panuke Road into stream no. 1.
4. Quarry no. 2 is drained by a constructed channel to the west of that quarry, which flows into two setting ponds, and then continues within a poorly defined channel (identified as stream no. 2 on Figure 2) through the forest to the north of quarry no. 2. The stream was followed a few hundred metres downstream of quarry no. 2 and it was noted that the stream flows into small poorly drained areas and at times disappears from the surface only to emerge a short distance downstream.
5. A portion of the proposed expansion of quarry no. 1 is located within the watershed that contains quarry no. 2, and based on personal communications with personnel from Dexter Construction this section of the proposed expansion will likely be accessed through quarry no. 2.
6. In addition to the aforementioned 24-inch diameter circular concrete culvert, there appears to be water flowing in two other locations under the access road between the quarries. From contour mapping, it is deduced that flow from these culverts is towards stream no. 2, and not towards stream no. 1.
7. Two small surface watercourses flow under Panuke Road near the location where power lines cross the road. A 30-inch diameter steel culvert and a 24-inch diameter concrete culvert both carry flows to the east of Panuke Road. It is surmised that stream no. 1 flows through one or both of these culverts to a small channel shown on 1:10 000-scale mapping as flowing north towards the Route 1.

Based on the observations made during the field inspection (and contrary to the topographic information shown on the 1:10 000-scale mapping), drainage from the two quarry sites does not flow into the same catchment (although they are in close proximity to each other). It can also be deduced that:

1. The Panuke Quarry expansion could affect both catchments (as portions of both catchments fall onto property no. 45336963).
2. Expansion of the Panuke Quarry to the western property boundary, and the likely access to the portion of this area west of stream no. 1 through quarry no.2, would increase the drainage area of the catchment containing quarry no. 2. Although the proposed quarry expansion is limited to the existing Panuke Quarry (and does not include expansion of quarry no. 2), the information below present scenarios that quantify the effects of the proposed quarry expansion on the flows from quarry no. 2.

The following information was thereby derived from the 1:10 000 scale mapping using an electronic planimeter (see Figure 2 for the relative locations of the features described below):

1. The drainage area of the catchment containing the Panuke Quarry is approximately 0.83 km^2 upstream of the crossing by stream no. 1 under the Panuke Road, and approximately 1.36 km^2 upstream of the confluence of stream no. 1 and a northern flowing stream located east of the Panuke Road.

2. The catchment containing quarry no. 2 has an existing drainage area of approximately 0.26 km^2 upstream of the confluence of stream no. 2 and a northerly flowing stream located west of the Panuke Road.
3. The present floor areas of quarry nos. 1 and 2 are approximately 6.5 hectares and 3.2 hectares, respectively.

5.0 Quarry Expansion

5.1 Quarry Areas

An additional 10 hectares of quarry will be added to Panuke Quarry over five years. This land will be on two properties (PIDs 45270493 and 45336963) and does not include quarry site no. 2 or the expansion of quarry no.2 into the adjacent cleared area. The Panuke Quarry expansion will, however, be split by 60 m to 100 m undeveloped area defined by setbacks from stream no. 1, with approximately 2.0 hectares east of the buffer and the remaining 8.0 hectares west of the buffer area. For determining runoff (and as a worst-case scenario), 2.7 hectares was used as the available land east of the brook for quarry expansion. The information is summarized in Table 1 below.

Table 1. Panuke Quarry Expansion Areas

Quarry	Existing Floor Area, hectares	Potential Area, hectares	Total Area, hectares
Panuke Quarry	6.5	10.0	16.5
Panuke Quarry east of brook	6.5	2.7	9.2
Panuke Quarry west of Brook	0.0	8.0	8.0
Combined quarry no. 2 and adjacent Panuke Quarry west of brook	3.2	15.4	18.6

Note: Potential area is land available for quarry expansion excluding the buffer along stream no. 1.

5.2 Quarry Runoff

The ranges of mean annual runoff at the quarry sites were estimated. The upper bounds of the mean annual runoff volume were calculated considering all precipitation contributes to runoff (using local climatic data). This was compared to values of mean annual runoff volume obtained from previously estimated mean annual runoff for the area (MacLaren Atlantic Ltd, 1980). Based on climatic normals (1971-2000) at the Windsor-Martock climatic station (approximately 6.7 km away) the average annual precipitation at the site is 1308.2 mm (Environment Canada, 2007). Assuming all of this precipitation is converted into surface runoff, the upper bound on the expected average annual runoff can be determined by the floor area of the quarry multiplied by average annual precipitation. Using runoff volumes throughout Nova Scotia based on MacLaren Atlantic Ltd. (1980), a mean annual runoff depth of 950 mm can be multiplied by floor areas of the quarry to obtain an estimate of mean annual runoff. A lower bound for the expected annual volume of site runoff was established using proration (based on drainage areas) of mean annual flow from a nearby hydrometric station. The hydrometric station 01DD004 (1967-1994), Sharpe Brook at Lloyds, whose drainage area is 8.81 km^2, was

chosen as most representative for proration purposes as its drainage area and hydrological characteristics were deemed most similar to those at the quarry site. Its mean annual flow of 0.221 m^3/s was obtained from the HYDAT CD (Version 2.04).

Table 2. Average Annual Runoff Volumes and Flow Rates from Quarry Floor

Quarry Area	Area	Average Annual Runoff Volumes and Flow Rates from Quarry Floor					
		Upper Bound based on Total Precipitation		MacLaren (1980) Runoff Estimate		Lower Bound based on Flow Proration	
	hectares	Volume, 1000 m^3	Mean annual Flow rate, L/s	Volume, 1000 m^3	Mean annual Flow rate, L/s	Volume, 1000 m^3	Mean annual Flow rate, L/s
Existing Panuke Quarry	6.5	85.3	2.7	61.8	2.0	51.4	1.6
Panuke Quarry Contiguous Expansion	16.5	216	6.8	157	5.0	130	4.1
Panuke Quarry East of Steam no.1	9.2	120	3.8	87.4	2.8	72.8	2.3
Existing Quarry No. 2	3.2	41.9	1.3	30.4	1.0	25.3	0.8
Panuke Quarry West of Stream no. 1	8.0	105	3.3	76.0	2.4	63.3	2.0
Combined expanded Quarry no. 2 and Panuke Quarry West of Stream no. 1	18.6	243	7.7	177	5.6	147	4.7

Table 3. Average Monthly Runoff Volumes, m^3, from Quarry Floor

Quarry Site	Area, ha	Average Monthly Runoff Volumes from Quarry Floor, m^3											
		Jan.	Feb.	Mar.	April	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.
Existing Panuke Quarry	6.5	5000 *6000*	3930 *4710*	7210 *8660*	9700 *11640*	6010 *7210*	2200 *2640*	910 *1090*	1050 *1260*	920 *1100*	2570 *3080*	5340 *6400*	6340 *7610*
Panuke Quarry Contiguous Expansion	16.5	12690 *15200*	9970 *12000*	18300 *22000*	24600 *29500*	15250 *18300*	5580 *6700*	2310 *2770*	2660 *3190*	2330 *2800*	6520 *7820*	13540 *16300*	16100 *19300*
Panuke Quarry East of Stream no. 1	9.2	7080 *8490*	5560 *6670*	10200 *12300*	13700 *16500*	8500 *10200*	3110 *3740*	1290 *1540*	1480 *1780*	1300 *1560*	3640 *4360*	7550 *9060*	8980 *10770*
Panuke Quarry West of Stream no. 1	8.0	6150 *7380*	4830 *5800*	8880 *10700*	11900 *14300*	7390 *8870*	2710 *3250*	1120 *1340*	1290 *1550*	1130 *1360*	3160 *3800*	6570 *7880*	7800 *9370*
Combined expanded Quarry no. 2 and Panuke Quarry West of Stream no. 1	18.6	14300 17200	11200 13500	20600 24800	27700 33300	17200 20700	6290 7550	2600 3120	3000 3600	2630 3150	7350 8820	15300 18300	18200 21800
% of annual flow volume		9.8%	7.7%	14.1%	19.0%	11.7%	4.3%	1.8%	2.0%	1.8%	5.0%	10.4%	12.4%

As presented in Table 3, mean monthly quarry runoff was estimated by prorating the mean monthly flows for hydrometric station 01DD004 (1967-1994), Sharpe Brook at Lloyds.

Levels of evapotranspiration for Nova Scotia have been estimated at between 200 and 400 mm a year (Nova Scotia Museum of Natural History, 1994) or about 15% to 30% of mean annual precipitation. Clearing the land of vegetative cover for quarry expansion will reduce interception and temporary storage of precipitation and result in less evapotranspiration and more direct runoff at the sites. Therefore, the mean monthly runoff values were multiplied by a factor of 1.2 to exemplify a potential increase in runoff rates due to the change in land use quarries, and these values are shown in italics beneath the original values in Table 3.

The peak flow rates from the Quarry and surrounding drainage to the quarry floor was determined using the Rational Method for the 10-, 25-, and 100-year design storms. The runoff coefficient was chosen as 0.70, reflecting that that the quarry floor has low infiltration rates. A relatively flat quarry floor (slope = 0.002 m/m) was assumed. The time of concentration for each quarry area was determined using the Barnaby-Williams equation which is a simple relationship relating time of concentration to catchment area, channel slope, and length. The rainfall intensities for these storms were determined from the rainfall-intensity-duration curves for Kentville CDA (period 1960-1995).

Table 4. Peak Flows from Quarry Floor

Location	Total Area, ha	Time of concentration, minutes	Peak flow from Quarry Floor (m^3/s)		
			10-year	25-year	100-year
Panuke Quarry Contiguous Expansion	16.5	44	1.06	1.41	1.89
Panuke Quarry East of Stream no. 1	9.2	34	0.68	0.93	1.30
Panuke Quarry West of Stream no. 1	8.0	18	0.86	1.16	1.56
Combined expanded Quarry no. 2 and Panuke Quarry West of Stream no. 1	18.6	37	1.34	1.75	2.44

As the quarry operations will last only five years, climate change is not expected to be a major concern during the period of operations, but runoff could increase after quarry operations cease. Using global circulation model projections for an atmosphere with tripled CO_2 levels, Swansberg et al. (2003) performed statistical downscaling of local precipitation for selected sites in New Brunswick. They stated that mean daily annual precipitation from 2010-2099 may increase 9-14% at southern NB stations compared to current climate conditions. Projections (based on the CGCM2 global circulation model) have been made for Kentville, Nova Scotia, of increases in average annual precipitation of 12% by 2070 and of 20% at the end of the century (Gary Lines, personal communication, December 20, 2006). Assuming that storm intensity would increase by similar amounts, then rainfall intensities could increase by 10%. Therefore the estimated values in the above table could be multiplied by a factor of 1.1 to account for climatic change.

5.3 Flow Retention/Siltation Treatment Structures

The criteria that were used to determine the peak design flow and the retention volume associated with the flow retention/siltation treatment structures for the quarry at the currently proposed ultimate level of development are as follows.

- The peak design flow for the pond consisted of the peak flow resulting from a 100-year return period storm event,
- The minimum pond volume was to be equal to the runoff volume of a 6-hour duration storm event with a 25-year return period. Note that the existing water holding area along the quarry floor will provide adequate retention/siltation treatment provided it meets standards for runoff volume retention.

The peak flows resulting from a 100-year-return-period storm event were presented previously (see Table 4). All of the hydraulic control structures associated with the quarry at the currently proposed ultimate levels of development should thus be designed for a peak flow magnitude of no less than the values given below.

Table 5. Minimum Peak Flow for Retention Pond Sizing

Location	Total Area ha	Peak Flow for Pond Sizing (1:100 year flow from quarry floor) m^3/s
Panuke Quarry Contiguous Expansion	16.5	1.89
Panuke Quarry East of Stream no. 1	9.2	1.30
Panuke Quarry West of Stream no. 1	8.0	1.56
Combined expanded Quarry no. 2 and adjacent Panuke Quarry West of Stream no. 1	18.6	2.44

Using HEC-1 modelling, the runoff volumes resulting from a 6-hour duration storm event with a 25-year return period were estimated. The total rainfall during such an event would be approximately 72.9 mm, as obtained from a table of return-period rainfall amounts provided by Atmospheric Environment Service as part of the rainfall-frequency-duration analyses for the Kentville CDA station. [The total rainfall during such an event was estimated as approximately 74.7 mm, based on information derived from the Rainfall Frequency Atlas for Canada (Hogg and Carr, 1985).] A simple triangular rainfall distribution was used. The NRCS land use curve number for the quarry for antecedent moisture conditions (AMC II) was taken as 86. The flow retention/siltation treatment structures (or capacity of quarry floor allowing for water accumulation between the interstices of porous media) should thus have volumes no less than those stated in the table below in order to accommodate the site runoff from the quarry at the currently proposed ultimate level of development. An appropriate collection system will prevent waters from the site from running off directly without first being directed to the retention area of the quarry site.

Table 6. Flow Retention /Siltation Treatment Structure Volumes

Location	Total Area, hectares	Flow Retention /Siltation Treatment Structures Design Volume (m^3)	Approx. Square Pond Dimensions in metres (1.5 m deep pond)	Approx. Square Pond Dimensions in metres (2 m deep pond)
Panuke Quarry Contiguous Expansion	16.5	6490	66 x 66	57 x 57
Panuke Quarry East of Stream no. 1	9.2	3620	49 x 49	43 x 43
Panuke Quarry West of Stream no. 1	8.0	3150	46 x 46	40 x40
Combined expanded Quarry no. 2 and adjacent Panuke Quarry West of Stream no. 1	18.6	7320	70 x 70	60 x 60

6.0 Effect of Quarry Expansion on Downstream Flows and Water Quality

6.1 Drainage Catchment Peak Flows - Pre-Development

The existing runoff was estimated for the three catchment areas. The Rational method is a widely used empirical equation for predicting instantaneous peak discharge from small watersheds. The peak discharge is assumed to occur when the rainfall duration equals the time of concentration. The time of concentration was determined using the Bransby-Williams equation, and the rainfall intensities were obtained from the intensity-duration-frequency curve for Kentville CDA, Nova Scotia (1960-1990). The runoff coefficient was for forest woodlands, with a lower runoff coefficient chosen for the smaller catchment to reflect the poor drainage dynamics. The results are presented in Table 7.

6.2 Drainage Catchment Peak Flows - With Quarry Development

The Rational method was then used to compute peak flows for the catchment area with different states of quarry development. The time of concentration was determined using the Bransby-Williams equation, and the rainfall intensities were obtained from the intensity-duration-frequency curve for Kentville CDA, Nova Scotia (1960-1990). The runoff coefficient was a composite coefficient based on area of forest woodlands and quarry surface. The runoff rates for the watersheds with quarry development are given in the Table 8.

Table 7. Existing Peak Flows

Location	Basin Area, Hectares	Quarry Area, Hectares	Forest Area, Hectares	Cleared Area, Hectares	Composite Runoff Coefficient, C	Peak Flow (m^3/s)		
						10-year	25-year	100-year
Quarry no. 1 catchment to Panuke Road (D.A. = 0.83 km^2)	83	6.5	76.5	0	0.28	1.7	2.3	3.2
Quarry no. 1 catchment to stream shown on 1:10 000 scale mapping (D.A. = 1.36 km^2)	136	6.5	129.5	0	0.27	2.6	3.4	4.7
Quarry no. 2 catchment to stream shown on 1:10 000 scale mapping (D.A. = 0.26 km^2)	26	3	16	7	0.21	0.7	0.9	1.3
NOTE: Runoff coefficients used for quarry = 0.70; for forested area containing quarry no. 1 = 0.25; for forested area containing quarry no. 2 = 0.05; for clear-cut area = 0.35.								

Table 8. Future Peak Flows

Location	Basin Area, Hectares	Quarry Area, Hectares	Forest Area, Hectares	Composite Runoff Coefficient, C	Peak Flow (m^3/s)		
					10-year	25-year	100-year
Quarry no. 1 catchment to Panuke Road (D.A. = 0.83 km^2)							
Panuke Quarry Contiguous Expansion	83	16.5	66.5	0.34	2.1	2.8	3.8
Panuke Quarry East of Stream no. 1	83	9.2	73.8	0.30	1.9	2.4	3.4
Quarry no. 1 catchment to stream shown on 1:10 000 scale mapping (D.A. = 1.36 km^2)							
Panuke Quarry Contiguous Expansion	136	16.5	119.5	0.30	2.9	3.8	5.3
Panuke Quarry East of Stream no. 1	136	9.2	126.8	0.28	2.7	3.5	4.9
Quarry no. 2 catchment to stream shown on 1:10 000 scale mapping (D.A. = 0.26 km^2)							
Panuke Quarry West of Stream no. 1	26	8	18	0.25	0.8	1.1	1.6
Quarry no. 2 catchment to stream shown on 1:10 000 scale mapping (D.A. = 0.33 km^2, quarry no. 2 expansion)							
Combined expanded quarry no. 2 and adjacent Panuke Quarry West of Stream no. 1	33	18.6	14.4	0.42	1.3	1.8	2.4
NOTE: Runoff coefficients used for quarry = 0.70; for forested area containing quarry no. 1 = 0.25; for forested area containing quarry no. 2 = 0.05.							

The above flow estimates were then compared to the flow estimates for existing conditions (as presented in Table 7), and the percentage difference in terms of existing conditions determined. As can be seen from Table 9, the additional quarry development would increase flows in the range of 5% to 20%. For the future scenario where Quarry no. 2 is expanded into the proposed expansion of the Panuke Quarry west of stream no. 1 (this is a hypothetical scenario that is not part of the currently proposed expansion), the future increase in flow in stream no. 2 could be as high as 100%.

Although quarry development will result in an increase in the peak rates of surface runoff at the outlet of the quarry and a reduction of the low flows (i.e. water will run off more quickly following additional quarry development), the placement of free-draining material over the disturbed areas and the use of properly sized flow retention structures (or holding areas along the quarry floor) are expected to fully mitigate the above re-distribution of flows.

Table 9. Percentage Change in Estimated Peak Flows (m^3/s)

Location	Increase in Peak Flows (%)		
	10-year	25-year	100-year
Quarry no. 1 catchment to Panuke Road (D.A. = 0.83 km^2)			
Panuke Quarry Contiguous Expansion	22%	22%	23%
Panuke Quarry East of Stream no. 1	12%	4%	10%
Quarry no. 1 catchment to stream shown on 1:10 000 scale mapping (D.A. = 1.36 km^2)			
Panuke Quarry Contiguous Expansion	12%	12%	13%
Panuke Quarry East of Stream no. 1	4%	3%	4%
Quarry no. 2 catchment to stream shown on 1:10 000 scale mapping (D.A. = 0.26 km^2)			
Panuke Quarry West of Stream no. 1	14%	22%	23%
Quarry no. 2 catchment to stream shown on 1:10 000 scale mapping (D.A. = 0.33 km^2)			
Combined expanded quarry no. 2 and adjacent Panuke Quarry West of Stream no. 1	86%	100%	85%

6.3 Effect on Downstream Water Quality

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

7.0 Summary

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

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

Yours very truly,

HYDRO-COM TECHNOLOGIES

Brian Burrell, M.Eng., P.Eng.

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APPENDIX C

Project Information Bulletin and Letters

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BURCHELLS

File No. 1026840

October 12, 2007

BY FACSIMILE 1-902-798-4093

Chuck Porter, MLA, Hants West
House of Assembly, Nova Scotia, PC Caucus Office
Walter B. Stephens Building
PO Box 3873
100 King Street
Windsor, NS B0N 2T0

Dear Mr. Porter:

Re: Panuke Quarry

Further to our meeting of today, I now enclose for you a copy of the Project Information Sheet prepared on behalf of Municipal Enterprises Limited in connection with the Panuke Quarry project, Hants County, Nova Scotia. This information sheet is being circulated to residents within 1½-2 kms. of the quarry site and is part of the community consultation process requested by the Department of Environment pursuant to the Environmental Assessment Regulations.

Municipal Enterprises Limited presently have a permit to operate a quarry of less than 4 hectares and they have removed all of the rock within that area. They now wish to remove rock from the southern end of the quarry site and, in order to do so, have to proceed with an Environmental Assessment of the site. Jacques Whitford Limited have been retained in this regard and they will prepare a report of the site that will address rare and sensitive flora, wildlife, lakes and streams, wetlands, socio-economic effects of the quarry, and atmospheric issues such as dust and noise. That draft report should be available by the end of November and will be sent to the Department of Environment & Labour. I will make a copy available for you.

If you have any questions in connection with the information set out on the enclosed Project Information Sheet or if you have any subsequent concerns arising from the Environmental Assessment report, you should not hesitate to contact me.

Yours very truly,

BURCHELL HAYMAN PARISH

Alan G. Hayman

AGH/baf
Encls.
cc: Cecil Vance (By Fax: 835-7300)
Angela Swaine, Jacques Whitford (By Fax: 468-9009)
Danny Clifton (By Fax: 1-902-895-1446)

Municipal Enterprises Limited
Panuke Quarry Project
Project Information Sheet

Project Overview
Municipal Enterprises Limited (MEL) has been operating a quarry for over five years at its facility on Panuke Road, Municipality of West Hants, Nova Scotia. The Nova Scotia Department of Environment and Labour (NSEL) granted approval for this quarry under DOE No. 2001-019700, effective September 14, 2001 and expiring September 9, 2011. This quarry is currently operated in accordance with the Nova Scotia Pit and Quarry Guideline (NSEL 1999).

MEL owns land adjacent to its existing quarry site and is in the process of applying to NSEL to amend its existing permit to allow the company to blast, crush, and stockpile aggregate on this adjoining parcel of land.

The quarried quartzite is primarily used for local construction such as road building. The primary markets for the products are government and non-government purchasers. The proposed activities on this adjacent property will be developed in various phases over the next five years depending on market demand. Approximately 10 hectares (25 acres) of land will be developed over that time.

Proposed project activities will be consistent with current quarry operations on the adjacent site. Aggregate production begins with drilling and blasting, which will be conducted by a licensed blasting contractor. Blasting will take place approximately two to four times per year depending upon market demand. After blasting, portable crushing equipment will be brought to the site to process the blasted rock. Various products (*i.e.* various aggregate sizes) will be stockpiled at the quarry site until they are transported to local markets via tandem trucks or tractor trailer trucks via the existing truck route. The average number of trucks hauling aggregates from the quarry is expected to remain unchanged and is currently in the range of 2,000 per year.

The anticipated average production rate will remain the same unless there is a significant contract awarded to the company. Production is now at the rate of approximately 60,000 tons per year. There are no limits on the current operating schedule, based on 15 hrs/day, 7 days/week, weather permitting, although peak demand may require operations to continue for 24 hrs/day, 7 days per week, weather permitting. The proposed schedule is consistent with the current operating schedule.

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

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

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

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

Potential effects of quarry activities on these components will be addressed in the registration document. Preliminary results of an environmental evaluation identified at least one small stream on the property. No other sensitive features have been identified onsite; however, field data is still being complied following this field season. 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 please contact:

Mr. Alan Hayman
Municipal Enterprises Limited
P.O. Box 48100 RPO Mill Cove
Bedford, NS B4A 3Z2
(902) 442-8311 (tel.): (902) 420-9326 (fax)

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

Project No. 1014939

October 10, 2007

Chief Brian Toney
The Annapolis Valley First Nation
P.O. Box 89
Cambridge Station, NS B0P 1G0

Dear Mr. Toney:

Re: Municipal Enterprises Ltd. Panuke Quarry Expansion Project

This letter is to inform you of a project that may be located close to your area of interest.

The Project consists of an expansion of quarry activities at the existing facility near Windsor, West Hants County, Nova Scotia. The developer, Municipal Enterprises Limited, is proposing to expand the area of the existing quarry while maintaining approximately the same level of production. 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 by October 31, 2007.

Yours truly,

JACQUES WHITFORD LIMITED

Angela Swaine
Project Manager

AS/vy

Enclosure

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Project No. 1014939

October 10, 2007

Mr. Donald M. Julien
The Confederacy of Mainland Mi'kmaq
P.O. Box 1590
57 Martin Cres.
Truro, NS B0N 5V3

Dear Mr. Julien:

Re: Municipal Enterprises Ltd. Panuke Quarry Expansion Project

This letter is to inform you of a project that may be located close to your area of interest.

The Project consists of an expansion of quarry activities at the existing facility near Windsor, West Hants County, Nova Scotia. The developer, Municipal Enterprises Limited, is proposing to expand the area of the existing quarry while maintaining approximately the same level of production. 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 by October 31, 2007.

Yours truly,

JACQUES WHITFORD LIMITED

Angela Swaine
Project Manager

AS/vy

Enclosure

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Project No. 1014939

October 10, 2007

Chief Alexander MacDonald
The Shubenacadie First Nation
522 Church Street
Micmac Post Office
Hants County, NS B0N 2H0

Dear Mr. MacDonald:

Re: Municipal Enterprises Ltd. Panuke Quarry Expansion Project

This letter is to inform you of a project that may be located close to your area of interest.

The Project consists of an expansion of quarry activities at the existing facility near Windsor, West Hants County, Nova Scotia. The developer, Municipal Enterprises Limited, is proposing to expand the area of the existing quarry while maintaining approximately the same level of production. 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 by October 31, 2007.

Yours truly,

JACQUES WHITFORD LIMITED

Angela Swaine
Project Manager

AS/vy

Enclosure

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APPENDIX D

Fish Habitat Study

Panuke Quarry Fish Habitat Survey

1.0 INTRODUCTION

1.1 Project Title: Panuke Quarry Fish Habitat Survey

This report describes the preliminary fish habitat assessment that was conducted by Jacques Whitford (JW) on September 20th, 2006. The study consisted of surveying an un-named stream flowing northwards alongside the western perimeter of the Panuke Road Quarry site in Windsor, Nova Scotia, and assessing its potential as fish habitat.

1.2. Regulatory Context

The presence of fish and the quality of fish habitat may influence expansion plans of the Panuke Road Quarry site. Standards for the protection of fish bearing habitat in Nova Scotia are stipulated by both federal and provincial regulatory agencies, such as Fisheries and Oceans Canada (DFO) and Nova Scotia Environment and Labour (NSEL).

A key piece of legislation is the *Fisheries Act*, which is administered by DFO. The *Fisheries Act* deals primarily with the proper management and control of fisheries, the conservation and protection of fish, the protection of fish habitat and prevention of pollution. The definitions outlined in the Act are important in understanding what constitutes 'fish' and 'fish habitat' under Canadian Law.

The Act defines 'fish habitat' as:

"spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes."

Fish habitat includes physical (*e.g.* substrate, temperature, flow velocity and volumes, water depth), chemical (*e.g.* dissolved oxygen, pH, nutrients) and biological (*e.g.* fish, benthic invertebrates, plankton, aquatic plants) attributes of the environment that are required by fish to carry out life cycle processes (*e.g.*, spawning, rearing, feeding, over-wintering, migration).

The federal Fisheries Act defines 'fish' to mean

"all fish, shellfish, crustaceans, aquatic animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and aquatic animals."

Therefore, ***all*** animals in habitats defined as fish habitat are considered fish under the Act.

1.3 General description

The following section describes the general aspects of the study area and findings of the fish habitat survey of the Panuke Road Quarry site. Several locations along the stream were identified as fish habitat. Generally, the stream showed little evidence of impacts from the quarry operations and water clarity was good, with no signs of turbidity due to silt run-off. In fact, sections along the perimeter of the quarry have been mitigated for silt run-off by the erection of appropriate silt screens (Photo 1). The stream bed was completely dry in many places leaving isolated pools along several stretches. Where water was present, the flow conditions were extremely low, but the stream did support abundant aquatic life, including unidentified fish species, amphibians and invertebrates. The water appeared well oxygenated despite the limited

flow rates. Some shallow sediments were found to be anoxic due to anaerobic microbial respiration; however, this represents natural conditions for organic laden sediments that were found in the stream. Evidence of flood debris, both natural (e.g. trees and branches) and anthropogenic (e.g. plastic litter), were found in and around the stream bed. Depth of the stream varied between 10 to 50 cm, with velocities ranging from <0.1 to 0.2 $m.s^{-1}$. The wet width varied from 1 to 5 m and the bank heights varied from 0 to 45 cm. The bottom substrate consisted of angular boulders, cobbles, gravel, and shallow silty sediments mixed with detritus.

Photo 1. Silt control screens erected around the SW perimeter of the quarry

2.0 STUDY APPROACH

Fieldwork was carried out on September 20th, 2006, by a study team of two accompanied JW aquatic scientists. Habitat was described along the stream and at two pools within the quarry itself. Assessment of aquatic habitat consisted of identifying physical units (*i.e.*, riffles, pools, and runs), in-stream cover, substrate composition, stream depth and width, overhead cover, water colouration, and existing anthropogenic impacts on the stream. The presence of fish, aquatic invertebrates, amphibians and wildlife using the riparian zone of the stream were noted. Photographs were taken along the stream to document habitat. All UTM waypoints were recorded in NAD83-Z20.

3.0 HABITAT AND ECOLOGICAL SURVEY

The following habitat summary provides a detailed description of abiotic and biotic characteristics of the surveyed stream. Sampling locations of fish habitat assessments are shown in Figure 1.

Photo 2. View facing up stream at the start of the survey, Site 1.

Site 1, UTM Grid (20414186, 4976004): The stream at this location had a dry width of 2.8 m and a wet width of 1.2 m. The flow rate was <0.1 $m.s^{-1}$ and the maximum water depth was 10 cm. Substrates consisted of leaf detritus, orange flocculent material and fine sediments, which were up to 5 cm deep, overlaying well embedded angular rocks and cobbles. There were no obvious signs of anthropogenic impacts. Both banks consisted of rocks which were covered with sphagnum moss and ferns. The banks were 30-40 cm high and offered no overhangs. There was 70% overhead canopy cover from mixed deciduous trees. The stream at this location also supported abundant aquatic vegetation and frogs.

Photo 3. The first culvert and aquatic plants showing direction of brook flow, Site 2.

Site 2, UTM Grid (20414141, 4976037): The stream at this location had a dry width of 3.0 m and a wet width of 2.8 m, passing through a 60 cm culvert underneath a forest track road. At this location, the stream consisted of a shallow pool with low flow where the maximum water depth was 25 cm. Substrates consisted of decaying leaves, detritus, and soft sediments overlaying well embedded angular rocks and cobbles. There were no obvious signs of anthropogenic impacts. Both banks consisted of rocks which were covered with sphagnum moss and ferns. The banks were 40 cm high and had slight undercutting. There was between 50-70% overhead canopy cover from mixed deciduous trees. Water striders were present at this site.

Photo 4. Dry stream bed, which would normally be a pool, Site 3.

Site 3, UTM Grid (20414105, 4976063): The dry stream bed at this location had a maximum width of 3.0 m, which would normally be a pool. Substrates consisted of decaying leaves, detritus, and soft sediments which were up to 5 cm deep and covered by dried orange flocculent material. These sediments were overlaying well embedded angular cobbles. There were no obvious signs of anthropogenic impacts. Both banks consisted of rocks which were covered with sphagnum moss and ferns. There was between 90-95% overhead canopy cover from mixed deciduous and coniferous trees at this site.

Photo 5. Had the stream not been dry a series of cascades would exist, Site 4.

Site 4, UTM Grid (20414061, 4976072): At this location, the partially dry stream bed exhibits several isolated pools of water with almost no flow. Had the stream been running there would be a series of cascades and runs. The stream had a dry width of 2.6 m, a wet width of 2.5 m and a maximum water depth of 50 cm in the deepest pool. Substrates consisted of decaying leaves, detritus, and soft sediments overlaying well embedded angular cobbles. Both banks consisted of rocks which were covered with sphagnum moss and ferns. There was 100% overhead canopy cover from mixed deciduous and coniferous trees. Along this 18 m section there would be a series of cascades and runs with a 7.5% slope as the stream descends 1.35 m.

Photo 6. Dried stream bed covered with leaf detritus and dried aquatic vegetation, Site 5.

Site 5, UTM Grid (20414026, 4976119): At this location, the dry stream bed exhibits a 20 m straight run with a 5.6% slope. The stream would have a dry width of 2.6 m. Substrates consist of dried aquatic vegetation overlaying well embedded angular cobbles and gravel. Banks consist of rocks covered with sphagnum moss and ferns. There was 100% overhead canopy cover from mixed deciduous and coniferous trees. At this site, the quarry was only 40-50 m NE from the stream.

Photo 7. Partially filled stream bed with large embedded weed covered boulders, Site 6.

Site 6, UTM Grid (20413996, 4976159): Under normal conditions the stream at this location would have riffles along this section, but now exhibits almost no flow. The stream had a width of 2.1 m and a maximum water depth of 22 cm in the deepest of 3 isolated shallow pools. Substrates consisted of decaying leaves, detritus, and soft silty sediments overlaying well embedded angular cobbles. Both banks consisted of rocks which were covered with sphagnum moss, and tree roots offering a small amount of overhang. There was 90% overhead canopy cover from mixed deciduous and coniferous trees. Along this section there was <5% slope.

Photo 8. Dry stream bed, Site 7.

Site 7, UTM Grid (20413938, 4976193): Under normal conditions, the stream at this site would have riffles along this section, but is now completely dry; with a maximum width of 5.5 m. Substrates consisted of embedded angular cobbles and gravel. Both banks consisted of rocks, which were covered with sphagnum moss and tree roots up to 40 cm high offering no overhang. There was 70% overhead canopy cover from mixed deciduous and coniferous trees. Along this section there was 7% slope and remnants of flood debris, such as tree branches and logs.

Photo 9. Dried stream bed showing flood debris, Site 8.

Site 8, UTM Grid (20413915, 4976240): Under normal conditions the stream at this site would have runs and riffles along this section, but is now completely dry, with a maximum width of 3.0 m. Substrates consisted of embedded angular rocks and cobbles covered by moist aquatic vegetation. Both banks consisted of rocks, which were covered with sphagnum moss and tree roots up to 30 cm high offering no overhang. There was 90% overhead canopy cover from mixed deciduous and coniferous trees. Along this section there was more evidence of flood debris such as tree branches and logs.

Photo 10. Poorly defined dried stream bed, Site 9.

Site 9, UTM Grid (20413937, 4976313): The stream here was again dry, but under normal conditions would have three poorly defined channels along this section. Combined, the three channels would have a maximum width of 20 m. Substrates consisted of embedded angular rocks and cobbles covered by aquatic vegetation. Banks are poorly defined at this site, but consist of rocks which were covered with sphagnum and other unidentified mosses, offering no overhang. There was 90% overhead canopy cover from mixed deciduous and coniferous trees. Along this section there was a steeper 15% slope and more evidence of flood debris, such as tree branches and logs.

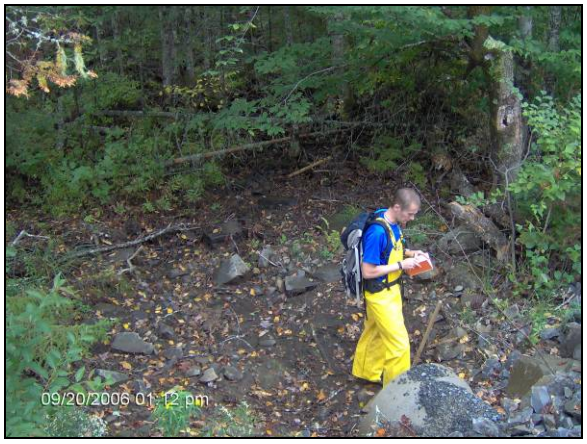

Photo 11. Second culvert with dried stream bed, Site 10.

Site 10, UTM Grid (20413954, 4976418): The stream at this location had a maximum width of 5.5 m and passed through a 60 cm culvert underneath a forest track road. Substrates consisted of decaying leaves, detritus, and soft sediments overlaying well embedded angular cobbles and gravel, along with some boulders. Both banks consisted of rocks which were covered with sphagnum moss and roots. There was 50% overhead canopy cover from mixed deciduous trees. Along this section there was a 4% slope and more evidence of flood debris, such as tree branches and logs.

Photo 12. Stagnant pool with no flow, Site 11.

Site 11, UTM Grid (20413985, 4976470): The stream at this location had a dry width of 2.4 m and a wet width of 1.4 m. There was a stagnant pool with virtually no flow rate and maximum water depth was 30 cm. This pool was preceded by a wide ill-defined stream bed. Substrates consisted of leaf detritus, and fine soft sediments, which were up to 20 cm deep. Banks were covered with sphagnum moss and ferns up to 30-40 cm high, offering small overhangs. There was 80-90% overhead canopy cover from mixed deciduous trees. Along this section there was <4% slope and the stream also supported water striders.

Photo 13. Dried stream bed, Site 12.

Site 12, UTM Grid (20414014, 4976519): Under normal conditions the stream would have runs and riffles along this section, but is now completely dry, with a maximum width of 3.0 m. Substrates consisted of embedded angular cobbles and gravel, covered dried aquatic vegetation. Banks are well defined, consisting of rocks which were covered with sphagnum moss, but offering no overhang. There was 50-60% overhead canopy cover from mixed deciduous and coniferous trees.

Photo 14. Tributary stream entering dried stream bed, Site 13.

Site 13, UTM Grid (20414041, 4976573): This is a tributary stream which enters the dry stream bed. The tributary has a flow rate of 0.2 $m.s^{-1}$ and originates from ground water out of rocks behind the quarry. The tributary has a wet width of 85 cm and a maximum water depth of 5 cm. Substrates consisted of leaf detritus, and fine soft sediments covering embedded angular cobbles and gravel. Banks were covered with sphagnum moss and ferns up to 30-40 cm high, offering small overhangs. There was 50-60% overhead canopy cover from mixed deciduous trees at this location.

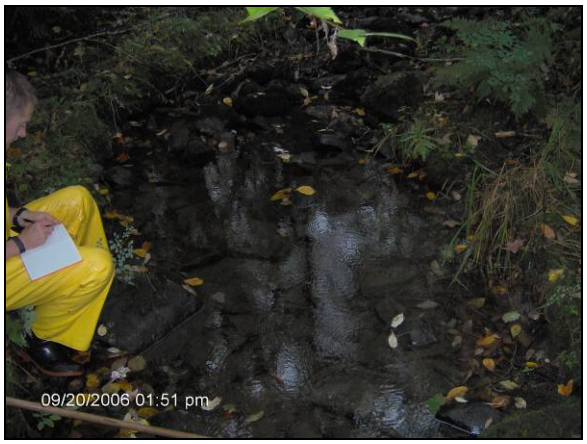

Photo 15. Small pool containing unidentified fish, Site 14.

Site 14, UTM Grid (20414046, 4976618): This section of the stream becomes a small pool with a maximum water depth of 25 cm and a width of 1.0 m. Substrates consisted of leaf detritus, and fine soft sediments covering embedded angular cobbles with almost no slope. Banks were covered with sphagnum moss and ferns up to 40 cm high offering small overhangs, where unidentified fish (2-3 cm long) were seen. There were also lots of water striders at this site. There was 70-90% overhead canopy cover from mixed deciduous trees.

Photo 16. Stream containing unidentified fish, Site 15.

Site 15, UTM Grid (20414073, 4976677): This section of the stream becomes more defined with a slow run with low flow, maximum water depth of 30 cm and width of 1.0 m. Substrates consisted of leaf detritus, and fine soft sediments, with a depth of 10 cm. No cobbles were seen here. Banks were covered with sphagnum moss and ferns up to 40 cm high, offering multiple overhangs, where unidentified fish (3-4 cm long) were seen. There were also lots of water striders at this site. There was 90% overhead canopy cover from mixed deciduous and coniferous trees.

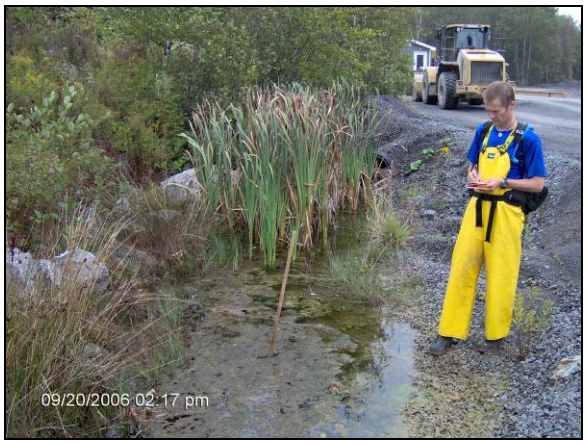

Photo 17. Small pool within the quarry supporting juvenile fish, Site 16.

Site 16, UTM Grid (20414049, 4976493): At this location there is a small pool (10 x 1.5 m) in the western corner of the quarry, choking with weed and surrounded by cat tails. The maximum water depth was 40 cm with soft quarry silts up to 10 cm deep. This pool contains >20 unidentified fish. The out flow of the pool passes through a culvert and forms the tributary stream at site 13.

Photo 18. Large pool within the quarry supporting juvenile fish, Site 17.

Site 17, UTM Grid (20414061, 4976072): At this site there is a large pool in the western corner of the quarry, containing weed and surrounded by cat tails. The maximum water depth was 35 cm with soft quarry silts up to 10 cm deep. This pool contains >50 unidentified fish. The out flow of the pool passes through a culvert which feeds into the small pool and ultimately forms the tributary stream at site 13.

4.0 SUMMARY

Small fish were observed along several stretches of the stream, at sites 14 and 15, and in the pools within the quarry itself, at sites 16 and 17. However, none of the fish were caught for identification, as DFO regulations prohibit electro-fishing in the waters and tributaries of the St. Croix River. The presence of fish indicates that the stream provides feeding habitat and shelter for fish, and likely provides spawning and rearing habitat (as indicated by the presence of small fish).

APPENDIX E

Vascular Plants Recorded in Study Area

TABLE E1 Vascular Plants found in the Study Area.

Common Name	Binomial	ACCDC Population Status (Nova Scotia)	
Balsam Fir	*Abies balsamea*	S5	GREEN
Striped Maple	*Acer pensylvanicum*	S5	GREEN
Red Maple	*Acer rubrum*	S5	GREEN
Sugar Maple	*Acer saccharum*	S5	GREEN
Mountain Maple	*Acer spicatum*	S5	GREEN
White Baneberry	*Actaea alba*	S4	GREEN
Red Baneberry	*Actaea rubra*	S5	GREEN
Rough Bentgrass	*Agrostis hyemalis*	S5	GREEN
Speckled Alder	*Alnus incana*	S5	GREEN
A Serviceberry	*Amelanchier Sp.*	Not Applicable	Not Applicable
Pearly Everlasting	*Anaphalis margaritacea*	S5	GREEN
Small Pussy-Toes	*Antennaria neglecta*	S4?	GREEN
Sweet Vernal Grass	*Anthoxanthum odoratum*	SE	EXOTIC
Spreading Dogbane	*Apocynum androsaemifolium*	S5	GREEN
Wild Sarsaparilla	*Aralia nudicaulis*	S5	GREEN
Whorled Aster	*Aster acuminatus*	S5	GREEN
Farewell-Summer	*Aster lateriflorus*	S5	GREEN
Large-Leaf Wood-Aster	*Aster macrophyllus*	S5	GREEN
Parasol White-Top	*Aster umbellatus*	S5	GREEN
Lady-Fern	*Athyrium filix-femina*	S5	GREEN
Yellow Birch	*Betula alleghaniensis*	S5	GREEN
Heart-Leaved Paper Birch	*Betula cordifolia*	S5	Not Applicable
Paper Birch	*Betula papyrifera*	S5	GREEN
Gray Birch	*Betula populifolia*	S5	GREEN
Bearded Short-Husk	*Brachyelytrum erectum*	S4S5	Not Applicable
Pennsylvania Bitter-Cress	*Cardamine pensylvanica*	S5	GREEN
Black Sedge	*Carex arctata*	S5	GREEN
Brownish Sedge	*Carex brunnescens*	S5	GREEN
Fibrous-Root Sedge	*Carex communis*	S5	GREEN
White-Edge Sedge	*Carex debilis*	S4S5	GREEN
Short-Scale Sedge	*Carex deweyana*	S4	GREEN
Long Sedge	*Carex folliculata*	S5	GREEN
Graceful Sedge	*Carex gracillima*	S4S5	GREEN
A Sedge	*Carex gynandra*	S5	GREEN
Bladder Sedge	*Carex intumescens*	S5	GREEN
Bristly-Stalk Sedge	*Carex leptalea*	S5	GREEN
Finely-Nerved Sedge	*Carex leptonervia*	S5	GREEN
Shallow Sedge	*Carex lurida*	S5	GREEN
New England Sedge	*Carex novae-angliae*	S5	GREEN
Few-Flowered Sedge	*Carex pauciflora*	S4S5	GREEN
Rough Sedge	*Carex scabrata*	S5	GREEN
Stalk-Grain Sedge	*Carex stipata*	S5	GREEN
Three-Seed Sedge	*Carex trisperma*	S5	GREEN
White Turtlehead	*Chelone glabra*	S5	GREEN
American Golden-Saxifrage	*Chrysosplenium americanum*	S5	GREEN
Small Enchanter's Nightshade	*Circaea alpina*	S5	GREEN
Virginia Virgin-Bower	*Clematis virginiana*	S5	GREEN
Clinton Lily	*Clintonia borealis*	S5	GREEN
Goldthread	*Coptis trifolia*	S5	GREEN
Spotted Coralroot	*Corallorhiza maculata*	S4	GREEN
Alternate-Leaf Dogwood	*Cornus alternifolia*	S5	GREEN

TABLE E1 Vascular Plants found in the Study Area.

Common Name	Binomial	ACCDC Population Status (Nova Scotia)	
Dwarf Dogwood	*Cornus canadensis*	S5	GREEN
Beaked Hazelnut	*Corylus cornuta*	S5	GREEN
Pink Lady's-Slipper	*Cypripedium acaule*	S5	GREEN
Flattened Oatgrass	*Danthonia compressa*	S4	GREEN
Poverty Oat-Grass	*Danthonia spicata*	S5	GREEN
Wild Carrot	*Daucus carota*	SE	EXOTIC
Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	GREEN
Northern Bush-Honeysuckle	*Diervilla lonicera*	S5	GREEN
Spinulose Shield Fern	*Dryopteris carthusiana*	S5	GREEN
Crested Shield-Fern	*Dryopteris cristata*	S5	GREEN
Evergreen Woodfern	*Dryopteris intermedia*	S5	GREEN
Marginal Wood-Fern	*Dryopteris marginalis*	S5	GREEN
Trailing Arbutus	*Epigaea repens*	S5	GREEN
Woodland Horsetail	*Equisetum sylvaticum*	S5	GREEN
Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	GREEN
American Beech	*Fagus grandifolia*	S5	GREEN
Hair Fescue	*Festuca filiformis*	SE	EXOTIC
Red Fescue	*Festuca rubra*	S5	GREEN
Virginia Strawberry	*Fragaria virginiana*	S5	GREEN
White Ash	*Fraxinus americana*	S5	GREEN
Rough Bedstraw	*Galium asprellum*	S5	GREEN
Teaberry	*Gaultheria procumbens*	S5	GREEN
Fowl Manna-Grass	*Glyceria striata*	S5	GREEN
Northern Oak Fern	*Gymnocarpium dryopteris*	S5	GREEN
American Witch-Hazel	*Hamamelis virginiana*	S5	GREEN
Meadow Hawkweed	*Hieracium caespitosum*	SE	EXOTIC
Shining Fir-Clubmoss	*Huperzia lucidula*	S5	GREEN
American Water-Pennywort	*Hydrocotyle americana*	S5	GREEN
Spotted Jewel-Weed	*Impatiens capensis*	S5	GREEN
Blueflag	*Iris versicolor*	S5	GREEN
Soft Rush	*Juncus effusus*	S5	GREEN
Lettuce	*Lactuca Sp.*	Not Applicable	Not Applicable
Twinflower	*Linnaea borealis*	S5	GREEN
American Fly-Honeysuckle	*Lonicera canadensis*	S5	GREEN
Hairy Woodrush	*Luzula acuminata*	S5	GREEN
Common Woodrush	*Luzula multiflora*	S5	GREEN
Stiff Clubmoss	*Lycopodium annotinum*	S5	GREEN
Running Pine	*Lycopodium clavatum*	S5	GREEN
Treelike Clubmoss	*Lycopodium dendroideum*	S4?	GREEN
Hickey's Clubmoss	*Lycopodium hickeyi*	S2?	Undetermined
Tree Clubmoss	*Lycopodium obscurum*	S5	GREEN
Northern Bugleweed	*Lycopus uniflorus*	S5	GREEN
Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	GREEN
Ostrich Fern	*Matteuccia struthiopteris*	S5	GREEN
Indian Cucumber-Root	*Medeola virginiana*	S5	GREEN
American Cow-Wheat	*Melampyrum lineare*	S5	GREEN
Partridge-Berry	*Mitchella repens*	S5	GREEN
Indian-Pipe	*Monotropa uniflora*	S5	GREEN
Sensitive Fern	*Onoclea sensibilis*	S5	GREEN
Cinnamon Fern	*Osmunda cinnamomea*	S5	GREEN
Interrupted Fern	*Osmunda claytoniana*	S5	GREEN

TABLE E1 Vascular Plants found in the Study Area.

Common Name	Binomial	ACCDC Population Status (Nova Scotia)	
Eastern Hop-Hornbeam	*Ostrya virginiana*	S5	GREEN
White Wood-Sorrel	*Oxalis acetosella*	S5	GREEN
Northern Beech Fern	*Phegopteris connectilis*	S5	GREEN
White Spruce	*Picea glauca*	S5	GREEN
Red Spruce	*Picea rubens*	S5	GREEN
Eastern White Pine	*Pinus strobus*	S5	GREEN
Large Roundleaf Orchid	*Platanthera orbiculata*	S2S3	GREEN
Drooping Bluegrass	*Poa saltuensis*	S4S5	GREEN
A Grass	*Poa Sp.*	Not Applicable	Not Applicable
Downy Solomon's-Seal	*Polygonatum pubescens*	S4S5	GREEN
Fringed Black Bindweed	*Polygonum cilinode*	S5	GREEN
Rock Polypody	*Polypodium virginianum*	S5	GREEN
Christmas Fern	*Polystichum acrostichoides*	S5	GREEN
Large-Tooth Aspen	*Populus grandidentata*	S5	GREEN
Quaking Aspen	*Populus tremuloides*	S5	GREEN
Tall Rattlesnake-root	*Prenanthes altissima*	S4	GREEN
Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	GREEN
Self-Heal	*Prunella vulgaris*	S5	GREEN
Fire Cherry	*Prunus pensylvanica*	S5	GREEN
Bracken Fern	*Pteridium aquilinum*	S5	GREEN
Shinleaf	*Pyrola elliptica*	S5	GREEN
Northern Red Oak	*Quercus rubra*	S5	GREEN
Creeping Butter-Cup	*Ranunculus repens*	SE	EXOTIC
Watercress	*Rorippa nasturtium-aquaticum*	SE	GREEN
Smooth Blackberry	*Rubus canadensis*	S5	GREEN
Dwarf Red Raspberry	*Rubus pubescens*	S5	GREEN
Mad Dog Skullcap	*Scutellaria lateriflora*	S5	GREEN
Hemlock Water-Parsnip	*Sium suave*	S5	GREEN
Solomon's-Plume	*Smilacina racemosa*	S4S5	GREEN
Canada Goldenrod	*Solidago canadensis*	S5	GREEN
Early Goldenrod	*Solidago juncea*	S5	GREEN
Downy Goldenrod	*Solidago puberula*	S5	GREEN
Rough-Leaf Goldenrod	*Solidago rugosa*	S5	GREEN
Rosy Twistedstalk	*Streptopus roseus*	S5	GREEN
Common Dandelion	*Taraxacum officinale*	SE	EXOTIC
Canadian Yew	*Taxus canadensis*	S5	GREEN
New York Fern	*Thelypteris noveboracensis*	S5	GREEN
Northern Starflower	*Trientalis borealis*	S5	GREEN
Ill-Scent Trillium	*Trillium erectum*	S3	GREEN
Painted Trillium	*Trillium undulatum*	S5	GREEN
Eastern Hemlock	*Tsuga canadensis*	S4S5	GREEN
Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	GREEN
Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	GREEN
Gypsy-Weed	*Veronica officinalis*	S5SE	EXOTIC
Alderleaf Viburnum	*Viburnum alnifolium*	S5	GREEN
Possum-Haw Viburnum	*Viburnum nudum*	S5	GREEN
Marsh Blue Violet	*Viola cucullata*	S5	GREEN
Smooth White Violet	*Viola macloskeyi*	S5	GREEN
Kidney-Leaf White Violet	*Viola renifolia*	S4	GREEN

APPENDIX F

Bird Species Recorded in Study Area

TABLE F1a Observations of Birds in Each Habitat Type, 2007

Bird	CC - Clear-cut	DA - Disturbed Area	FO - Flew Over	HU - Habitat Unknown	IH - Immature Hardwood	IM - Immature Mixedwood	LS - Low Shrub Swamp	MM - Mature Mixedwood	MH- Mature Hardwood	MTS - Mixedwood Treed Swamp	TS - Tall Shrub Swamp	Grand Total
White-throated Sparrow					2			1				**3**
Parula Warbler								1	5			**6**
Red-eyed Vireo									8			**8**
Yellow-rumped Warbler								3				**3**
Black-capped Chickadee									1			**1**
Ovenbird								1	6			**7**
Black-and-white Warbler								2	1			**3**
Pileated Woodpecker									1			**1**
American Redstart									2			**2**
Least Flycatcher									2			**2**
Magnolia Warbler									1			**1**
American Robin	2								4			**6**
American Woodcock									2			**2**
Northern Flicker									1			**1**
Hairy Woodpecker									4			**4**
Hermit Thrush									1			**1**
Blackburnian Warbler									1			**1**
Black-throated Green Warbler									1			**1**
Dark-eyed Junco	1							1				**2**
Brown Creeper									1			**1**
Solitary Vireo									4			**4**
American Goldfinch									2			**2**
Cedar Waxwing									1			**1**
Yellow-bellied Sapsucker									2			**2**
Common Nighthawk	1											**1**
Killdeer	1											**1**
Grand Total	**5**	**0**	**0**	**0**	**2**	**0**	**0**	**9**	**51**	**0**	**0**	**67**
26 species, 67 individuals												

TABLE F1b Observations of Birds in Each Habitat Type, 2006

Bird	CC - Clear-cut	DA - Disturbed Area	FO - Flew Over	HU - Habitat Unknown	IH - Immature Hardwood	IM - Immature Mixedwood	LS - Low Shrub Swamp	MM - Mature Mixedwood	MH- Mature Hardwood	MTS - Mixedwood Treed Swamp	TS - Tall Shrub Swamp	Grand Total
American Goldfinch			1						3			**4**
American Redstart		1										**1**
American Robin			2					1	2			**5**
Barred Owl									1			**1**
Black-and-white Warbler								2				**2**
Blackburnian Warbler								1	1			**2**
Black-capped Chickadee				2				7	1			**10**
Black-throated Blue Warbler								1	2			**3**
Black-throated Green Warbler								4	5			**9**
Brown Creeper								1				**1**
Canada Warbler								1				**1**
Cedar Waxwing								2				**2**
Common Raven				1								**1**
Dark-eyed Junco								1				**1**
Downy Woodpecker								1				**1**
Eastern Wood Pewee									1			**1**
Hermit Thrush				1				3	1			**5**
Least Flycatcher									3			**3**
Northern Flicker									2			**2**
Ovenbird				1				10	9			**20**
Parula Warbler								3	2			**5**
Pileated Woodpecker									1			**1**
Red-eyed Vireo								2	5			**7**
Red-tailed Hawk								1				**1**
Ruby-crowned Kinglet								1				**1**
Spotted Sandpiper		4										**4**
Swainson's Thrush								1				**1**
Tree Swallow			1									**1**
White-throated Sparrow		4										**4**
Winter Wren									1			**1**
Yellow-bellied Sapsucker									4			**4**
Yellow-rumped Warbler								2				**2**
Grand Total	**0**	**9**	**4**	**5**	**0**	**0**	**0**	**45**	**44**	**0**	**0**	**107**
32 species, 107 individuals												

TABLE F2 Breeding Status and Population Status of Birds Recorded in the Study Area and the Breeding Bird Atlas Square within which the Study Area is Located.

Common Name	Scientific Name	Breeding Status (BBA Data)	Breeding Status (Field Survey, 2006)	Breeding Status (Field Survey, 2007)	NSDNR Rank	ACCDC Rank
Alder Flycatcher	*Empidonax alnorum*	Possible	Not Observed	Not Observed	Green	S5B
American Crow	*Corvus brachyrhynchos*	Possible	Not Observed	Not Observed	Green	S5
American Goldfinch	*Carduelis tristis*	Possible	Possible	Probable	Green	S5
American Kestrel	*Falco sparverius*	Possible	Not Observed	Not Observed	Green	S5B
American Redstart	*Setophaga ruticilla*	Confirmed	No Evidence	Possible	Green	S5B
American Robin	*Turdus migratorius*	Confirmed	Probable	Probable	Green	S5B
American Woodcock	*Scolopax minor*	Not Observed	Not Observed	Possible	Green	S4S5B
Bald Eagle	*Haliaeetus leucocephalus*	Confirmed	Not Observed	Not Observed	Green	S5B,S4N
Bank Swallow	*Riparia riparia*	Possible	Not Observed	Not Observed	Green	S4B
Barn Swallow	*Hirundo rustica*	Confirmed	Not Observed	Not Observed	Yellow	S4B
Barred Owl	*Strix varia*	Not Observed	Possible	Not Observed	Green	S5
Belted Kingfisher	*Ceryle alcyon*	Possible	Not Observed	Not Observed	Green	S5B
Black-and-white Warbler	*Mniotilta varia*	Possible	Possible	Possible	Green	S5B
Blackburnian Warbler	*Dendroica fusca*	Confirmed	Possible	Possible	Green	S4S5B
Black-capped Chickadee	*Parus atricapillus*	Confirmed	Probable	Possible	Green	S5
Black-throated Blue Warbler	*Dendroica caerulescens*	Not Observed	Possible	Not Observed	Green	S4B
Black-throated Green Warbler	*Dendroica virens*	Possible	Possible	Possible	Green	S5B
Blue Jay	*Cyanocitta cristata*	Confirmed	Not Observed	Not Observed	Green	S5
Boreal Chickadee	*Parus hudsonicus*	Possible	Not Observed	Not Observed	Yellow	S4
Brown Creeper	*Certhia Americana*	Not Observed	Possible	Possible	Green	S5
Brown-headed Cowbird	*Molothrus ater*	Possible	Not Observed	Not Observed	Green	S4B
Canada Warbler	*Wilsonia canadensis*	Confirmed	Possible	Not Observed	Yellow	S4B
Cedar Waxwing	*Bombycilla cedrorum*	Probable	Possible	Possible	Green	S5B
Chestnut-sided Warbler	*Dendroica pensylvanica*	Possible	Not Observed	Not Observed	Green	S5B
Chipping Sparrow	*Spizella passerina*	Confirmed	Not Observed	Not Observed	Green	S5B
Common Grackle	*Quiscalus quiscula*	Possible	Not Observed	Not Observed	Green	S5B
Common Loon	*Gavia immer*	Possible	Not Observed	Not Observed	Yellow	S4B,S4N
Common Nighthawk	*Chordeiles minor*	Possible	Not Observed	Possible	Yellow	S4B
Common Raven	*Corvus corax*	Possible	Possible	Not Observed	Green	S5
Common Yellowthroat	*Geothlypis trichas*	Probable	Not Observed	Not Observed	Green	S5B
Dark-eyed Junco	*Junco hyemalis*	Confirmed	Probable	Possible	Green	S5
Downy Woodpecker	*Picoides pubescens*	Possible	Possible	Not Observed	Green	S5
Eastern Kingbird	*Tyrannus tyrannus*	Possible	Not Observed	Not Observed	Green	S4B
Eastern Wood-Pewee	*Contopus virens*	Possible	Possible	Not Observed	Green	S4B
European Starling	*Sturnus vulgaris*	Confirmed	Not Observed	Not Observed	Exotic	SE
Evening Grosbeak	*Coccothraustes vespertinus*	Confirmed	Not Observed	Not Observed	Green	S5
Golden-crowned Kinglet	*Regulus satrapa*	Possible	Not Observed	Not Observed	Green	S5B
Gray Catbird	*Dumetella carolinesis*	Confirmed	Not Observed	Not Observed	Green	S5B
Hairy Woodpecker	*Picoides villosus*	Possible	Not Observed	Confirmed	Green	S5
Hermit Thrush	*Catharus guttatus*	Confirmed	Possible	Probable	Green	S5B
House Sparrow	*Passer domesticus*	Possible	Not Observed	Not Observed	Exotic	SE
Killdeer	*Charadrius vociferus*	Not Observed	Not Observed	Probable	Green	S5B
Least Flycatcher	*Empidonax minimus*	Not Observed	Probable	Possible	Green	S5B
Magnolia Warbler	*Dendroica magnolia*	Confirmed	Not Observed	Possible	Green	S5B
Northern Flicker	*Colaptes auratus*	Possible	Possible	Possible	Green	S5B
Northern Parula Warbler	*Parula americana*	Not Observed	Possible	Possible	Green	S5B
Northern Waterthrush	*Seiurus noveboracensis*	Possible	Not Observed	Not Observed	Green	S5B
Ovenbird	*Seiurus aurocapillus*	Possible	Probable	Probable	Green	S5B
Pileated Woodpecker	*Dryocopus pileatus*	Not Observed	No Evidence	Possible	Green	S5
Purple Finch	*Carpodacus purpureus*	Confirmed	Not Observed	Not Observed	Green	S5B
Red-breasted Nuthatch	*Sitta canadensis*	Possible	Not Observed	Not Observed	Green	S5
Red-eyed Vireo	*Vireo olivaceus*	Possible	Probable	Possible	Green	S5B
Red-tailed Hawk	*Buteo jamaicensis*	Possible	Possible	Not Observed	Green	S5B
Red-winged Blackbird	*Agelaius phoeniceus*	Confirmed	Not Observed	Not Observed	Green	S5B
Ring-necked Pheasant	*Phasianus colchius*	Possible	Not Observed	Not Observed	Exotic	SEB
Rock Dove	*Columba livia*	Possible	Not Observed	Not Observed	Exotic	SEB
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Possible	Not Observed	Not Observed	Green	S4B
Ruby-crowned Kinglet	*Regulus calendula*	Possible	Possible	Not Observed	Green	S5B
Ruby-throated Hummingbird	*Archilochus colubris*	Possible	Not Observed	Not Observed	Green	S5B
Savannah Sparrow	*Passerculus sandwichensis*	Possible	Not Observed	Not Observed	Green	S5B
Solitary Vireo	*Vireo solitarius*	Confirmed	Not Observed	Probable	Green	S5B
Song Sparrow	*Melospiza melodia*	Confirmed	Not Observed	Not Observed	Green	S5B
Spotted Sandpiper	*Actitis macularia*	Confirmed	Probable	Not Observed	Green	S5B
Swainson's Thrush	*Catharus ustulatus*	Confirmed	Possible	Not Observed	Green	S5B
Swamp Sparrow	*Melospiza georgiana*	Confirmed	Not Observed	Not Observed	Green	S5B
Tennessee Warbler	*Vermivora peregrina*	Confirmed	Not Observed	Not Observed	Green	S5B
Tree Swallow	*Tachycineta bicolor*	Not Observed	No Evidence	Not Observed	Green	S5B
Veery	*Catharus fuscescens*	Possible	Not Observed	Not Observed	Green	S5B
White-throated Sparrow	*Zonotrichia albicollis*	Confirmed	Probable	Confirmed	Green	S5B,SZN
Winter Wren	*Troglodytes troglodytes*	Possible	Possible	Not Observed	Green	S5B
Yellow Warbler	*Dendroica petechia*	Confirmed	Not Observed	Not Observed	Green	S5B
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Possible	Not Observed	Not Observed	Green	S5B
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Possible	Confirmed	Probable	Green	S5B
Yellow-rumped Warbler	*Dendroica coronata*	Possible	Confirmed	Probable	Green	S5B