

**S. W. WEEKS CONSTRUCTION LTD.
ENVIRONMENTAL ASSESSMENT REGISTRATION
EAST UNIACKE QUARRY EXPANSION PROJECT**

PROJECT NO. NSD17810

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REPORT TO

S. W. WEEKS CONSTRUCTION LTD.

ON

**ENVIRONMENTAL ASSESSMENT REGISTRATION
EAST UNIACKE QUARRY EXPANSION PROJECT
BEAVER BANK, NS**

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May 20, 2004

EXECUTIVE SUMMARY

S. W. Weeks Construction. Ltd. (Weeks Construction) proposes to expand the footprint of its existing quarry at East Uniacke, Hants County, Nova Scotia. The proposal will allow continued aggregate production (blasting and crushing), stockpiling, and occasional asphalt production. Quarry advancement and aggregate production at the quarry is limited by the need for additional stockpile area adjacent to the existing quarry working face. The proposed activities will take place over the next 25 to 30 years involving a total of approximately 80.1 acres (32.4 ha) of land immediately adjacent to the existing quarry.

The quarry opened in June 2003 and produces a variety of aggregate types. The current and anticipated average production rate is 200,000 tonnes per year, and potentially as much as 500,000 if a significant contract were awarded. The current and anticipated operating schedule is 12 hrs/day, 5 days/week on a year-round basis, weather permitting.

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

Weeks Construction is required to register this project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. Other relevant provincial regulations include the Activities Designation Regulations, which requires an Industrial Approval from the NSDEL for the quarry operation, and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (2003). Provincial guidelines to be adhered to include the Nova Scotia Pit and Quarry Guidelines (NSDEL 1999).

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

- fish and fish habitat;
- rare and sensitive flora;
- wetlands;

- wildlife;;
- groundwater resources;
- archaeological and heritage resources;
- air quality; and
- socio-economic environment.

Environmental effects from the quarry expansion will include the loss of terrestrial habitat within the quarry footprint. This area does not include unique habitat or rare or sensitive species; therefore, these effects are not anticipated to be significant. Assuming the mitigative measures specified in this report are implemented, and the quarry is operated according to existing provincial guidelines and approvals, no significant adverse residual environmental or socio-economic effects are likely.

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1.0 PROPONENT AND PROJECT IDENTIFICATION

1.1 Proponent Information

S. W. Weeks Construction Limited (Weeks Construction; the Proponent) was incorporated as a Nova Scotia company in 1971 where it carried out its construction and materials related business. Today, Weeks Construction owns four quarries in Nova Scotia that are permitted to supply aggregates to the general public and an additional three quarries which operate solely for the provision of aggregates for provincial highway projects. A copy of Registry of Joint Stocks are included in Appendix A.

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Company President, Chief Executive Officer and/or Environmental Assessment Contact

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Official Title: Environmental Analyst, Project Manager
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Fax: (902) 468-9009

Signature of Chief Executive Officer

Date

1.2 Project Information

Name of the Undertaking: East Uniacke Quarry Expansion Project
Location of the Undertaking: East Uniacke, Hants County, Nova Scotia

2.0 PROJECT INFORMATION

2.1 Description of the Undertaking

Weeks Construction owns and operates a quarry in East Uniacke, Hants County, NS (Figure 2.1 and 2.2). An Industrial Approval (No. 2002-030481), pursuant to Division V of the Activities Designation Regulations, was issued by Nova Scotia Environment and Labour (NSEL) on January 15, 2003. This permit allows for construction and operation of a quarry, 9.882 acres in area (see Figure 2.2). A copy of the permit is appended to this report (Appendix B).

Weeks Construction proposes to expand its quarry to allow for continued aggregate production (blasting, crushing, and stockpiling) and intends to supply various construction and road building projects and activities. Weeks Construction owns the existing quarry lands as well as the surrounding lands, which will effectively allow for an expansion of its operation.

Weeks Construction originally considered an expansion area of approximately 40.5 ha (100 acres) as seen on Figure 2.2. As a result of the field and desktop studies undertaken in support of this environmental registration report, the expansion area was revised to approximately 32.4 ha (80.1 acres) (Figure 2.2). This was done to exclude wetland habitat in the southern portion of the expansion area to minimize potential environmental effects on these wetlands as well as those further south which receive their drainage/flow.

The quarry opened in June 2003. The anticipated average production rate is 200,000 tonnes per year, and potentially as much as 500,000 if a significant contract were awarded. The current and anticipated operating schedule is 12 hrs/day, 5 days/week on a year-round basis, weather permitting. Estimated rock reserves in the proposed expansion area is in excess of 20 million tonnes. Quarry operations will continue to take place over the next 25 to 30 years, depending upon the demand for aggregate in the area.

2.2 Geographical Location

The quarry is located in East Uniacke on the east side of the Beaver Bank Road (Route 354), Hants County, NS. Entrance to the quarry is via an access road, approximately 400 metres (m) in length, from a privately owned access road. Entrance to the private road is along the Beaver Bank Road (Route 354), approximately 1.8 km north of the Hants County and Halifax Regional Municipality boundary line. (Figure 2.2). The quarry and proposed quarry expansion area are situated on lands that have been recently clear cut (*i.e.*, within the past three to five years). Vegetation consists predominantly of spruce and fir with low shrubs scattered over barren areas. Generally, the proposed quarry expansion area is bound to the west by the Beaver Bank Road, to the south by the privately owned access road, to the east by a small stream (unnamed tributary to Hebert River), and to the north by a wetland area.



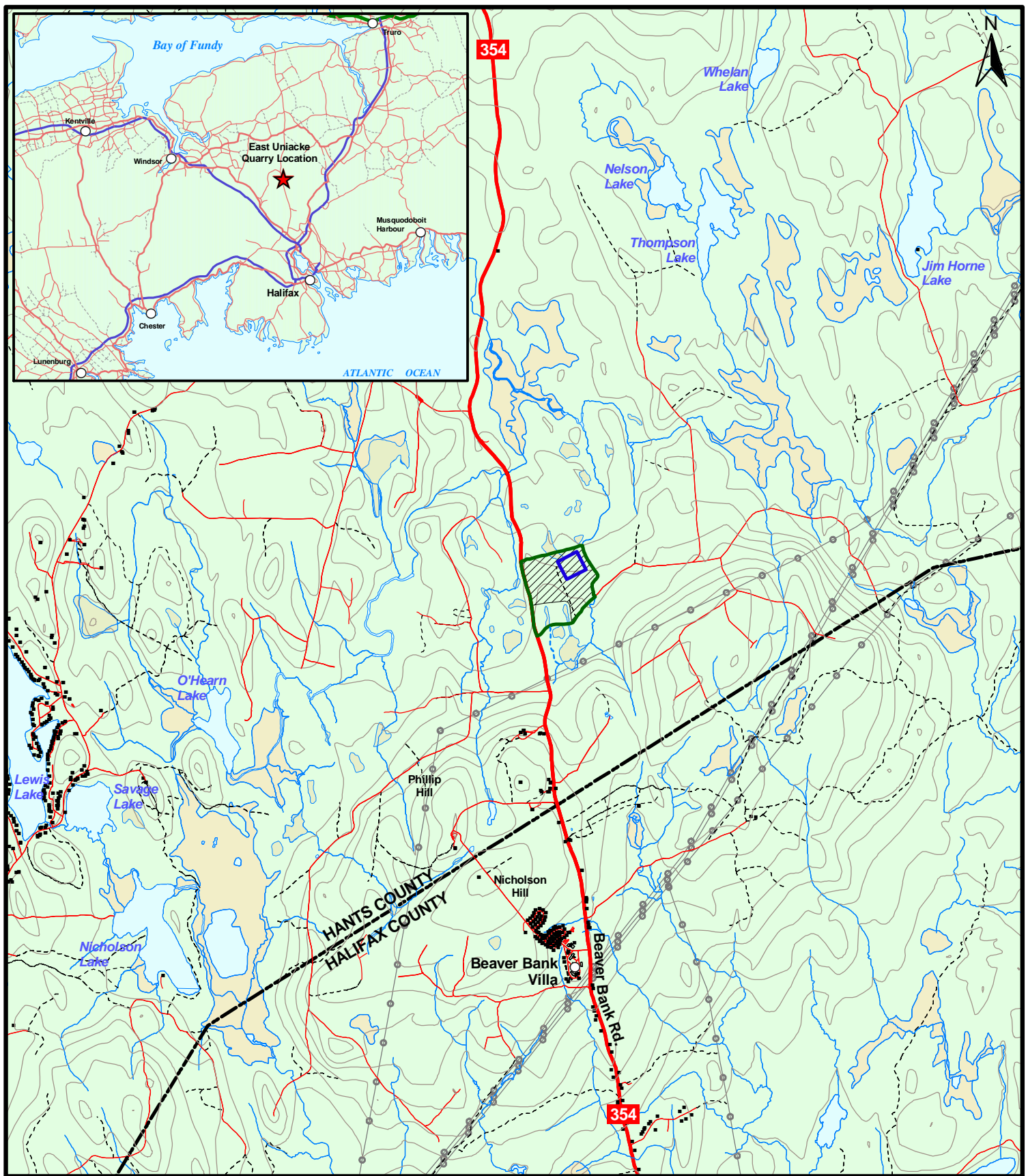
Figure 2.1

East Uniacke Quarry Location Map



Map Parameters
 Projection: UTM
 Zone: 20
 Datum: NAD 83
 Scale: 1:700,000
 Project Number: NSD17810
 Date: December, 2003





 Proposed Original Expansion Area

 Approximate Existing Quarry Area

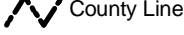
 Revised Expansion Area


 Major Road

 Minor Road

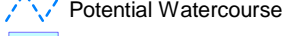
 Dirt Road

 Utility Line

 County Line

 Building/Structure

 Stream

 Potential Watercourse

 Lake

 Wetland

Figure 2.2
Proposed East Uniacke
Quarry Expansion Project



Map Parameters:
 Projection: UTM
 Datum: NAD83
 Zone : 20
 Date: January, 2004
 Project #: NSD17810



Residential development in the immediate vicinity of the project is low (*i.e.*, less than 20 residences within a 2 km radius of the quarry). The nearest communities are Beaver Bank, approximately 15 km to the south, and Rawdon, more than 20 km to the north and west.

The quarry is located near Phillip Hill and Nicholson Hill which stand approximately 600 m (1,968.5 feet) above sea level. A thin mantle of sandy glacial till covers the proposed quarry expansion area. Two bedrock formations, both of the Meguma Group underlie the overburden material across the proposed quarry expansion area (Figure 2.3). The Goldenville Formation, to the north, consists of meta-sandstones (*i.e.*, meta-quartzarenites, quartzites and meta-greywackes with minor slate and meta-siltstone). The Halifax Formation, to the south, consists of slates with minor meta-sandstones and meta-siltstones (Ryan 1997).

2.3 Physical Components

The existing quarry operation consists of a laydown area for the portable crushing equipment, various aggregate stockpiles, quarry floor and working face, settling pond, scale and scale house, and access road (Figure 2.4). There is no fuel storage, storage of dangerous goods, pipelines, port facilities or railways associated with the existing and facility, and none are proposed for the quarry expansion.

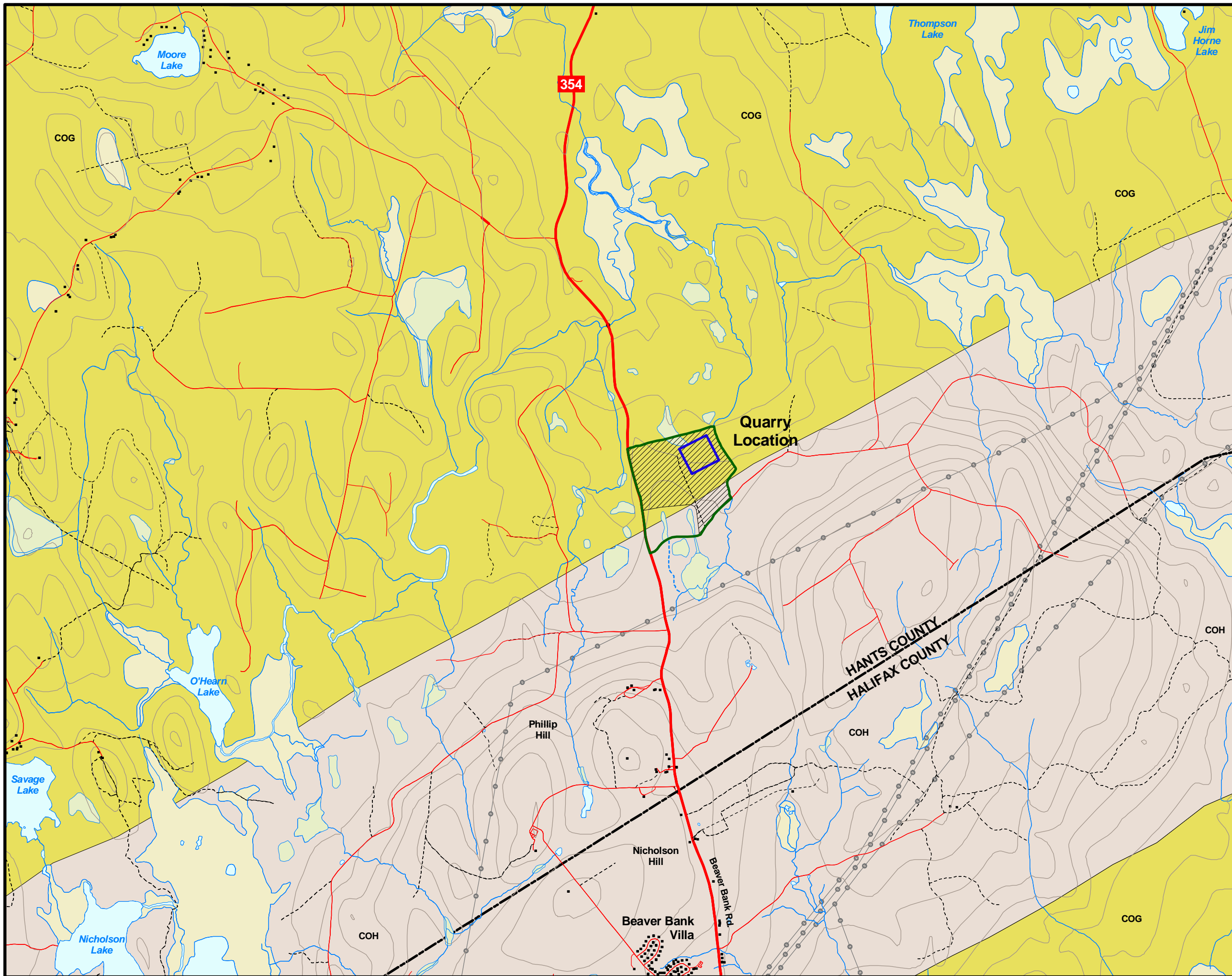
Topsoil and overburden that have been striped prior to drilling and blasting are stored on site (Figure 2.4) for subsequent use during site reclamation. The piles have been hydroseeded to reduce potential for erosion and sedimentation. This practice will continue throughout the development and operation of the proposed expansion area.

The laydown area is a located on the quarry floor. The surface area of the quarry floor is approximately 7,500 m² (1.8 acres). The crushing equipment is transported to the site as required (*i.e.*, after blasting). Presently, aggregate stockpiles are located in various locations within the quarry limits, as space allows. As the quarry expands and additional space on the quarry floor is created, a dedicated stockpile area will be established. Surface runoff and quarry drainage are collected on the quarry floor, which has the capacity to hold a significant quantity of water. Overflow from the quarry floor drains to a settling pond (approximately 9 m x 15 m x 2.5 m) located in the northwest corner of the existing operation. Overflow from the pond is directed to a wetland area.

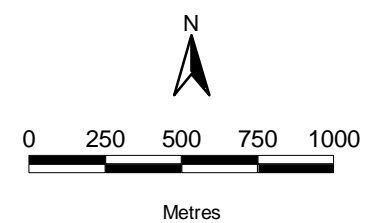
The nearest residence is approximately 1.1 km from the boundary of the revised proposed quarry expansion and approximately 1,500 m from the current working face. As shown on the Figure 2.2, there are no residences/structures within 1 km of the quarry, 5 within 1.5 km and 17 within 2 km. The general direction of quarry advancement will be south, stopping short of the contact with the Halifax Formation, and west. Rock will be sampled and tested regularly to confirm the suitability of the aggregate and confirm that the Halifax Formation slates, known widely to be acid producing, have/will not be encountered/disturbed. To date, quarry rock sampled and analyzed was not acid producing (refer to Section 5.6.1).

Figure 2.3

Bedrock Geology of the East Uniacke Quarry Expansion Project



- Bedrock Geology**
 - COG Goldenville Formation
greywacke, slate
 - COH Halifax Formation
Slate, siltstone, rare limestone at base
- East Uniacke Quarry**
 - Proposed Original Expansion Area
 - Approximate Existing Quarry Area
 - Revised Expansion Area
- Topography**
 - Building/Structure
 - Stream
 - Potential Watercourse
 - Lake
 - Wetland
- Roads**
 - Major Road
 - Minor Road
 - Dirt Road
 - Utility Line
 - County Line



Map Parameters:
Projection: UTM
Datum: NAD83
Zone : 20
Scale: 1:25,000
Date: April 28, 2004
Project #: NSD17810

Source Data: Ryan, R.J. 1997, NSDNR



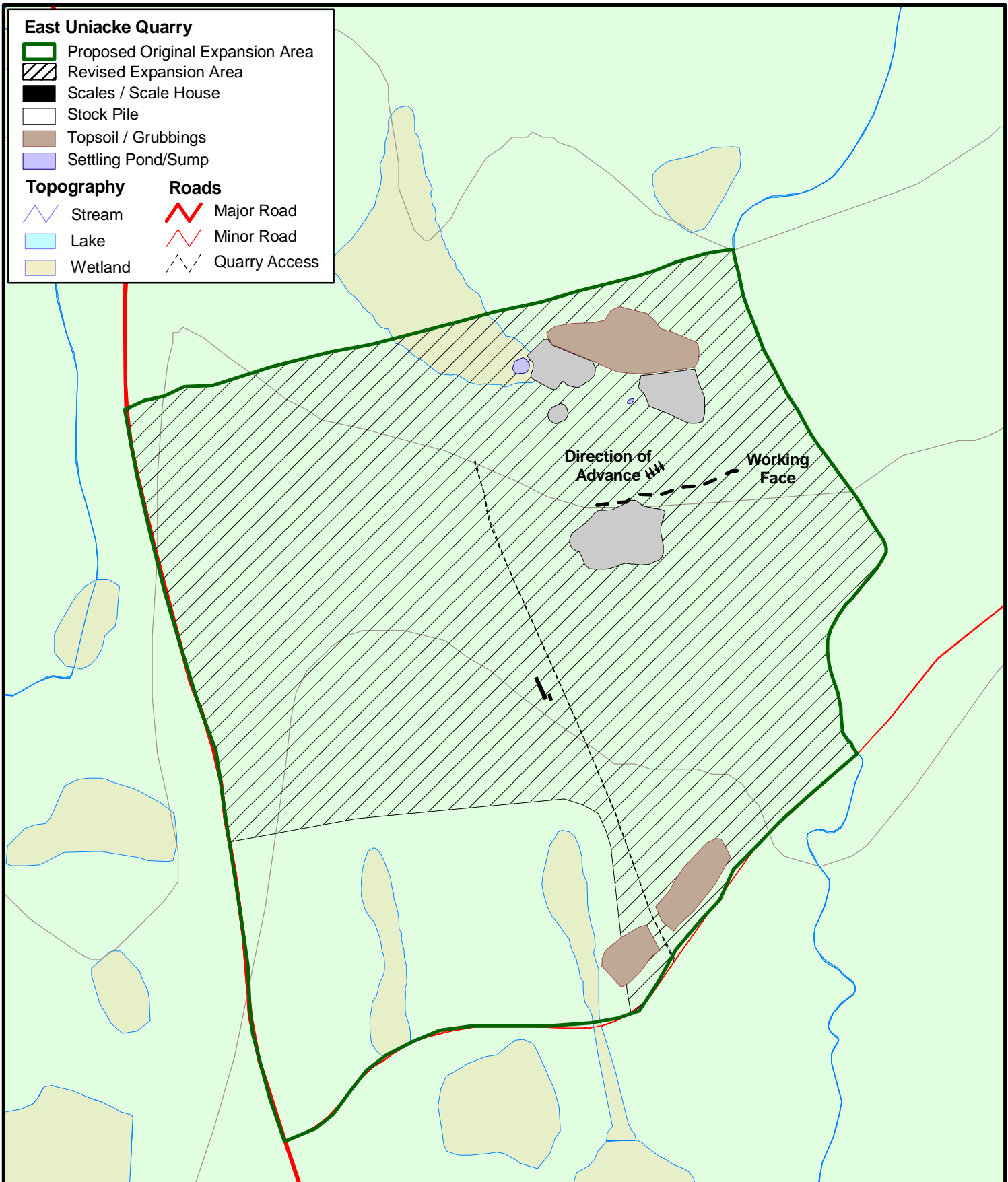
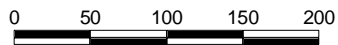


Figure 2.4

East Uniacke Quarry Components

Data Source:
NSGC



Meters

Map Parameters
 Projection: Modified Transverse Mercator
 Zone: 5
 Datum: ATS 77
 Scale: 1:5,000
 Project Number: NSD17814
 Date: January, 2004

x:\projects\novascotia\nsd17810

2.4 Site Preparation and Construction

Weeks Construction purchased approximately 100 acres of land from Kimberly Clarke in 2002. Timber had been harvested from the area three to five years prior to quarry development. Access to the existing quarry development is along existing roads, likely constructed during earlier harvesting activities. The quarry access road was upgraded in order to accommodate the truck traffic. Drainage ditches were installed along the access road and a drainage culvert installed to maintain drainage.

To minimize the potential for erosion and sedimentation, grubbing and removal of overburden was and will be conducted on an as needed basis, to accommodate drilling and blasting activities. Topsoil and grubbed and overburden materials are stockpiled on site and have been stabilized with hydroseed for subsequent use during rehabilitation.

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

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

2.5 Operation and Maintenance

2.5.1 Quarry Operation Activities

The proposed Project activities will be consistent with the current quarry operations approved by NSEL (Approval No. 2002-030481) and will be in accordance with the Pit and Quarry Guidelines (NSDEL 1999). These guidelines apply to all pit and quarry operations in the province of Nova Scotia and provide: separation distances for operations, including blasting; liquid effluent discharge level limits; suspended particulate matter limits; sound level limits; and requirements for a rehabilitation plan and security bond.

Aggregate production begins with drilling and blasting. It is anticipated that blasting will occur once or twice a year, and occasionally more frequently, between April and December. A qualified blasting company will conduct this work. The blasting sub-contractor is responsible for blast designs and methods in accordance with the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (2003). Blasting activity will be conducted in accordance with the Pit and Quarry Guidelines. A blast design has been prepared and submitted to NSDEL.

The blasted rock will be processed by portable crushing equipment transported to the quarry site for a period of approximately ten weeks, depending on the quantity of rock that must be processed. The various aggregate products will be stockpiled in designated areas within the quarry. Piles will be built in layers to minimize segregation and prevent contamination by mixing of different piles. Material is hauled and moved within the quarry with the loader. Other equipment will likely include an excavator and/or front-end loader.

Products will be transported from the quarry via tandem and tractor trailer trucks along the Beaver Bank Road (Route 354) and possibly along Trunk 14, Highway 101, and Route 1 (Sackville Road) to the local markets. The Beaver Bank Road is subject to spring weight restrictions, which reduces axle-loading requirements for several weeks each spring. Since the quarry opened in June 2003, the number of trucks per day hauling aggregates has been between 15 and 40. The volume of trucks per day depends on market demand. If a large supply contract were awarded to the quarry (*i.e.*, a large highway construction project), it is anticipated that the volume of trucks per day could increase to as much as 150 for short intervals (*i.e.*, up to four weeks) throughout the duration of the supply contract.

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

2.5.2 Effluents and Emissions

In accordance with best practices and standard NSEL requirements, runoff controls will be in place to ensure that effluent generated during operations is managed appropriately. Surface runoff at the quarry collects on the quarry floor. The quarry floor has the capacity to contain/retain a significant volume of runoff (*i.e.*, greater than 3,000 m³). Overflow from the quarry floor drains to a settling pond constructed in the northwest corner of the developed area (Figure 2.4). The majority of runoff collected evaporates or infiltrates. Overflow from the settling pond drains to the northwest toward a wetland, several hundred metres from a watercourse. The existing containment/retention capacity is more than adequate for the existing facility. The containment/collection capacity of the quarry floor will increase as the quarry expands. Additional ponds will be installed, as required, in accordance with NSEL's Erosion and Sedimentation Control Handbook for Construction Sites (NSDEL 1988) and the quarry's approval to operate, and in consultation with NSEL's engineers/inspectors.

A hydrological review of the East Uniacke Quarry and the proposed expansion was conducted by Hydro-Com Technologies Limited (refer to Appendix C). The assessment considered the original proposed expansion area. An addendum to the assessment, based on the revised expansion area, is also included in Appendix C. The report states that a reduction in evapotranspiration and a subsequent increase in the volume of surface runoff will occur as a result of the quarry development. It was determined that, based on the revised expansion area, the required capacity of the settling ponds should have a volume of no less than 7,200 m³ in order to accommodate site runoff and drainage from the quarry at the proposed ultimate level of development (*i.e.*, assuming the entire proposed expansion is developed).

The initial report concluded that the effects on the downstream flows (*i.e.*, an increase of approximately 0.3 % to the Herbert River) and on water quality (*i.e.*, sediment loading) associated with the proposed ultimate level of quarry development can be fully mitigated using the placement of free-draining material (*i.e.*, rock/gravel) and properly sized flow retention/siltation treatment areas. Following the use of these mitigative measures, the remaining residual effects on downstream flows and water quality are expected to be minor.

Overflow from the settling pond(s), if any, will be monitored and sampled according to the terms and conditions of the existing approval (and future updates) and the Pit and Quarry Guidelines to ensure total suspended solids levels do not exceed the approved final effluent discharge limits. In the unlikely event that overflow exceeds final effluent discharge limits as determined through monitoring, contingency measures may include pumping of sediment laden water to vegetated areas (away from watercourses) or through filter bags for additional filtration and/or use of additional filtration devices or structures.

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

Combustion emissions will be generated from the operation of vehicles and equipment. Given the scope of the planned operations, these emissions will be minimal and localized. Emissions will be reduced through proper equipment maintenance and inspection.

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

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

Sound monitoring will be conducted at the request of NSEL.

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

2.5.3 Hazardous Materials and Contingency Planning

There is no planned storage of hazardous materials or petroleum products at the quarry site. A qualified company will be contracted to conduct regular maintenance of equipment. Used oil and filters are removed from the site.

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

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

2.6 Decommissioning and Reclamation

Weeks Construction will undertake a progressive rehabilitation program at the quarry site. The rehabilitation process at the quarry began during initial site development with the preservation of topsoil for future revegetation of the quarry. As distinct areas within the quarry become inactive, the area will be graded to a stable slope, covered with topsoil, and seeded. At the end of the quarry operation (within six months of abandonment), rehabilitation will consist of: grading and contouring of all slopes and exposed rock faces in consideration of rock falls, slope stability, and safety; spreading existing stockpiled topsoil; and hydroseeding. The laydown area within the quarry, which is covered with quarried materials, will be graded, as required, and levelled to allow for future commercial, industrial, recreational, or residential land use. A reclamation plan is on file with NSEL.

3.0 SCOPE

3.1 Scope of the Undertaking

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

The quarry opened in June 2003 and produces a variety of aggregate types. The working face is approximately 18 m (60 ft) in height and does not go below the natural water table (*i.e.*, the quarry floor is not under water and has not flooded since the quarry opened). Weeks Construction will continue to excavate from the working face and will not excavate deeper into the quarry floor.

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

Expansion of the quarry will be initiated within two years following approval from NSEL, as the existing developed area becomes depleted of aggregates. The proposed expansion area will cover a total of approximately 32.4 ha. Setback distances described in the Pit and Quarry Guidelines will be adhered to. The proponent previously considered a larger area for development, as illustrated on Figure 2.2; however, in the interest of protecting wetland habitat in the vicinity of the proposed expansion area, the expansion area was revised to exclude the wetland habitat south of the quarry.

The proposed operating schedule will be based on 12 hrs/day, 5 days/week (and weekends as required), year round, weather permitting. Blasting and crushing of aggregate is expected to occur once or twice a year and occasionally more frequently, between April and December, when demand for the product is required. The current and anticipated production rate is approximately 200,000 tonnes per year, and potentially as much as 500,000 tonnes per year, if a large supply contract were awarded. Transport of aggregates from the quarry is via tandem and tractor trailer trucks to local markets along the Beaver Bank Road (Route 354) to Trunk 14, Highway 101, and Route 1. The number of trucks leaving the quarry daily is between 15 and 40. This could increase to as much as 150 trucks per day if a large supply contract were awarded to the proponent and quarry (*i.e.*, a highway construction project).

Weeks Construction will undertake progressive rehabilitation activities at the quarry. Refer to Section 2.6 for additional information related to decommissioning and abandonment activities.

3.1.1 Purpose and Need for the Undertaking

The purpose for the Project is to allow Weeks Construction to expand the existing quarry footprint and continue operations at their quarry at East Uniacke. The quarry is currently operating under Approval No. 2002-030481, issued by NSEL on January 15, 2003. This permit is for a quarry operation of up to 4 ha. A copy of the NSEL Approval is included in Appendix B. The areas regulated by this approval are near depletion.

The aggregates produced at the quarry are an important requirement in municipal and residential construction projects in the region and are of an appropriate quality for highway construction and maintenance projects. Weeks Construction anticipates the source material in the proposed expansion area to be of similar quality to the material currently extracted at the existing quarry, primarily greywacke and quartzite.

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

3.1.2 Project Alternatives

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

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

3.2 Scope of the Environmental Assessment

The proposed project involves expansion of a quarry footprint beyond 4 ha. Therefore, the project must be registered for Environmental Assessment under the Environmental Assessment Regulations of the Nova Scotia *Environment Act* as a Class I Undertaking. This report fulfils the primary requirements for project registration under this legislation.

Other relevant provincial regulations and guidelines include the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996) and the Nova Scotia Pit and Quarry Guidelines (NSDEL 1996). Relevant federal legislation and policies includes the *Species at Risk Act*, *Fisheries Act*, *Migratory Birds Convention Act*, the Federal Policy on Wetland Conservation, A Wildlife Policy for Canada, the Federal Water Policy, the Toxic Substances Management Policy, and the federal strategy for pollution prevention.

The scope of the environmental assessment in relation to the proposed Project has been determined by the Proponent and their consultant and is based upon the proposed Project elements and activities, the professional judgement and expert knowledge of the study team, consultations with the public and regulatory authorities on this and similar projects, and the results of field studies conducted in support of this environmental assessment. The *Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia* (NSDEL 2002), was also used to determine/focus the scope of the assessment. The proponent and their consultant met with provincial regulatory agencies (NSEL and NSDNR) on November 18, 2003 to discuss the location of proposed expansion, and elements and activities associated with the proposed Project, in an effort to further focus the scope of the assessment. Landowners adjacent to the quarry were also contacted (see Section 4.0) for the purpose of issues identification.

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

- surface water resources and fish and fish habitat;
- groundwater resources;
- rare and sensitive flora;
- wildlife (including herpetiles and breeding birds)
- wetlands;
- archaeological and heritage resources;
- air quality; and
- socio-economic environment.

4.0 PUBLIC INVOLVEMENT

4.1 Methods of Involvement

In December 2003, a Project Information Bulletin (Appendix E) was distributed to landowners and some local businesses within approximately 2 km of the quarry. A total of seventeen bulletins were delivered. The purpose of the bulletin was to advise local residents and businesses immediately adjacent to the quarry (*i.e.*, those who are potentially most affected) of the proposed expansion and provide them with and opportunity to comment on the proposed undertaking. This consultation effort assists with issues scoping and development of appropriate mitigation for potential adverse effects.

4.2 Stakeholder Comments and Steps Taken to Address Issues

Table 4.1 summarizes the comments received and issues raised as a result of a meeting held with regulatory agencies (November 18, 2003) and the information bulletin that was distributed. Also included in Table 4.1 is Weeks Construction's response/proposed resolution to the issues raised.

Table 4.1 Summary of Stakeholder Comments and Concerns		
Raised by:	Issue/Concern	Response/Proposed Resolution
NSDEL	Potential environmental effects on wetlands within and adjacent to the quarry.	The proposed quarry expansion area was revised to exclude wetland habitat south of the quarry. Potential environmental effects on wetlands are addressed in Section 5.4.
NSDEL	Potential impacts on surface water and groundwater flows as a result of quarry development and expansion.	The proponent will install monitoring wells (refer to Section 5.6) at a number of locations within the quarry expansion area and will monitor groundwater levels on a regular basis. Potential environmental effects on surface water and groundwater flows are addressed in Sections 5.2 and 5.6 respectively.
Local Resident	How will the potential additional truck traffic impact the Beaver Bank Road and who is responsible for maintaining the road?	The Beaver Bank Road is owned and maintained by the Nova Scotia Department of Transportation and Public Works. The Halifax Regional Municipality (HRM) has some responsibility for maintenance (<i>i.e.</i> , snow removal) for the portion of the road through HRM. Transportation related issues are addressed further in Section 5.9.
Local Resident	Safety concerns related to the truck traffic along the Beaver Bank Road.	Transportation and safety related issues are addressed further in Section 5.9.

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

5.1 Methodology

Field studies were conducted by Jacques Whitford between June 30 and September 15, 2003 to investigate and establish the existing conditions and to determine appropriate mitigation, if necessary, to minimize environmental effects from the proposed expansion Project. These surveys consisted of: vegetation survey; breeding bird survey; mammal survey; herpetile survey; and fish and fish habitat survey. These surveys were undertaken by qualified terrestrial and fresh water ecologists employed by Jacques Whitford. An assessment of potential archaeological and heritage resources was undertaken by a qualified archaeologist. A reconnaissance survey of road conditions was also conducted by a qualified transportation engineer. Additional information, in support of the field studies and the assessment, was gathered through a review of: air photos; site mapping; and other information sources, such as the Nova Scotia Museum, Statistics Canada, the Nova Scotia Department of Transportation and Public Works, and the Nova Scotia Department of Natural Resources.

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

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

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

5.2 Fish and Fish Habitat

5.2.1 Description of Existing Environment

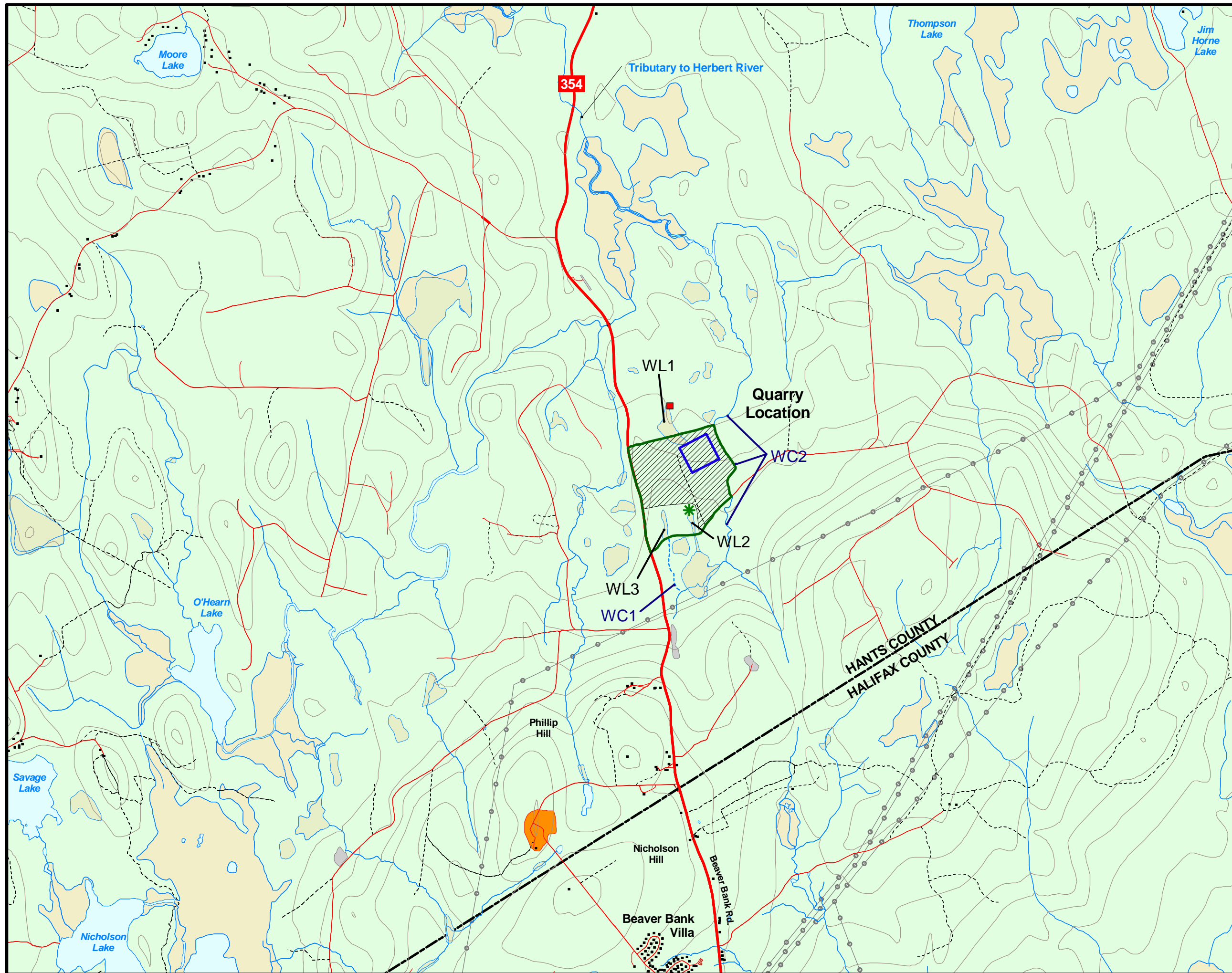
During a review of 1:50,000 scale NTS mapping, the site location map provided by Weeks Construction Ltd., and aerial photographs (1994), two potential watercourses were identified immediately adjacent to the proposed quarry expansion area (Figures 5.1): one south of the private access road and another along the eastern boundary of the proposed expansion area. To confirm the existence of these watercourses and evaluate the potential for fish habitat, the (original) proposed quarry expansion area and potential watercourses were surveyed and assessed by a qualified aquatic biologist on August 25, 2003.

The potential watercourse (WC1 on Figure 5.1) identified on the mapping located south of the expansion area, which appears, to originate at the private access road (south end of the small wetland), did not exist. There was no evidence of a defined stream channel observed. A small culvert was installed at the road crossing, likely at the time the private road was constructed. Drainage from the small wetland, if any, likely flows through the culvert and along the roadside ditch to Route 354. There was no drainage at the time of the survey.

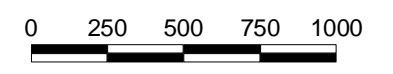
The potential watercourse (WC2 on Figure 5.1) identified and located along the east boundary of the expansion area was confirmed during the field study. The headwaters of this watercourse are located south of the power line crossing, east of Route 354. There are two main channels that make up the headwaters. One flows through a forest and the other is water captured in a wetland area located adjacent to the power lines (see Figure 5.1). The width of each of the channels is approximately 30 cm and water depth rarely exceeds 15 cm. Canopy cover ranges from 0% in the wetland to 100% in the forest. Once the two channels converge, the watercourse becomes wider and deeper, in some areas. These wider and deeper areas were mostly blocked by floating debris or beaver activities. As a result, elongated pools of water in open areas, that can reach 150 cm wide and 120 cm deep, have developed. Sediment in the pools (upstream of the quarry) had orange floc that would suggest elevated aluminium and/or iron levels in the water/sediment. Between those pools there are sections of the watercourse that were dry at the time of the survey. This was also likely due to the presence of the debris. The watercourse crosses the private access road through three metal culverts. At the time of the survey, debris was blocking the upstream portion of these culverts (south side of private access road). Evidence at the site indicated that the watercourse had flowed over the road in a recent major rain event.

Although not confirmed, it is reasonable to assume that the orange floc observed in the sediments in the pools may be the result of acidic runoff from the access road. It was noted during a review of the aerial photography and discussions with NSDNR staff that the access roads constructed to support forestry operations in the area over the past 15 – 20 years were constructed with material extracted from a quarry developed within the Halifax Formation which, as previously indicated, are widely known to be acid producing.

Figure 5.1
Habitat Survey Results
for East Uniacke Quarry
Expansion Project



- East Uniacke Quarry**
- Proposed Original Expansion Area
 - Approximate Existing Quarry Area
 - Revised Expansion Area
- Topography**
- Building/Structure
 - Watercourse (WC)
 - Potential Watercourse
 - Lake
 - Wetland (WL)
- Roads**
- Major Road
 - Minor Road
 - Dirt Road
 - Utility Line
 - County Line
- Areas of Interest**
- * Boreal Aster
 - Four-toed Salamander
 - Air Strip
 - Pit
 - Sewage Treatment Facility



Metres

Data Source:
NSGC

Map Parameters:
 Projection: UTM
 Datum: NAD83
 Zone : 20
 Scale: 1:25,000
 Date: November 2003
 Project #: NSD17810



The downstream end of the culverts (north side of the private access road) was free of debris. Only two of the three culverts conveyed water at the time of the survey. It is unlikely that these culverts offer any passage to fish because of the obstruction and lack of water.

The portion of the watercourse flowing alongside the eastern boundary of the quarry contains numerous physical features that would prevent or impede fish migration. The watercourse has a high gradient and the stream flows over rock ledges and boulders. In some instances, water is observed cascading at least 150 cm on a rock face. However, sections of the watercourse between the boulders and rock ledges consist of deep pools of water. Brown trout juveniles were observed a pool located upstream of the location where water was cascading.

Downstream of the location where water was cascading, no other impediments to fish passage were observed. In this portion, stream width ranges from 50 to 150 cm and water depth ranges from 15 to 60 cm. Canopy cover remains consistent at 85%. Brown trout juveniles were observed in pools.

In the opinion of the aquatic biologist that conducted the habitat assessment, the section of the stream flowing alongside the eastern boundary of the quarry satisfies the requirements of the Department of Fisheries and Oceans and constitutes fish habitat.

Timber harvesting activities (within the last 3-5 years) maintained a vegetated buffer zone along the watercourse, approximately 60 m wide. The existing quarry operation has maintained this buffer zone.

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

Weeks Construction will maintain the approximate 60 m treed buffer between the watercourse and quarry activities. This will minimize the potential for environmental effects of the quarry operation on fish and fish habitat.

Clearing, grubbing, and topsoil stripping activities can increase the potential for sediment erosion and deposition downgradient, particularly during periods of heavy rainfall or snow melt. These activities will also result in a reduction of evapotranspiration and a corresponding increase in surface runoff, which in turn increases potential for sediment erosion and deposition. Placement of free-draining material (*i.e.*, blasted rock) over the disturbed areas and the use of properly sized flow retention structures is expected to mitigate erosion and sedimentation effects. As the quarry develops, exposed soil capable of producing sediment laden-runoff will be stabilized with blasted rock and stockpiles of topsoil and overburden will be stabilized with hydroseed for future use in during rehabilitation. Additional retention capacity on the quarry floor will be created as the quarry develops and additional settling pond(s) will be installed, as needed (see Section 2.5.2). Surface runoff will be directed to the settling pond(s). Overflow from the final settling pond will be monitored and sampled in accordance with the terms and conditions of the existing Approval (and future updates) and the Pit and Quarry

Guidelines to ensure suspended solids levels do not exceed the approved final effluent discharge limits. As previously noted, the settling pond drains to the northwest, several hundred metres from any watercourse.

Blasting in and adjacent to watercourses can cause direct deleterious effects on fish health, death or damage to fish eggs and larvae, excessive dust deposited in streams, disturbance to the habitat, and introduction of acidic drainage if the bedrock contains sulphide mineralization. The 60 m buffer zone that will be maintained between quarry activities and the watercourse will minimize the potential physical effects of blasting. Blasting shall be conducted in accordance with the Pit and Quarry Guidelines and the Guidelines for use of Explosives in Canadian Fisheries Waters (Wright and Hopky 1998).

In addition, blasting may result in chemical impacts on fish (*e.g.*, release of ammonia). Although ammonia is a nutrient required for life, ammonia is toxic in its ionic form, which occurs in high pH environments. Excess ammonia may accumulate in fish and cause alteration of metabolism or increases in body pH. Fish may suffer a loss of equilibrium, hyper-excitability, increased respiratory activity and oxygen uptake, and increased heart rate. At extreme ammonia levels, fish may experience convulsions, coma, and death. Experiments have shown that the lethal concentration for a variety of fish species ranges from 0.2 to 2.0 mg/l. At present, Environment Canada has not identified a buffer zone between an area in which ammonia-based explosive are used and a freshwater system (Danie Dube, pers. comm. May 2004). Most of the studies to date have looked at the effects of ammonia discharge from wastewater, fertilizer, and pulp and paper activities directly into a freshwater system. Due to the significant distance between the settling pond discharge and the watercourse (*i.e.*, several hundred metres), the relative infrequent use of explosives at the quarry (*i.e.*, two to three times per year, rarely more), and the nature of ammonia uptake in neutral pH environments, chemical impacts on the fish as a result of blasting are not likely to occur.

Based on the results of the fish and fish habitat assessment and the 60 m buffer zone that will be maintained between quarry activities and the watercourse, there is limited potential for quarry activities to interact with fish and fish habitat. With use of properly sized flow retention/siltation treatment measures and compliance with the existing Approval and the Pit and Quarry Guidelines, effects on fish habitat will be negligible.

In summary, significant Project-related effects on fish and fish habitat are not likely to occur.

5.3 Rare and Sensitive Flora

5.3.1 Description of the Existing Environment

A vascular plant inventory was compiled for the site. The survey was focussed on natural habitats located in the area where quarry expansion is expected to occur. The study area is composed of eight distinct habitat types. These include mature softwood forest, immature mixedwood forest, recent clear-cut, mixedwood treed swamp, poor fen, coniferous treed bog, bog, treed bog, and disturbed areas.

Mature softwood forest is found along the western edge of the property. A strip of mature forest was left along the edge of Highway 354 when the property was harvested. The age of this stand was estimated to be between 50 and 70 years of age depending on location. The dominant species are red spruce, balsam fir, red maple and white birch.

Immature mixedwood forest is found at the southeastern corner of the property. This stand is composed of a mixture of wire birch, red spruce, red maple, balsam fir, and white birch. The stand understory is well developed and is dominated by witherod and lambkill. The stand is estimated to be 20 years old. This plant community is a transition zone between forest and barrens habitat.

Barrens are found at two locations on the property, both near the southern boundary. These barrens are characterized by a an open, patchy tree canopy composed mainly of balsam fir and tamarack and a dense shrub understory composed of a mixture of lambkill, witherod, huckleberry, late lowbush blueberry, Canada blueberry, and rhodora. A few small open areas dominated by reindeer lichen are found in the barrens habitat located in the southeastern portion of the property.

Recent clear-cuts cover most of the property. These clear-cuts are estimated to be about five years old. Regeneration is good on most of the clear-cut areas and consists mainly of balsam fir, red spruce, and red maple. The presence of dead red maple and white birch coppices as well as the general low abundance of wild red raspberry suggests that these clear-cuts were treated with herbicide to reduce the abundance of intolerant hardwoods and low shrubs.

Three wetlands are found on the within the originally proposed quarry expansion area. The wetland located along the northern boundary of the property supports a two wetland habitats including poor fen and mixedwood treed swamp. The mixedwood treed swamp is characterized by an open tree canopy composed mainly of red maple and black spruce. The moderately dense shrub understory is dominated by stunted red maple, black spruce and tamarack as well as various shrub species, the most abundant of which are trailing blackberry, sweet gale, leather-leaf and black alder. Poor fen habitat is found near the center of the wetland and consists of an open plant community dominated by sphagnum moss, sedge (*Carex exilis*), bog goldenrod, and cotton-grass (*Eriophorum virginicum*). The two wetlands located along the southern edge of the originally proposed quarry expansion area are bogs. The bog located near

the southwestern corner is a small treed bog which is characterized by an open tree canopy composed of stunted black spruce and tamarack and a well developed shrub understory composed mainly of rhodora and lambkill. The second bog is located adjacent to the existing quarry access road. The portion of this bog located with the originally proposed expansion area consists of a sphagnum moss carpet which is punctuated by a variety of herbaceous vascular plants including cotton-grass, bog goldenrod, spike rush (*Eleocharis tenuis*), and beak-rush (*Rhynchospora alba*).

Disturbed areas are found along the access road and the quarry site. These areas are characterized by a sparse ground cover composed mainly of introduced weeds and forage grasses. Some species present in this habitat type include field horsetail (*Equisetum arvense*), evening primrose (*Oenothera biennis*), brown top (*Agrostis capillaris*), and tickle-grass (*Agrostis hyemalis*).

Rare Vascular Plants

Prior to conducting vascular plant surveys, the Atlas of Rare Vascular Plants in Nova Scotia (Pronych and Wilson 1993) was reviewed to determine if any rare vascular plant species had been recorded in the vicinity of the study area. Data was compiled for the 10 km X 10 km atlas square within which the study area is situated as well as all of the atlas squares adjacent to that atlas square. Table 5.1 lists the 12 rare species which have been recorded within the 900 km² encompassed by the nine atlas squares surrounding the study area.

Binomial	Flowering Period/ Ease of Identification	Preferred Habitat	NSDNR Status
<i>Bartonia virginica</i> (Bartonia)	July to September. Readily identifiable by vegetative characters.	Lakeshores, sandy and peaty bogs, occasionally on barrens.	Green
<i>Betula michauxii</i> (Newfoundland Dwarf Birch)	June and July. Easily identified by vegetative characteristics.	Peat and sphagnum bogs.	Undetermined
<i>Crataegus mollis</i> (Hawthorn)	June. Fruit required for identification.	Hedgerows and occasionally waste places.	Undetermined
<i>Dirca palustris</i> (Leatherwood)	Late May. Readily identified by vegetative characteristics.	Rich deciduous or mixed woods.	Red
<i>Eleocharis nitida</i> (Slender Spikerush)	Flowers as early as mid-June. Fruit required for identification. Fruit present in summer and early autumn.	Moist soil often over basalt.	Undetermined
<i>Euthamia tenuifolia</i> (Goldenrod)	August and September. Inflorescence required for identification.	Dry sandy soils and beaches.	Yellow
<i>Fraxinus pennsylvanica</i> (Black Ash)	May and June. Fruit helpful in identification but can be readily identified by foliage, and bark characteristics.	Low ground, damp woods and swamps.	Yellow
<i>Lilium canadense</i> (Canada Lily)	July. Easily identified by fruit and vegetative characteristics.	Meadows and stream banks (rich sites)	Yellow

Binomial	Flowering Period/ Ease of Identification	Preferred Habitat	NSDNR Status
<i>Polygonum pennsylvanicum</i> var. <i>pennsylvanicum</i> (Pinkweed)	July through September. Flowers required for identification.	Roadside ditches, dyked marshes, grain fields.	Green
<i>Ranunculus flammula</i> (Buttercup)	July to September. Flowers or fruit helpful in identification.	Semi-aquatic, in bogs and cold streams.	Yellow
<i>Salix candida</i> (Hoary Willow)	April to June. Readily identified by foliage and twigs.	Calcareous bogs and thickets.	Red
<i>Salix sericea</i> (Silky Willow)	Late March to early May. Can be identified from vegetative characteristics but is most readily identified when fruit and flowers are present.	Low thickets and stream banks.	Yellow

Suitable habitat is present in the study area for six of the twelve species including bartonia, Newfoundland dwarf birch, black ash, pinkweed, buttercup, and silky willow. The soils of the property are unsuitable for leatherwood, Canada lily, slender spikerush, goldenrod, and hoary willow; suitable habitat is not present for hawthorn. All of the rare species recorded in the general vicinity of the study area with the exception of silky willow can be readily identified in late June and mid-September, when the rare plant surveys were conducted. Silky willow is most easily identified between late March and early May when this species flowers and sets seed. It was not possible to conduct a survey at this time. However, after the surveys were conducted it was possible to determine the absence of this species by reviewing the records of willows found on the site. Four willow species were recorded in the study area including *Salix bebbiana*, *S. discolor*, *S. humilis*, and *S. pyrifolia*. None of these species is similar in appearance to silky willow and no unidentified willow species were noted during the surveys suggesting that silky willow was not present. Given these results, it is our opinion that the June 30 and September 15 vegetation surveys conducted would be sufficient to allow the detection of rare vascular plant species expected in the general area.

Vascular plant surveys were conducted on the property on June 30 and September 15, 2003. The surveys were focussed on natural habitats located in the area where quarry expansion is expected to occur and in areas where no future disturbance is expected. All species of vascular plant encountered during the surveys were identified and their population status in Nova Scotia were determined through a review of the General Status of Species in Nova Scotia (NSDNR 2003a), the list of species contained in the Nova Scotia *Endangered Species Act* (NSDNR 2003b), and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2003). A list of the vascular plant species found on the site is presented in Appendix E. One of the species encountered during the field survey, boreal aster (*Aster borealis*) is listed as status undetermined (NSDNR 2003a) indicating that little is known regarding its distribution and abundance in Nova Scotia. There are 14 recorded locations for this species in Nova Scotia (Roland and Zinck 1998) and JWEL has identified this species at another location near Shelburne in addition to the population found in the study area for a total of 16 populations in the province.

Further discoveries of this species could result in it being designated as a secure species (M. Zinck pers. comm. November 2003). The boreal aster was found in the bog located near the entrance to the quarry (Figure 5.1). Unfortunately, the status of this species was not determined until after survey was completed so the number of plants present in the bog was not counted; however, it is estimated that less than 50 plants were present. The larger portion of the bog is located outside of the originally proposed expansion area. It is not known if the distribution of boreal aster extends into this area. None of the other vascular plant species recorded during the surveys are considered to be uncommon or rare in Nova Scotia (NSDNR 2003a; NSDNR 2003b) or in Canada (COSEWIC 2003).

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

To mitigate potential environmental effects on wetland habitat and associated sensitive flora, Weeks Construction revised the expansion area such that the two bogs are now located outside of the revised proposed expansion area. The revised boundary is 30 m from the boundary of the bogs. As such, the population of boreal aster found will not be directly eliminated. The hydrological assessment of the revised expansion area (Appendix C) concluded that no environmental hydrological effects on the two bogs are expected.

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

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

5.4 Wetlands

5.4.1 Description of Existing Conditions

Three wetlands were found in the originally proposed quarry expansion area. These include two mixedwood treed basin swamp/basin bog wetland complexes (Wetlands 1 and 2) and a treed bog (Wetland 3).

Wetland 1 is located at the northern end of the property (Figure 5.1). It is approximately 2.18 ha in size and is situated immediately adjacent to the existing quarry. This wetland straddles the property boundary and with less than 30 % of the wetland located inside the property. The wetland is relatively free of disturbance. Overflow from the quarry settling pond drains into the wetland but there was no evidence that this drainage was adversely affecting the wetland. Wetland plant communities located

near the settling pond were healthy and of similar species composition to plant communities elsewhere in the wetland. There was no evidence of tree die back associated with alteration of wetland hydrology. Black spruce, a species sensitive to water level alterations, was present near the outfall of the settling pond and was in good health suggesting that current inputs of drainage water from the existing quarry are not adversely affecting plant communities in the wetland. There was evidence to indicate that there have probably been water level fluctuations in the wetland in the past 10 to 20 years. Heavily rotted standing dead trees were common and trailing blackberry was abundant. These features are often found in wetlands that have been subjected to water level fluctuations such as beaver flooding. There is some minor disturbance associated with quarrying operations. Fly rock from the quarry has landed in the wetland producing a number of small pools. These pools are only found within approximately 50 m of the edge of the existing quarry boundaries.

The wetland consists of two wetland types: mixedwood treed basin swamp and basin bog. Mixedwood treed basin swamp is found around the margin of the wetland where peat depths are relatively shallow. An open tree canopy composed mainly of a mixture of red maple, black spruce and tamarack characterizes this wetland type. Shrub cover is well developed and consists largely of trailing blackberry (*Rubus hispidus*), sweet gale (*Myrica gale*), leather-leaf (*Chamaedaphne calyculata*), swamp rose (*Rosa nitida*), and winterberry (*Ilex verticillata*). The ground vegetation layer is dominated by sphagnum moss along with less amounts of royal fern (*Osmunda regalis*), bog goldenrod (*Solidago uliginosa*), tawny cotton grass (*Eriophorum virginicum*), and sedge (*Carex exilis*).

Basin bog is located in the interior of the wetland. This habitat is characterized by a sparse shrub layer composed largely of sweet gale, speckled alder (*Alnus incana*) and stunted red maple (*Acer rubrum*) and tamarack (*Larix laricina*). The ground vegetation layer is well developed and consists of a carpet of sphagnum moss punctuated by patches of sedge (*Carex exilis*), bog goldenrod and tawny cottongrass. Ericaceous shrubs are scarce and graminoid species are abundant suggesting that this bog is more fertile than most bogs. This may indicate that this portion of the wetland receives some groundwater inputs. As such, it is transitional between bogs which are nutrient poor and fens which relatively fertile.

A list of vascular plants found in this wetland is presented in Appendix G. Birds observed in the wetland included White-throated Sparrow, Blue-headed Vireo, Black-capped Chickadee, Dark-eyed Junco, Swamp Sparrow, American Goldfinch and Common Yellowthroat. Tracks and feces of varying hare and white-tailed deer were observed in the wetland suggesting that these mammals use the wetland or travel through it. Herpetile species noted from the wetland included green frog, pickerel frog, northern spring peeper, four-toed salamander, eastern smooth green snake, and maritime garter snake. One relatively rare amphibian species, the four-toed salamander, was found in the wetland. A female four-toed salamander and her clutch of eggs were found in a small pool at the northern tip of the wetland (Figure 5.1) outside of the property. Four-toed salamanders nest in sphagnum moss hummocks at the edges of pools or sluggish streams. Suitable four-toed salamander nesting habitat was found only at the northern tip of the wetland where several small pools were found. Four-toed salamander is listed by NSDNR as a yellow species indicating that it is sensitive to anthropogenic activities. Local

herpetologists believe that this species is more widespread and abundant than previously thought. A recent study (JWEL 1999) corroborates this belief. The study found four-toed salamander nest sites in 25 of 46 locations tested with a total of 79 nests found in the 25 sites where the species was present. Nests were found in a variety of natural and anthropogenic sites including ditches and wheel ruts. JWEL has encountered four-toed salamanders at a wide variety of locations in Nova Scotia. Given these findings, the presence of a four-toed salamander nest in the wetland is not considered to be a significant environmental constraint. A wetland evaluation for Wetland 1 is presented in Appendix F.

Wetland 2 is approximately 5.3 ha in total of which only 0.5 ha is within the originally proposed expansion area (Figure 5.1). This wetland consists of mixedwood treed basin swamp and basin bog. The wetland has been bisected by a woods road that forms the property boundary. A small lobe of bog habitat is found to the north of the road while a much larger area of mixedwood treed swamp and bog wetland is located on the south side of the road. The road passes through a narrow neck of wetland habitat approximately 5 m wide. The bog habitat located within the originally proposed expansion area has sparse tree and shrub cover. Tree cover consists of stunted black spruce (*Picea mariana*), tamarack and red maple. Shrub cover is composed mainly of a mixture of trailing blackberry and speckled alder. The high abundance of trailing blackberry suggests that water level fluctuations have occurred in this wetland possibly as a result of past road construction. The ground vegetation layer is dominated by a mixture of sphagnum moss, tawny cotton grass, bog goldenrod, white beakrush (*Rhynchospora alba*), spike rush (*Eleocharis tenuis*), and rush (*Juncus canadensis* and *J. pelocarpus*).

The species composition of the basin bog habitat on the southern side of the road is different from that found on the north side of the road. The ground vegetation layer is rich in grasses and sedges in addition to sphagnum moss. The most abundant ground vegetation species are sphagnum moss, Pickering's blue-joint (*Calamagrostis pickeringii*), sedge (*Carex exilis* and *C. stricta*) and bog goldenrod. Shrub and tree covers are sparse. The most abundant shrub species are bog laurel (*Kalmia polifolia*), Labrador tea (*Ledum groenlandicum*), leather-leaf, witherod (*Viburnum nudum*), and common juniper (*Juniperus communis*). Tree cover consists of a few stunted tamarack, black spruce and red maple.

The mixedwood treed basin swamp habitat is found mainly in the narrow neck of the wetland. Tree cover is open and patchy, consisting of tamarack, wire birch (*Betula populifolia*), red maple and black spruce. Shrub cover is dense and consists mainly of leather-leaf, trailing blackberry, rhodora (*Rhododendron canadense*), winterberry, witherod, and meadowsweet (*Spiraea alba*). The ground vegetation layer consists mainly of sphagnum moss and sedge (*Carex stricta*).

Appendix G lists the vascular plant species present in this wetland. One of the species encountered in the wetland, boreal aster, is uncommon in Nova Scotia. The population status and distribution of this species have been discussed in Section 5.3.1.

Bird species associated with the wetland include Northern Flicker, Yellow-bellied Flycatcher, Palm Warbler, Common Yellowthroat White-throated Sparrow, and Dark-eyed Junco. White-tailed deer and varying hare were the only mammal species noted in the wetland. Herpetile species found in the

wetland included northern spring peeper, wood frog, green frog, eastern smooth green snake and northern redbelly snake. None of the animals associated with the wetland is considered to be rare or sensitive to anthropogenic activities (COSEWIC 2003; NSDNR 2003a; NSDNR 2003b).

Wetland 3 is located near the southwestern corner of the originally proposed expansion area. It is a coniferous treed basin bog which is 0.65 ha in size. The southern tip of this wetland has been disturbed as a result of construction of a logging road. Tree cover in this wetland is composed largely of black spruce and tamarack along with a few red maple. The shrub layer is moderately well developed and is dominated by rhodora, lambkill (*Kalmia angustifolia*), false holly (*Nemopanthus mucronata*), and meadowsweet. The most abundant species of the ground vegetation layer are sphagnum moss, hair-cap moss (*Polytrichum* sp.), tawny cotton grass, and sedge (*Carex paupercula*).

Appendix G lists the vascular plant species found in the wetland. Common Yellowthroat and Mourning Dove were the only bird species observed in the wetland and no mammal species were detected in the wetland during the field surveys. Green frog was the only herpetile observed in the wetland. Green frogs were found in the ditch pools along side the portion of the logging road which cuts through the wetland. None of the plants or animals recorded in or near the wetland is considered to be rare or sensitive to human activities (COSEWIC 2003; NSDNR 2003a; NSDNR 2003b).

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

Quarry development could result in the loss of Wetland 3 and the loss of part of Wetland 2. Wetland habitat loss is of particular concern in Wetland 2 since the area lost provides habitat for boreal aster, an uncommon species in Nova Scotia. No habitat loss would occur in Wetland 1; however, the hydrology of this wetland would be altered. As the quarry expands the amount of exposed impermeable surface will increase resulting in larger surface water inputs to Wetland 1. The amount of surface water and groundwater entering Wetland 1 will increase further as the excavation proceeds southward past the existing watershed divide and water that normally flows to the south will be diverted to the north. The change in hydrology at Wetland 1 could result in changes in plant and animal communities in the Wetland as a result of changes in water level, duration and frequency of flooding and inputs of sediment into the wetland.

The effects of the project on Wetlands 2 and 3 and a substantial part of the potential hydrological effects on Wetland 1 can be mitigated by changing the boundaries of the quarry. Weeks Construction has adjusted the boundary in the southwestern corner of the quarry to the north in order to avoid Wetlands 2 and 3 and provide a buffer to minimize hydrological effects (Figure 5.1). The revised site boundary will eliminate adverse effects to Wetlands 2 and 3 and will help to reduce hydrological effects on Wetland 1. The hydrological effects on Wetland 1 can be further mitigated by placing free-draining material over all disturbed areas and constructing properly sized flow retention/siltation treatment structures. To date, effluent from the settling pond has been minimal as the majority of the surface runoff evaporates or

infiltrates from the pond or quarry floor. Effluent will be monitored in accordance with the approval to operate, and future updates. The design of flow retention/siltation treatment structures as well as the width of the buffer zones around Wetlands 2 and 3 should be based on hydrological modelling and the results of monitoring well data collected on the site. Should adverse effects on Wetland 1 occur, Weeks Construction will work with NSDNR to develop further mitigative measures, which may include wetland compensation.

In summary, assuming the application of proposed mitigation measures, significant Project-related effects on wetlands functional attributes are not likely to occur.

5.5 Wildlife

5.5.1 Description of the Existing Environment

Birds

A breeding bird survey was conducted at the site on June 30, 2003. Additional bird observations were recorded during the vegetation survey conducted on September 15, 2003. The area surveyed included all of the area found within the property as well as areas up to 250 m outside of the property. The survey began at 05:20 and ended at 10:10. During the survey all habitats on the property were visited and all birds heard or observed were recorded. The breeding status of each species recorded was determined using the methodology employed by the Atlas of Breeding Birds of the Maritimes program. Species identified but not exhibiting signs of breeding were classified as non-breeders. Species observed or heard singing in suitable nesting habitat were classified as possible breeders. Species exhibiting the following behaviors were classed as probable breeders:

- Courtship behaviour between a male and female;
- Birds visiting a probable nesting site;
- Birds displaying agitated behaviour; and
- Male and female observed together in suitable nesting habitat.

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

- Nest building or adults carrying nesting material;
- Distraction display or injury feigning;
- Recently fledged young;
- Occupied nest located; and
- Adult observed carrying food or faecal sac for young.

The population status of each species was determined from existing literature. Lists of provincially rare or sensitive birds were derived from the General Status of Wildlife in Nova Scotia (NSDNR 2003a) and Species at Risk in Nova Scotia (NSDNR 2003b) while nationally rare species were derived from COSEWIC (2003).

A list of bird species recorded during the survey is in Appendix H. A total of 140 birds representing 29 species were recorded during the breeding bird survey. The most abundant species in descending order of abundance were White-throated Sparrow (14.3% of all birds recorded), Dark-eyed Junco (12.1%), Palm Warbler (10.7%), Common Yellowthroat (9.3%), American Robin (5.0%), Blue-headed Vireo (5.0%), and Black-and-white Warbler (5.0%). Together these species accounted for 61% of the total number of birds recorded during the survey. Six species were confirmed as breeding on the site, three were listed as probable breeders, nineteen were listed as possible breeders, and no evidence of breeding activities were found for one species. The habitat type in which the largest numbers of birds were encountered was clear-cut. Twenty-four percent of all bird observations were made in this habitat type. The high frequency of observations in this habitat type is attributable largely to the fact that this was the most abundant habitat type in the study area. Other habitats which supported relatively large numbers of birds included mature softwood forest, immature softwood forest, mature mixedwood forest and immature mixedwood forest. Although these habitat types accounted for a relatively small area of the study area, they provide good feeding and nesting habitat for a wide range of species and therefore attract higher densities of birds than the clear-cut areas which cover most of the property. The habitats which supported the greatest bird species richness were mature softwood forest, mature mixedwood forest and immature mixedwood forest. None of the bird species recorded during the breeding bird surveys is considered to be rare in Nova Scotia (Erskine 1992) or particularly sensitive to anthropogenic activities (NSDNR 2003a). Additional information regarding use of the area by birds was derived from a review of the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1990).

Mammals

Information regarding the presence of rare mammals and sensitive mammal habitat within the study area was derived from field surveys and a review of Nova Scotia significant habitat mapping data base (NSDNR 2003c). Field surveys were conducted concurrently with vegetation and bird surveys on June 30 and September 15, 2003. The field surveys provide a good indication of the presence of large mammal species in the study area. Knowledge of the distribution of small mammals in the study area is limited by their secretive nature and the undesirable requirement to conduct intensive small mammal trapping programs to determine their presence in the area. Fortunately, many small, rare mammals have very specific habitat requirements, which can be used to predict areas where they are likely to be found.

The study area is characterized by moderate habitat diversity. Most of the area has been harvested within the past five years. Remnants of mature softwood forest and mature mixedwood forest are found along the edge of Route 354. Small patches of immature softwood and mixedwood forest are

found scattered around the property. Barrens habitat is present in two areas in the southern half of the property. Three wetlands are present along the margins of the property, one along the northern margin and two along the southern margin.

The species recorded in the study area are generally typical of woodland habitats. Species recorded during the field survey included white-tailed deer (*Odocoileus virginianus*), varying hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), mink (*Mustella vison*), and coyote (*canis latrans*).

A review of the NSDNR significant habitat mapping data base (NSDNR 2003c) did not reveal the presence of any rare or sensitive mammal species in the vicinity of the study area or critical habitat such as deer wintering areas. All of the habitats present in the study area are commonly encountered throughout the province and are unlikely to provide habitat for rare small mammal species.

Herpetiles

Information regarding amphibians and reptiles and their habitat within the study area was also derived during the June 30 and September 15, 2003 surveys. Five amphibian and three reptile species were encountered during the surveys including four-toed salamander (*Hemidactylium scutatum*), northern spring peeper (*Pseudocaris crucifer*), pickerel frog (*Rana palustris*), wood frog (*Rana sylvatica*), green frog (*Rana clamitans melanota*), northern redbelly snake (*Storeria occipitomaculata occipitomaculata*), eastern smooth green snake (*Liochlorophis vernalis borealis*), and maritime garter snake (*Thamnophis sirtalis pallidula*). Most of the reptiles and amphibians noted in the study area were observed in the three wetlands located around the periphery of the property in the three wetlands or in roadside ditches and pools along the woods road which forms the southern property boundary. One of the species found during the surveys, four-toed salamander, is considered to be sensitive to human activities or natural events (NSDNR 2003a) while the rest are considered to be secure in Nova Scotia. A four-toed salamander was found at the northern end of Wetland 1 (Figure 5.1). It was found outside of the property in a sphagnum moss hummock at the edge of a small pool. This site provided suitable nesting habitat for this species although no eggs or egg residue were found when the four-toed salamander was captured. As discussed in Section 5.4.1, four-toed salamanders are believed to be more abundant and widespread than previously thought. A recent study has demonstrated that they are relatively widespread and make use of a variety of habitats including manmade habitats such as ditches and wheel ruts so long as sphagnum moss hummocks are present in close proximity to pools or sluggish streams. In Wetland 1 suitable breeding habitat was found only at the northern tip of the wetland approximately 200 m north of the proposed expansion area.

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

None of the bird species recorded during the breeding bird surveys is listed under the NS *Endangered Species Act*, is considered to be rare in Nova Scotia (Erskine 1992), or particularly sensitive to

anthropogenic activities (NSDNR 2003a). Migratory birds are protected under the *Migratory Birds Convention Act*. It is illegal to kill migratory bird species not listed as game birds or destroy their eggs or young. Other bird species not protected under the federal act such as raptors are protected under the provincial *Wildlife Act*. In order to avoid contravening these regulations it is recommended that clearing and grubbing of areas to be used as quarry sites be conducted outside of the breeding season for most bird species (April 1 to August 1) so that the eggs and flightless young of birds are not inadvertently destroyed. Similarly, wherever feasible, blasting should be scheduled for outside of the breeding season to minimize disturbance to nesting birds.

No critical areas for mammals such as deer wintering areas are known to exist in the study area. The species recorded in the study area are generally typical of woodland habitats. The field survey and a review of existing records (NSDNR 2003c) did not reveal the presence of any rare mammal species in the vicinity of the study area. The habitats present in the study area are commonly encountered throughout the province and are unlikely to provide habitat for rare small mammal species.

Four-toed salamander, a species listed as sensitive by NSDNR (2003a) was found 200 m north of the property at the northern tip of Wetland 1. No other suitable four-toed salamander breeding habitat was found in Wetland 1. The suitable four-toed salamander habitat present in Wetland 1 will not be physically disturbed by quarrying activities; however, there is some potential for the hydrology of the wetland to be altered slightly since it receives drainage from the existing quarry and areas where future quarrying will take place. Evidence suggests that four-toed salamanders are adaptable and more widespread and abundant than previous records would indicate. Local populations of four-toed salamander are unlikely to be significantly adversely affected by quarrying activities.

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

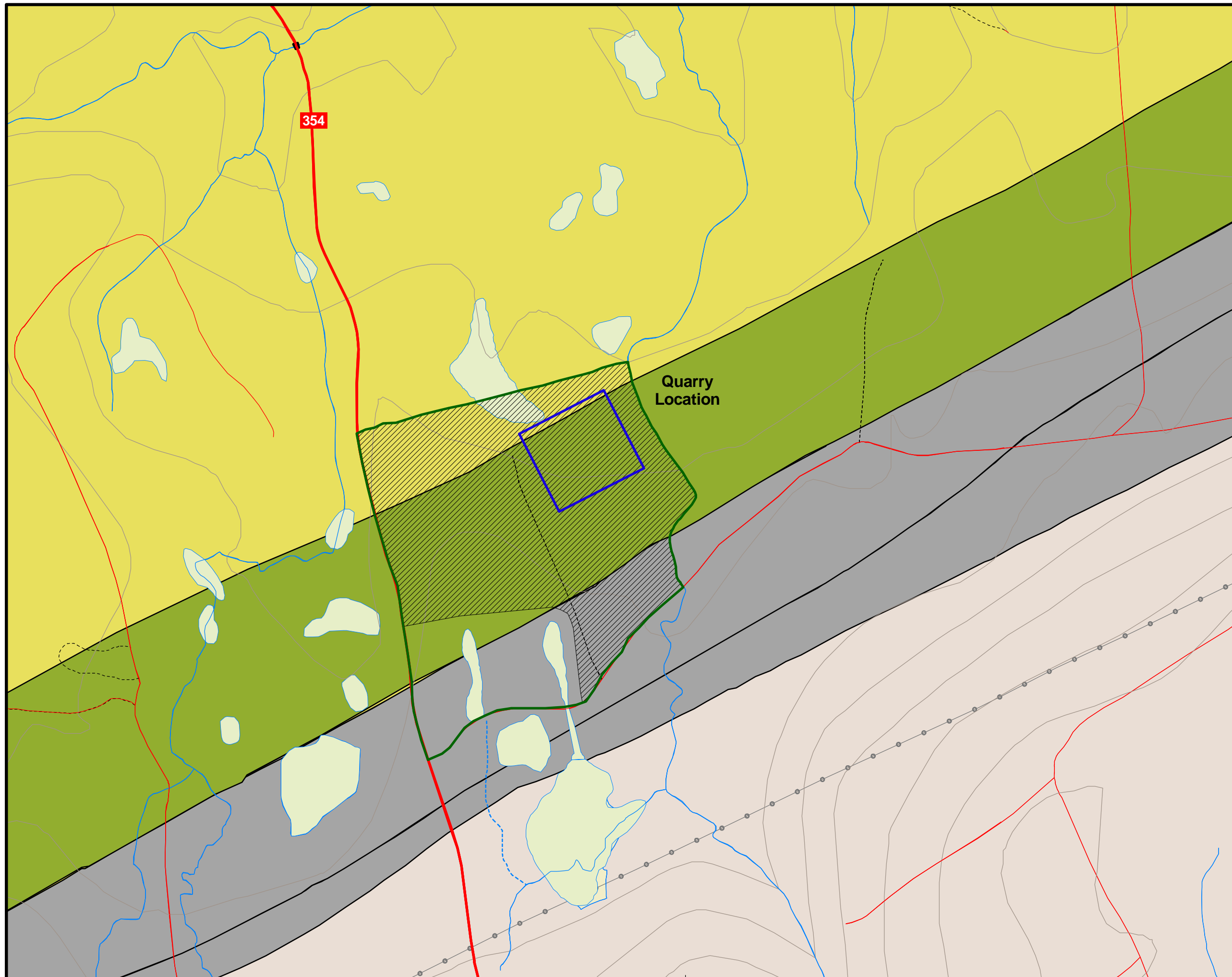
5.6 Groundwater Resources

5.6.1 Description of Existing Environment

As indicated in Section 2.2, a thin mantle of sandy glacial till covers the proposed quarry expansion area. Two bedrock formations, both of the Meguma Group, underlie the overburden material across the proposed quarry expansion area (Figure 5.2). The Goldenville Formation, to the north, consists of meta-sandstones (*i.e.*, meta-quartzarenites, quartzites and meta-greywackes with minor slate and meta-siltstone). This formation can be further sub-divided into the Lewis Lake Unit (medium to coarse grained meta-sandstones) and the Steve's Road Unit (quartz-rich meta-sandstones with interbeds of meta-siltstones). The Halifax Formation, to the south, consists of slates with minor meta-sandstones and meta-siltstones, which can also be sub-divided into the Cunard Member (and the transitional Beaverbank Unit (Ryan 1997). The nearest community, North Beaverbank, is located 5 km to the south and is underlain by the Goldenville Formation.

Figure 5.2

Detailed Bedrock Geology at East Uniacke Quarry Expansion Project



Bedrock Geology

- Goldenville Formation - Lewis Lake Unit
- Goldenville Formation - Steve's Road Unit
- Halifax Formation - Beaverbank Unit
- Halifax Formation - Cunard Member

East Uniacke Quarry

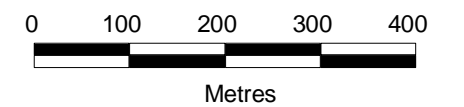
- Proposed Original Expansion Area
- Approximate Existing Quarry Area
- Revised Expansion Area

Topography

- Building/Structure
- Stream
- Potential Watercourse
- Wetland

Roads

- Major Road
- Minor Road
- Dirt Road
- Utility Line
- County Line



Map Parameters:
Projection: UTM
Datum: NAD83
Zone : 20
Scale: 1:8,000
Date: April 28, 2004
Project #: NSD17810

Data Source: Ryan, R.J. 1997, NSDNR



The gradational beds at the transition between the Goldenville Formation and the Halifax Formation (*i.e.*, the Beaverbank Unit) have been the focus of extensive exploration for gold. This transitional unit is approximately 390 m thick at the quarry location. It has been suggested that the manganese-rich slates and siltstones of this transition zone are preferentially mineralized (Graves and Zentilli 1982, 1988). The unit has abundant sulphides that can be readily detected on aeromagnetic data (King 1994). Ryan (1997) concluded that the discovery of gold at Steve's Road reaffirmed that there are gold occurrences in the Meguma Group rocks that are not directly associated with quartz veining.

Topographic information provided for the existing quarry indicates that it is approximately 4 ha in area, and the floor is relatively flat-lying. Two small excavations, approximately 1 m deep, within the quarry floor are used to collect surface runoff and to provide a water supply for dust control. The quarry rock face is up to 18 m in height and the direction of advance is south. A northward flowing watercourse lies approximately 60 m to the east of the existing quarry (Figure 5.2). As discussed in Section 5.2, the watercourse has a high gradient along the length of the proposed quarry expansion area.

Groundwater flow directions at the proposed quarry expansion area are interpreted based on topography. Since the quarry site lies within the Herbert River watershed, with the watershed divide lying south of the quarry, it is assumed that deep groundwater flow beneath the site is towards Minas Basin in the north. Shallow groundwater flow beneath the site is also towards the north, and recharges Herbert River and its tributaries, including the brook east of the quarry. Depending on the groundwater table elevation, groundwater may enter through the quarry's walls and floor, particularly along the quarry's south wall during periods of high water table levels (*i.e.*, spring and fall). Near the southeast corner of the quarry where its floor lies approximately 4 m below the nearest section of the watercourse, shallow groundwater flow could also move towards the quarry. Any groundwater entering the quarry is expected to move radially outwards to the north end of the quarry into a settling pond and eventually back into the watercourse further downstream.

Water Wells

Water supply for any rural development in the vicinity of the proposed quarry expansion is derived from individual dug or drilled water wells. There are known developments in the vicinity, with the nearest residence reportedly located a distance of 1.1 m south of the quarry, along Route 354 (Figure 5.2). Other residential developments are located both north (down-gradient) and further south (up-gradient) along Route 354.

A review of available NSDEL well records provides information for forty-one driller well logs that are reportedly located in North Beaverbank, the nearest community to the quarry area. Most of these wells are reported to have been constructed in either quartzite or slate (*i.e.*, Goldenville Formation). Since the community of North Beaverbank is underlain by the Goldenville Formation (*i.e.*, the same formation as the quarry site), these records are considered the most representative of water wells that could be drilled

in the vicinity of the proposed quarry expansion area. These records are inferred to service single residential homes or light commercial facilities. The well construction details for these bedrock wells are summarized in Table 5.2. The wells average 62 m in depth and have an average of 8 m of casing. The well yields range from nil to 136 litres per minute (L/min) (0 to 30 igpm), with a median yield of 13.6 L/min (3 igpm). Depth to the water table averages 1.4 m below grade, consistent with a lowland groundwater discharge area.

	Well Depth (m)	Casing Length (m)	Well Diameter (mm)	Estimated Yield (gpm)	Water Level (m)	Overburden Thickness (m)
Minimum	24.4	6.1	150	0.1	0.9	0.6
Maximum	123.5	23.8	165	30	12.2	108.2
Average	62.3	8.1	151	6.1	4.6	12.6
Median	61.0	6.1	150	3.0	4.6	3.0
Number	41	41	41	40	17	41

Water Quality

The water quality from wells constructed in the Goldenville Formation is expected to be good, with most parameters meeting the Canadian Drinking Water Guidelines (Health Canada, 2003). Arsenic in excess of the drinking water guidelines is a possible naturally occurring water quality issue. Other potential aesthetic problems such as iron, manganese and moderate hardness have occasionally been reported.

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

The potential environmental effects on groundwater resources from a quarry operation include temporary siltation of nearby wells due to intermittent blasting, possible reduced water levels in wells hydraulically up-gradient of the quarry (temporary or permanent), decrease in well yield, and possible water quality deterioration of down-gradient wells from accidental releases of deleterious substances such as fuel oil within the quarry area or acidic drainage production. Potential impacts to residential water wells are a function of distance, location of a well with respect to groundwater flow directions, intensity and frequency of blasting, and individual well construction methods.

Since the site may lie in a local groundwater discharge area, the water table may be shallow in the region of wetland areas, as well as the brook to the east. As the quarry advances to the south, increased groundwater seepage into the quarry would be expected. Although much of the inflow may be associated with perched groundwater levels, the quarry could potentially intersect the bedrock groundwater table, particularly if the elevation of the quarry floor is not raised as it advances further to the south. If the quarry approaches the watercourse to the east, or the wetland areas in the south, which may represent headwaters to the stream, shallow water table levels and possible drainage into the quarry could be encountered. However, as previously stated, a 60 m buffer will be maintained along the

watercourse along the eastern boundary of the proposed expansion area, and the revised proposed quarry expansion area excludes the small wetlands in the south, minimizing the potential for such effects.

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

In the unlikely event that the water level were to be lowered by the proposed quarry expansion, the degree of water level decline at a domestic well would be proportional to the distance from the edge of the quarry, decreasing exponentially with distance. In consideration of the distance between the quarry and the nearest existing residential well (*i.e.*, at least 1.1 km) and the inferred low yields of local drilled wells in fractured quartzite bedrock (*i.e.*, 3 igpm), loss of yield at the existing residential wells is not anticipated.

Changes in water quality may theoretically occur as a result of excavations in the recharge area of the wells. Wells located down-gradient (north) of the quarry are more likely to be affected in this manner than wells to the south, due to the location of the groundwater and surface water divide. Potential impacts include: temporary siltation from blasting, oil and nitrate from blasting operations, lubricant compounds, and other chemical releases within the quarry area. Again, due to distance, significant impacts are not anticipated due to natural attenuation primarily by dilution and dispersion along the groundwater pathways, and the likelihood of groundwater discharge to intervening streams. In the unlikely event of water quality deterioration, mitigation would include appropriate treatment, replacement of the supply, or provision of bottled water.

A possible long term impact of well water quality is decreased pH or increased dissolved solids from attenuation of acidic drainage from exposed sulfide-rich bedrock. A sample collected at the quarry in September 2002 in support of the Industrial Approval application, was analyzed to determine the potential for acid drainage production. Analyses results confirmed that the rock is not acid producing. The percent sulphide by weight of 0.053 for the quarry sample is well below the provincial guideline of 0.4 percent. The average acid production potential of the samples was 0.16 kg sulphide/tonne which is also well below the provincial guideline of 12.51 kg sulphide/tonne.

Additional samples were collected in the April 2004 and were also analyzed for acid production potential. The total sulphur content was 0.003% and the acid production potential was 0.09 kg/t. At the time of sample collection, the pH of the surface runoff collected in the settling pond was measured at 6.8. As indicated in Section 2.3, rock will be sampled and tested regularly to confirm the suitability of the aggregate and confirm that the Halifax Formation slates, known widely to be acid producing, have/will not be encountered/disturbed. Monitoring of stockpile runoff for pH will be conducted seasonally. Monitoring for acid drainage indicator compounds is not required at this time.

Mitigation of short-term turbidity impacts caused by blasting vibration would likely involve temporary provision of bottled water to affected residents, or provision of an in-line dirt filter. In the unlikely event of persisting long-term degraded water quality, or a well yield loss event, Weeks Construction will replace or repair any water supply well found to be adversely affected by their quarry operation to the satisfaction of the owner.

It is recommended that groundwater monitoring wells be installed in the proposed quarry expansion area. These wells should be drilled to a depth of 3 to 5 m below the existing quarry floor and can be used for monitoring groundwater depths on a regular basis, in consideration of seasonal variations and blasting activities (*i.e.*, before and after blasting). This data could be used to monitor the elevation of the groundwater table across the proposed area of expansion, and the hydraulic connection between the quarry and the nearby watercourse. Furthermore, it could be used to assist with quarry development planning by assessing potential groundwater inflow to the quarry and any identifying potential water management issues.

In summary, significant Project-related effects on groundwater resources are not likely to occur.

5.7 Archaeological and Heritage Resources

5.7.1 Description of the Existing Environment

For the purposes of this assessment, archaeological and heritage resources are defined as physical remains that inform us of the human use of and interaction with the physical environment. These resources may be above or below the surface of the ground and cover the earliest Pre-Contact times to the relatively recent past.

Heritage resources are generally considered to include historic period sites such as cemeteries, heritage buildings and sites, monuments, and areas of significance to First Nations or other groups. Pre-Contact refers to the time before the arrival of non-Aboriginal peoples.

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

Background research was conducted using the records at the Public Archives of Nova Scotia. Maps consulted included those by A.F. Church (1871) and Faribault. These maps cover the period from the middle of the nineteenth century to the beginning of the twentieth century. There were no potential archaeological features shown on either map that fell within or adjacent to the study area.

A NORAD radar station (RCAF Station Beaverbank) used to exist in the area. It was located at what is now the Beaver Bank Villa. The station was built in 1954 and closed in 1964. The station was located between Nicholson and Phillip Hill and the support buildings and Permanent Married Quarters were in Beaver Bank Villa. One of the larger buildings in the Domestic area of the station is now used as a nursing home. A fire station, convenience store, and community centre are still in use.

The study area is deemed to have a low potential for containing archaeological or heritage resources pertaining to First Nations peoples. There are no apparent resources within the area that would have attracted settlement during the pre-Contact period (400 to 500 years ago). Any First Nation's resources within the general area would likely be found on the Lewis/Savage/Nicholson Lake water system, approximately five kilometres to the west and the Grand Lake/Shubenacadie Canal system approximately eight kilometres to the east.

Based on the background research, there appears to be low potential for the study area to contain archaeological resources dating to the historic period. While it is on a major road, there are no historic settlements located within the immediate area.

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

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

The study area has only low potential for identifiable human use in the pre-Contact and historic periods. No archaeological/heritage resources or areas of elevated heritage potential were identified in the study area during the visual reconnaissance. It is assumed that no areas beyond study area will be disturbed during the development and operation of the proposed quarry expansion area. As such, development and operation of the proposed quarry are not expected to have any adverse environmental effects on heritage resources.

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

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

5.8 Air Quality

5.8.1 Description of the Existing Environment

NSDEL monitors air quality at ten stations across Nova Scotia susceptible to air quality problems. Common air pollutants monitored regularly are sulphur dioxide (SO₂), particulate matter (PM), carbon monoxide (CO), ground level ozone (O₃), nitrogen dioxide (N₂O), and hydrogen sulphide (H₂S). Exceedances for these contaminants are generally small and infrequent in Nova Scotia. The closest NSDEL monitoring site to the East Uniacke Quarry is located in downtown Halifax, more than 30 km from the quarry site. Since 1997, the province began continuous reporting of an air quality index for the Halifax – Dartmouth region. Since reporting began, air quality has been predominantly in the “Good” category (NSDEL 1998).

Motor vehicles, electrical power generation, pulp and paper processing and oil refining are the major local sources of air pollutants in the province. Port Hawkesbury is the only area in the province that experiences periodic exceedances in air quality. All other air quality exceedances in the province are caused by ground level ozone, generated outside the region (NSDEL 1998).

The East Uniacke Quarry is located in a rural setting with little or no industry within a radius of 10 km. It is not anticipated that the common air pollutants are exceeded at the quarry location due to the separation distance of more than 15 km from the urban centre of HRM.

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

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

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

Efforts to minimize the generation of dust at the site have been made by covering laydown and work areas with blasted materials, and covering stockpiled topsoil with seed and hay. Fugitive dust emissions will be controlled with the application of water obtained from the settling pond and/or sump as per current practice. Monitoring of particulate emissions (dust) will be conducted at the request of NSEL.

In summary, assuming appropriate dust suppression measures are undertaken, significant Project-related effects on air quality are not likely to occur.

5.9 Socio-economic Environment

5.9.1 Description of the Existing Environment

Population and Employment

The quarry is located in East Uniacke, north of the community of Beaver Bank and south of the community of Rawdon, in Hants County. The quarry is located in a rural setting with approximately 375 residences within 5 km of the quarry site. The population in the general area (*i.e.*, East Hants) is 20,801. The population in this area increased by 5.3 % from 1996 to 2001. The employment rate in East Hants is 59.3 % while the unemployment rate is 8.7 % (Statistics Canada 2001). Approximately half of the experienced labour force consists of sales and service occupations and trades, transport, and equipment operator and related occupations.

The county line is approximately 1.8 km south of the quarry. The majority of the aggregates from the quarry, to date, have been sold to customers in HRM, predominantly for municipal water and sewer projects and residential and commercial developments. The population of HRM is slightly less than 360,000 and has increased by 4.7 % from 1996 to 2001 (Statistics Canada 2001). The employment rate in HRM it is 63 % while the unemployment rate is 7.2%. Approximately 32 % of the of the labour force consists of management occupations and business, finance, and administration occupations and another 40 % consists of sales and service occupations and trades, transport, and equipment operator and related occupations.

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

Land Use

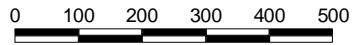
The proposed expansion area is located on lands that have been clear-cut within the past 3-5 years. The previous landowner, Kimberly Clarke, conducted timber harvesting, and associated activities (*i.e.*, construction of access roads), on their properties in the general area of the quarry for a number of years. Evidence of this is obtained from the aerial photography from 1992 (Figure 5.3). Kimberly Clarke developed a gravel pit, located south of the power lines, for use during construction of forest roads. The pit was not open to the public for sale of materials, and is no longer operating.

The area in which the quarry is located is zoned R4 – Rural.

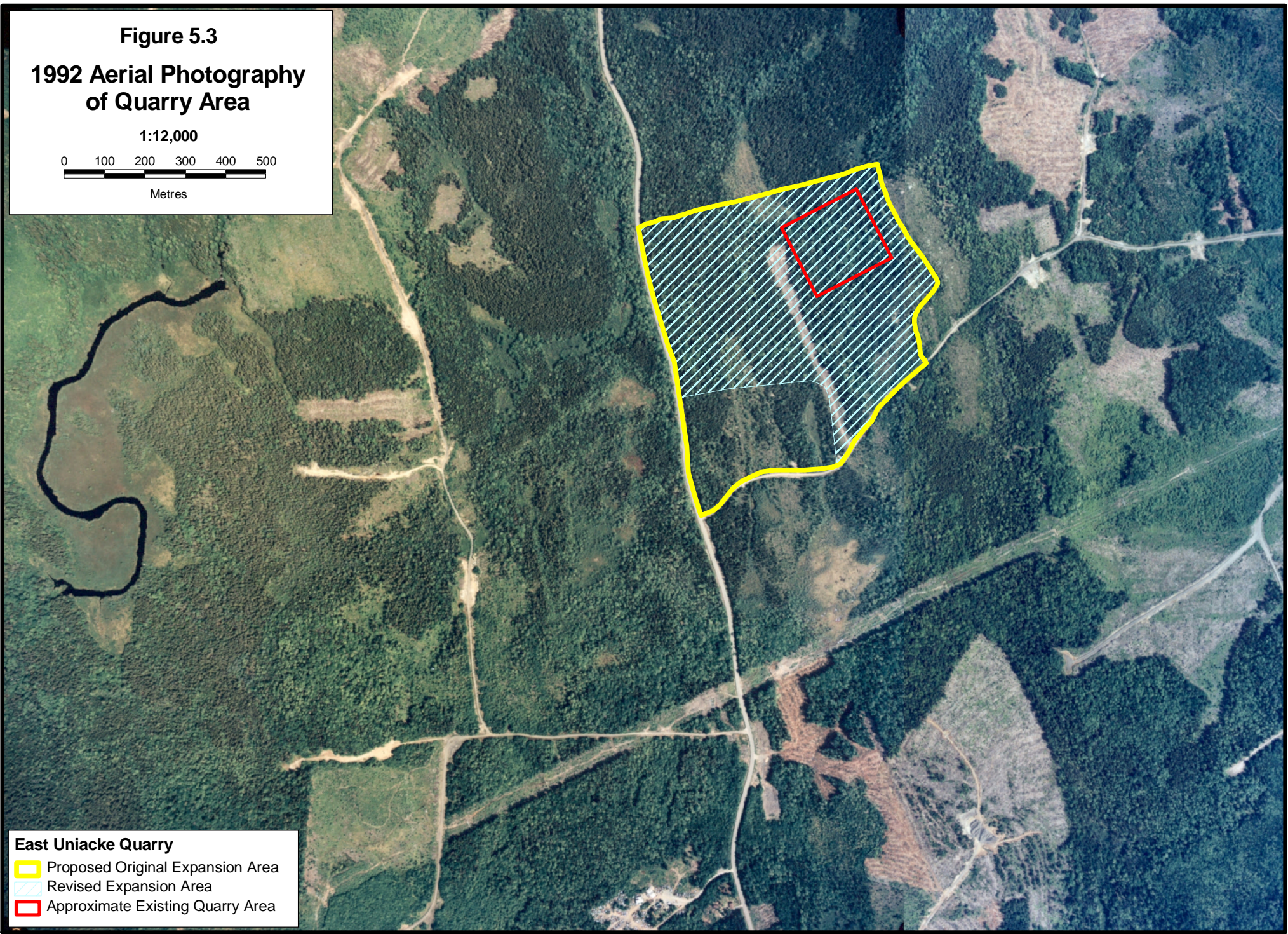
Figure 5.3

**1992 Aerial Photography
of Quarry Area**




1:12,000



Metres



East Uniacke Quarry

-  Proposed Original Expansion Area
-  Revised Expansion Area
-  Approximate Existing Quarry Area

Transportation

A transportation assessment of the Beaver Bank Road, Route 354 and discussion of potential impacts of the quarry operation was conducted in support of this environmental registration. A description of the road follows and a discussion of potential impacts is found in Section 5.9.2.

The Beaver Bank Road has a posted speed limit of 80 km/h throughout the entire section, approximately 18 km, from the Halifax/Hants County line to Trunk 14 at Upper Rawdon, north of the quarry. South of the county line, the speed limit varies between 50 and 80 km/h. The horizontal alignment has numerous curves, however all curves are easily negotiated at the posted speed limit. The paved surface, which is badly broken throughout the entire section north of the Kinsac Road intersection, is typically about 6.3 m wide with about 1.0 to 1.2 m of gravel shoulders. South of the Kinsac Road intersection, a large section of the road was paved in 2000. The Beaver Bank Road between the Kinsac Road and Sackville is in fairly good condition with few potholes. The road is subject to spring weight restrictions. The appropriate Truck Entrance symbol signs (WC-8) are posted on both the northbound and southbound approaches to the quarry entrance roadway.

In 1996 and again in 2001, the Department of Transportation and Public Works obtained machine traffic counts along the Beaver Bank Road at the Halifax/Hants County line. Annual average daily traffic (AADT) volumes estimated from these counts indicated that both 1996 and 2001 AADT volumes were approximately 1000 vehicles per day (vpd). Since the daily volumes did not change between 1996 and 2001, it is assumed that the 2003 AADT is still approximately 1,000 vpd. Average weekday hourly volumes calculated from three one week counts obtained by TPW in 2001 indicate that the peak hourly volume on the Beaver Bank Road is approximately 100 vehicles per hour (vph) near the quarry entrance. As one would expect, the peak volume occurs during the evening commute, around 6pm. The daily volumes are typical of suburban traffic patterns and exhibit only minor seasonal fluctuations.

South of the County line, weekday volumes are expected to be approximately 1,000 vpd to the Beaver Bank Villa and will increase as one travels from there to Glendale Drive. For example, weekday volumes north of Kinsac Road are 4,000 vpd, volumes south of Kinsac Road are 8,000 vpd, and volumes just north of Glendale Drive are 24,000 vpd.

During the five year period from 1998 and 2002, the Beaver Bank Road north of the quarry to Trunk 14 experienced a total of 19 motor vehicle collisions. Six collisions resulted in property damage only while 12 collisions reported injuries and one collision reported a fatality. The fatal collision involved a motorcycle single vehicle collision, during daylight hours, with dry pavement. There were 15 single vehicle accidents and four two-vehicle accidents. Two collisions involved deer and six were attributed to winter weather conditions.

The relative safety of a section of roadway is evaluated by comparing Study Area collision rates to the average collision rates for all similar roadways in the Province. The 1998 to 2002 average collision rates by severity for all provincial collector routes similar to the Beaver Bank Road are shown in Table 5.3. The “property damage only” and total collision rates for the Beaver Bank Road are lower than average and the injury collision rate is comparable to the provincial average for all collector routes. While the calculated fatal collision rate is higher than the provincial rate, the difference is not considered significant since it is the result of one fatal collision in five years on a low volume roadway.

Table 5.3 Number of Collisions and Collision Rates										
Year	AADT	HMVK	Number of Collisions				Collision Rates			
			PDO	Injury	Fatal	Total	PDO	Injury	Fatal	Total
Route 354 Section 007 (Halifax / Hants County Line to Trunk 14 - Upper Rawdon; 17.82 km long)										
1998	1010	0.0657	2	1	0	3	30.4	15.2	0.0	45.7
1999	1010	0.0657	1	1	0	2	15.2	15.2	0.0	30.4
2000	1010	0.0659	2	2	0	4	30.4	30.4	0.0	60.7
2001	1010	0.0657	1	3	1	5	15.2	45.7	15.2	76.1
2002	1010	0.0657	0	5	0	5	0.0	76.1	0.0	76.1
Totals		0.3286	6	12	1	19				
Average (1998 to 2003) Collision Rates for Study Section Route 354							18.3	36.5	3.0	57.8
Average (1998 to 2003) Provincial Collision Rates for all Collector Routes							62.8	35.2	0.6	98.6
Source: NSTPW base and published collision data.										

Additional transportation infrastructure and networks in the area includes the Halifax International Airport (approximately 100 km from the quarry) and the Port of Halifax (approximately 30 km from the quarry).

Recreation and Tourism

Anecdotal information from a resident/landowner in the general area of the proposed quarry expansion included historical use of lands east of the quarry for hunting. Hunting activities have declined since timber harvesting activities in the area began. Many of the forest roads have been gated, denying access to private property. The presence of brown trout juveniles in the tributary to the Herbert River that runs along the east boundary of the proposed expansion area would indicate that the general area is likely supports recreation fishing.

There are no parks in the general area.

Human Health

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

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

Population and Employment

Potential environmental effects on local residents and employment are discussed below.

Quarrying activities will produce noise from equipment operation and blasting. The quarry is located more than a kilometre from the nearest residence. It is sheltered from the Beaver Bank Road by a tree buffer, left in place during timber harvesting activities. The potential for noise from the quarry site to have a significant effect on residents is minimal.

Blasting operations associated with the proposed expansion will be conducted in accordance with current operations at the quarry as permitted by NSEL (Approval No. 2002-030481, issued January 15, 2003) and in accordance with the *Pit and Quarry Guidelines* (NSDEL 1999). Blasting will be conducted in accordance with the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (2003). It is understood that additional blast monitoring activities and/or reporting may be required by NSEL. A blast design has been prepared and submitted to NSEL.

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

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

Sound monitoring will be conducted at the request of NSEL.

A treed buffer will be maintained along the Beaver Bank Road. No new aesthetic impacts are anticipated due to the expansion. The existing quarry is not visible from the Beaver Bank Road.

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

Expansion of the Weeks Construction quarry to allow for continued operation will result in an overall positive effect on the regional economy. The availability of additional supply to the market place should encourage a more stable price for aggregate. In some cases (*i.e.*, markets in close proximity to quarries) the overall price for aggregates will be lower, since cost of aggregate largely reflects the distance it has been hauled. This, in turn, can significantly reduce costs of construction, which, in the case of public

infrastructure such as highways, communities, public works agencies, and taxpayers should result in financial benefits (NSDNR 2004).

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

Land Use

Due to the existing industrial activity onsite (*i.e.*, quarry) and the distance from residences (*i.e.*, greater than a kilometre), impacts on existing and future adjacent land uses are not expected. Quarry activities will be conducted in accordance with the Pit and Quarry Guidelines and all setback distances specified in the Guidelines will be maintained. In addition, expansion of the quarry will be conducted in consultation with the Municipality of East Hants, and in accordance with any development agreement that may be required.

Transportation

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

No new access roads are required for this project. Weeks Construction will maintain the portion of the private access road owned by Kimberly Clarke in accordance with the easement agreement.

While traffic volumes south of the Beaver Bank Villa are much higher than volumes near the quarry entrance, the addition of 50 to 150 trucks per day represents less than 0.5 % of the 24,000 vpd. This small increase in volume is not expected to affect the performance or safety of the Beaver Bank Road. The collision records and rates did not indicate any abnormal safety concerns. It was noted during the reconnaissance survey that the existing pavement centreline markings indicate a “passing zone” for the Beaver Bank Road southbound through the quarry entrance. It is recommended that the “skip” line be replaced with a solid yellow line to remove the passing zone. In the interest of public safety, Weeks Construction will raise this concern with the Department of Transportation and Public Works, who is responsible for the operation and maintenance of the Beaver Bank Road.

In summary, addition of 50 to 150 loaded trucks per day to the Beaver Bank Road from the quarry should not affect the level of performance or safety of the road.

Recreation and Tourism

The existing quarry and proposed expansion of the operation are not likely to have an impact on hunting and recreational fishing in the general area. The quarry is situated on cleared lands adjacent to a road, not suitable conditions for hunting. It is unlikely that recreational fishing would take place in the tributary to the Herbert River along the proposed expansion area. Fishing may occur further downstream and in the Herbert River. Expansion and operation of the quarry are not expected to have an impact due to the distance from these potential recreation fishing locations.

Human Health

Human health related issues are discussed in Section 5.8 Air Quality and Sections 5.9.1.3 and 5.9.2.3 Transportation. The health and safety of nearby residences is not expected to be affected by the Project.

Summary

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

5.10 Other Undertakings in the Area

There are no other quarry operations licensed to operate in a 10 km radius of the East Uniacke Quarry. There is a hard rock quarry operating approximately 30 km north and west, in South Rawdon and three major quarries operating in HRM, all of which are more than 25 km from the East Uniacke Quarry. These other quarries generally do not add to the traffic flow along the Beaver Bank Road.

6.0 EFFECTS OF THE PROJECT ON THE ENVIRONMENT

Activities associated with the proposed quarry expansion and operation will be conducted in accordance with terms and conditions of the existing Industrial Approval for Weeks Construction existing quarry operation in East Uniacke, as well as future amendments to the Approval, and the Pit and Quarry Guidelines (NSDEL 1999). Environmental effects of the quarry expansion will include the loss of terrestrial habitat within the proposed revised quarry expansion area. Field surveys conducted to date indicate that this area does not include unique habitat or rare or sensitive species; therefore, these effects are not anticipated to be significant.

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

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

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

7.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

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

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

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

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

8.0 OTHER APPROVALS REQUIRED

As stated in Section 2.0, the Proponent is required to register this project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. Other relevant provincial regulations include the Activities Designation Regulations, which requires an Industrial Approval from the NSDEL for operation of the Project, and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (2003). Provincial guidelines to be adhered to include the *Pit and Quarry Guidelines* (NSDOE 1999). Examples of other relevant federal legislation include the *Fisheries Act* and the *Migratory Birds Convention Act*.

9.0 FUNDING

The proposed expansion will be 100 percent privately funded.

10.0 ADDITIONAL INFORMATION

No additional information is provided in support of this document.

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