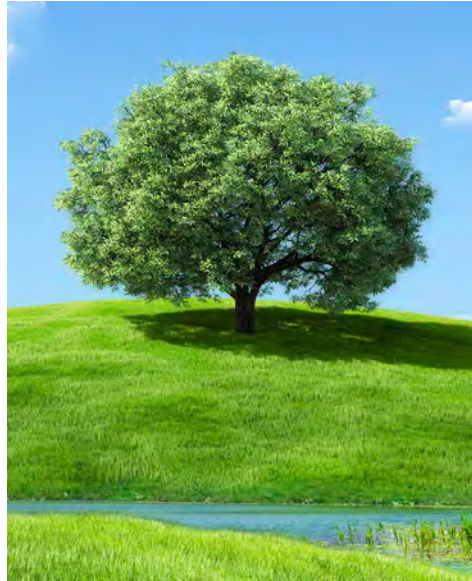




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Report

Brierly Brook Quarry Environmental Assessment Registration Document

Brierly Brook, Antigonish Co., Nova Scotia

Prepared for: Nova Construction Co. Ltd.

Conestoga-Rovers & Associates

45 Akerley Boulevard
Dartmouth, Nova Scotia B3B 1J7

January 2015 • 081464 • Report No. 1





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Glossary of Abbreviations

Note: Both imperial and metric units may have been used throughout the document. Every effort has been made to standardize units; however units given are as reported.

ACCDC	Atlantic Canada Conservation Data Centre
ARD	Acid Rock Drainage
CEAA	Canadian Environmental Assessment Act or Agency
CEPA	Canadian Environmental Protection Act
CO / CO ₂	Carbon monoxide / Carbon dioxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRA	Conestoga-Rovers and Associates
dB / dBA	Decibel (A-scale)
EA	Environmental Assessment
EARD	Environmental Assessment Registration Document
ha	Hectare
IA	Industrial Approval
km	Kilometre
km/hr	Kilometre per hour
Lpm	Litres per minute
m	Metres
masl	Metres above sea level
MBCA	Migratory Bird Convention Act
mg/L	milligrams per Litre
NO _x / NO ₂	Nitrogen oxides / Nitrogen dioxide
NPRI	National Pollutant Release Inventory
NSDNR	Nova Scotia Department of Natural Resources
NSE / NSEL	Nova Scotia Environment, currently (since 2008), but historically referred to as NS Environment & Labour depending on the timeframe.
NSEA	Nova Scotia Environment Act
NSESA	Nova Scotia Endangered Species Act
PID	Property Identification Number
PM 10 / PM 2.5	Particulate matter (10 – less than 10 microns, 2.5 less than 2.5 microns)
POL	Petroleum, Oil and Lubricants
SARA	Species at Risk Act
SO _x / SO ₂	Sulphur oxides / Sulphur dioxide
SPL	Sound pressure levels
t	Tonnes
TSP	Total Suspended Particulates
VEC	Valued Environmental Component
VOC	Volatile Organic Compound
µg/m ³	Microgram per cubic metre

Section 1.0 Proponent and Project Information

The proponent is Nova Construction Company Limited. - a Nova Scotia registered firm. The Nova Scotia Registry of Joint Stocks information of the proponent is included in Appendix A.

Proponent Contact Information:

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President

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Donald Chisholm

President, Nova Construction Co. Ltd.

15 Jan, 2015
Dated

Section 2.0 Project Information

2.1 Name

Name of the Undertaking: Nova Construction - Brierly Brook Quarry.

2.2 Location

Location of the Undertaking: 319 Brierly Brook Rd, Brierly Brook, Antigonish County, Nova Scotia; Property – PID 10111946; Coordinates: 571360 E, 5050970 N (UTM Zone 20 NAD83 CSRS). See Figures 1 and 2.

Section 3.0 Project Scope

3.1 Scope of the Undertaking

The scope of the proposed quarry is similar to past activities at the site since 2009 and encompasses the activities associated with construction, operation, and decommissioning of a quarry, as follows:

- site preparation;
- resource excavation;
- on-site processing: including blasting, crushing, and stockpiling;
- transportation/trucking;
- rehabilitation; and,
- closure.

The project location and proposed quarry outline are shown in Figures 2 and 3. The proposed project includes the development and operation of an aggregate quarry totaling approximately 14 ha, including the existing permitted quarry of 4 ha, and will adhere to all setback and other requirements of the Nova Scotia Environment (NSE) *Pit and Quarry Guidelines* (1999) and as prescribed in the existing Industrial Approval 2013-085263 for quarry operations and Industrial Approval 2013-086120 for the mobile asphalt plant. The existing elevation of the property is 115 metres above sea level (masl) in the southeast to approximately 220 masl in the northwest corner of the site. The final quarry floor will be about 179 masl throughout. The site requires blasting to extract rock for the mobile facilities that will be employed within the quarry for crushing and screening to produce aggregate rock products. Areas have been set aside for stockpiles; overburden storage; and use of temporary settling ponds to treat site runoff. No permanent facilities are required to support the quarry operations.

The study area, for the purposes of this Environmental Assessment (EA), encompasses the footprint of the proposed quarry and the property owned by Nova Construction to include: surface environment, air shed, noise shed, watershed, downstream receiving water bodies, and groundwater within measurable zones of influence as outlined in subsequent Sections of this Report.

The anticipated average production rate is approximately 100,000 metric tonnes of aggregate per annum. The operating schedule will be based typically on 12 hour days, 5-6 days per week, as market demand requires, during the construction season. The extractable reserves in the project footprint are estimated to be 2,000,000 tonnes of aggregate.

The quarry will advance as the resource in the current approved 4 ha quarry is depleted, pending an Environmental Assessment (EA) approval and receipt of an amended Industrial Approval (IA). The extended quarry is anticipated to be in operation for 20 years, depending on market demand, followed by a period of final reclamation activity.

Site run-off will be collected and directed to a temporary settling pond(s). Temporary ponds and other sedimentation control measures will be constructed in advance of quarry development, to ensure adequate sedimentation control during site works and quarry development. Settling ponds will be constructed as needed to ensure that limits for maximum suspended solids in the discharge are not exceeded as stipulated in any IA Amendment that would be granted by NSE.

Decommissioning and rehabilitation plans are described in Section 5.5. Rehabilitation will commence in a progressively feasible manner thereby minimizing the disturbed footprint during the project timeframe.

3.2 Purpose and Need for the Undertaking

The purpose of the undertaking is to meet local and regional aggregate demand by allowing Nova Construction to extend the existing quarry footprint and continue operations at their quarry in the Antigonish area. The quarry currently operates under an existing Industrial Approval - 2013-085263, issued by NSE on 12 June 2013 and remains in effect until 10 June 2023. The site also has authority, in the form of Industrial Approval 2013-086120 (expiry 21 June 2023), to operate a mobile asphalt plant. This approval includes the use of the mobile asphalt plant at other sites in Nova Scotia.

Nova Construction has been operating a quarry on this property since 2009 under the NSTIR Exemption. The resource on this property extends beyond the current approved limits. Nova Construction has investigated the extent of the resource on its property and the rock meets the requirements for construction and asphalt aggregate. The resource continues north and east onto the property and therefore requires an Environmental Assessment Approval and amendment to its existing Industrial Approval to continue to supply the demand for aggregate, an important economic component of the natural resource sector, required for road building, maintenance programs and infrastructure development in the region.

Nova Construction will continue to provide direct employment to local employees and suppliers and indirect employment will continue in related industries. This natural resource sector is the highest average salary paying in the industry and one of the highest paying of all industries in the province –mostly in rural areas.

Environmental management is a priority to Nova Construction. It is the corporate objective for operations to meet and/or exceed the current standards to achieve a high level of environmental performance. This Environmental Assessment Registration Document (EARD) presents these environmental goals and outlines the Nova Construction's methodology to continue to protect the environment. Company personnel have the proven ability to meet environmental goals as is evident through the operation and successful reclamation and closure of several permitted mines and quarries in Nova Scotia.

3.3 Consideration of Alternatives

Alternatives to an undertaking are defined as functionally different ways of achieving the same end. There are no viable alternatives to aggregate extraction in this particular geology – drilling and blasting is required. Aggregate may be found in other areas but the location of a quarry with rock that can meet the technical requirements for aggregate is fixed by the local geology. This quarry is currently in operation and the resource is known to continue throughout the proponent's property. The expanded Brierly Brook Quarry will continue to serve construction aggregate markets throughout the Antigonish County area.

One alternative to the undertaking is a "do nothing" alternative. A "do nothing" approach results in no aggregate extracted from this area and no benefits to Nova Scotians. The "do-nothing" alternative would have adverse effects on potential revenues realized, potential employment, and skills development associated with the Project that would not occur. While there are a limited number of sites within 20 km of the proposed project that could be developed, this area has already hosted several quarry operations.

Alternative methods of carrying out the undertaking are defined as means of similar technical character or methods that are functionally the same. The analysis addresses alternatives to extraction methods; site layout and infrastructure configuration; processing options. The planned process is to drill, blast, crush, and stockpile material for sale.

Alternatives to processing aggregate on-site are cost prohibitive and not in line with corporate philosophy on maximizing sustainable practices. Off-site processing would involve the transport of material via local roadways to other facilities. This may in effect move the material further away from the intended market thereby raising the cost of the product due to double handling and shipping costs.

3.4 Scope of the Environmental Assessment

This document serves to provide information required by NSE to approve an existing quarry owned and operated by Nova Construction Co. Ltd. in Brierly Brook, Nova Scotia. The proposed

Project must be registered for Environmental Assessment under the Environmental Assessment Regulations of the Nova Scotia *Environment Act* as a Class I Undertaking.

The scope of this document has been determined by Nova Construction and Conestoga-Rovers & Associates (CRA), based on the Project components, activities, field studies and regulatory consultations. The *Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia* (NSE 2009) was also used to determine/focus the scope of the assessment. Provincial regulatory officials have been aware of the intention to submit the EARD for this undertaking. Provincial regulators have assisted in scoping by bringing forth issues of concern and/or uncertainty. No federal environmental triggers have been determined. Other relevant provincial and federal regulations and guidelines include the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996); *Migratory Birds Convention Act*; *Species-At-Risk Act*; *Fisheries Act*; Nova Scotia Pit and Quarry Guidelines (1999).

Methodologies and approaches to reflect current environmental and socio-economic conditions are contained in this EARD, as are results and implications of the completed formal public consultation program. Baseline data was collected as a part of preparation of this EARD. Additional information was found in publicly available documents related to the area and data collected by the proponent and consultants on existing environmental conditions. The approach to site operations, including environmental management and monitoring, is based on knowledge gathered on similar projects. CRA personnel have experience in conducting environmental assessments for other similar projects. Nova Construction has considerable in-house environmental expertise, as it relates to the design and operation aggregate quarries, that has been applied to this project.

The Valued Environmental Component (VECs) analysis is based on the project description, the environmental setting, and stakeholder input. The environmental assessment evaluates the potential effects, including cumulative effects, of each Project phase, (i.e., development, operation and decommissioning), as well as malfunctions and accidents, with regard to each identified. The VECs are as follows:

- Geology;
- Surface Water Resources and Wetlands;
- Groundwater Resources;
- Flora and Fauna Species and Habitat;
- Air Quality / Noise;
- Socioeconomic and Land Use; and,
- Archaeological and Cultural Resources.

Provincial environmental legislation and regulations apply to Nova Construction in regards to the design, site preparation, operation, and rehabilitation of the quarry. In addition to the environmental legislation, other acts and regulations relating to labour standards, best practices, and other phases are applicable to the Project. Nova Construction is aware of the applicable acts and regulations that pertain to the quarry. Nova Construction personnel have effectively demonstrated the ability to prepare the necessary information and design plans required to obtain permits and approvals, as well as the ability to operate within the requirements of such acts and regulations as demonstrated by past work at Brierly Brook, Stellarton, Point Aconi, and many other sites.

If the Project is approved, it will be subject to an EA Approval issued with Conditions of Release. The project will also require an amendment to the existing provincial IA for the site. An IA defines specific operational conditions and limitations, including dust, noise, surface water and groundwater discharge criteria and monitoring and land rehabilitation. An application to amend the IA would be submitted by Nova Construction when/if EA approval is received. This approval application is reviewed by and granted by NSE.

Nova Construction is aware of the municipal legislation applicable to this Project and will continue to work with the local planning office and staff as required.

3.5 Nova Construction - Environmental Policy

Nova Construction Co. Ltd. is committed to progressive environmental management responsibilities in the execution of its contracts. It is imperative that all operations are conducted and work performed in a manner that minimizes, to the greatest extent, any adverse effect to the environment.

Nova Construction Co. Ltd. pledges to adhere to the following principles in the conduct of its activities and operations:

1. Protecting the health and safety of employees of the company and members of the public who may be affected by the company's operations;
2. Reducing the discharge or emission of toxic, hazardous or other contaminants. With a goal of working towards the ultimate elimination of such discharges or emissions;
3. Striving to meet or exceed regulatory requirements applicable to the company's operations.
4. Reducing the amount of waste; particularly hazardous waste, created by the company's operations.
5. Ensuring that water is transported, handled, and disposed of in a safe and responsible manner, in accordance with regulatory requirements;
6. Striving to prevent spills and other accidents;

7. Ensuring the use of safe operating procedures and technology in order to minimize environmental, health and safety risks;
8. Maximizing energy efficiency and conversion.

Section 4.0 Public Involvement

Public consultation is a key element in the environmental assessment process in that it allows the proponent to gather and use information from communities surrounding the project site and use this information in final project design. Nova Construction understands the value of public engagement and appreciates the community input on the project and envisions a long and mutually beneficial public engagement program for the Project.

4.1 Methods of Involvement

The intent of the public involvement program was to (a) provide information about the intended project; (b) elicit questions, concerns, or suggestions from the local community and other stakeholders; and, (c) attempt to address those questions / concerns either through the provision of information or accommodating changes to the Project design.

The consultation program was undertaken following the completion of the environmental baseline study program for the project. This approach was used to be able to provide the public with current information on that environmental status of the properties in question. The local community is already familiar with Nova Construction as an operator in this area (this quarry has operated since 2009) and familiar with extractive industries, as there are several pits, quarries and mines in the vicinity. There have not been any reported issues with the existing site under previous or current operating Industrial Approvals.

The following listed activities have been undertaken by the Company with respect to public consultation and communications:

- Letter of introduction of the project to First Nations Communities
- Discussions with stakeholders, government agencies
- Public Information Session for EA – Brierly Brook Quarry

Materials used as part of the public consultation program are located in Appendix B.

4.1.1 Public Information Session

A Public Information Session was held on Wednesday, April 2nd 2014 (12 pm to 9 pm) at the quarry. The Session was advertised by flyer-to-the-door delivery of about 60 addresses in the Brierly Brook area (delivery on March 27th); in the community newspaper - The Casket on March 26th and April 2nd; and the provincial newspaper - The Chronicle-Herald, on March 29th, 2014. The Public Information Session was advertised on the site signage for 10 days prior to the event as well.

A series of panels provided an explanation of the proponent and the project which explained the following:

Panel Name	Panel Description
Environmental Assessment Process	Described the EA process as a tool and how the community input is important to the process.
Who is Nova Construction?	Introduction to the company, where they operate and are headquartered.
The Quarry Project	Specific details on the project being proposed and key components, including project timelines, size and what types of material are being extracted.
Processing	Description of the aggregate processing methodology.
Environmental Baseline Studies	An overview of the various studies completed and key results. Outline of the process to return the site to a state at least equal to that prior to disturbance.
Reclamation Plan	Preliminary Reclamation Plans showing typical slopes and results/goals.

Participants were asked to sign in to the Session and introductions were exchanged. A pamphlet, outlining the panels and further contact information, was distributed as a takeaway. Participants then viewed the various panels and information and were assisted by company representatives and consultants with any questions that they had. A summary of the number of participants and their home community is provided in Table 4.1.

TABLE 4.1: HOME COMMUNITIES OF PUBLIC INFORMATION SESSION PARTICIPANTS

Location	Number of People
Brierly Brook	11
Antigonish	2
Total	13

Comments from the participants were discussed and recorded. This format allows all participants to get a sense of the primary issues/concerns raised, how Nova Construction answered these questions, and how they used this information to address specific aspects of the Project. A summary of the comments is provided in Table 4.2.

4.1.2 First Nations

Registered letters, dated August 11, 2014, were sent to Chief Andrea Paul and Chief Paul Prosper, of the Pictou Landing and Paqtnkek First Nations respectively (Appendix B) describing the project and offering information sharing. Subsequent emails have been sent to the Chiefs offering information on the project and the schedule of the EA submission. First Nations were formally consulted on the project by NSE during the Industrial Approval in 2013. To date, no

response has been received regarding this project from the Chiefs; however, Nova Construction is prepared to openly discuss any aspect of the project that may be brought forward by First Nation interests.

Nova Construction will engage in discussions as warranted and are cognizant of the “Made in Nova Scotia Process” for Mi’kmaq engagement. A separate copy of the EARD will be sent by Nova Construction to Pictou Landing and Paqtnkek First Nations, if requested. Any concerns that are forthcoming to Nova Construction will be submitted to NSE as part of the public review of the EARD.

First Nations input through the EA public review process is important and encouraged by Nova Construction. Nova Construction will be pro-active in its attempt to address any First Nation's concerns.

4.1.3 Regulatory Agency Consultation

Prior to commencing the environmental assessment process, Nova Construction engaged in discussion / meetings with NSE officials to understand the process of expanding their existing operation and the legislative requirements in the successful approval of the project. These discussions/ meetings served to assist with defining the project footprint and identifying possible impediments to the project that can’t be addressed through design or management, of which none were noted. Nova Construction will continue to be in contact with these regulatory agencies and others identified in the EA process as the project progresses. Further, a Draft of this document was vetted through government agencies for comment prior to this current final submission. Comments by regulators and how they were addressed are listed in Table 4.2

TABLE 4.2: SUMMARY OF COMMENTS RAISED BY GOVERNMENT AGENCIES ON THE DRAFT EA

Comment	Response
Project is located in a Mainland Moose Priority Area.	Noted. Moose surveys following approved NSDNR survey protocol were conducted. No moose were encountered or signs of moose observed on the project site. (See Section 6.4 & Appendix C)
If wetland 2 and 3 are removed during the quarry expansion process, what will be the impact on the small watercourse and potentially on Brierly Brook?	Given the low water storage capacity in Wetlands 2 and 3, and the minor input of flow from Watercourse 1 into Brierly Brook, project activities are not likely to have any significant impact on stream flow and biota within Brierly Brook. Watercourse 1 is not fish habitat, and provides little habitat for other species. (See Section 6.2)

Comment	Response
In order to capture the worst-case scenario for noise generation, if noise is to be monitored, it is advisable to place the noise monitoring equipment on the boundary of the expanded quarry's footprint and to monitor noise levels during a period of peak truck traffic when on-site equipment is operational and the highest volume of traffic is expected.	The monitoring locations are noted and the application of monitoring equipment will be applied in the manner suggested in the comment or as directed by NSE.
Mapping needs to be included which clearly shows these water features in relation to the quarry, the overall property, settling ponds and other mitigation measures, down-gradient water resources, etc - with drainage patterns clearly discerned.	Maps throughout the document show all the features noted; however for clarity a single map of these features is given in Figure 6.2-2
Brierly Brook located down-stream is known to be significant fish habitat and needs to be protected. Down-gradient areas from the quarry therefore, need both water quality and water quantity protection from quarry activities.	Surface water quantity and quality in Brierly Brook is protected via a number of site measures and existing environment. For quantity the site does not use water for aggregate washing and does not have a water supply well. For quality concerns there are no direct pathways for effluent as they go through an existing settling pond and planned ponds in the future, site discharge, if any, is monitored as requested for TSS and pH and possibly more parameters as directed by NSE. Site measures for sediment and erosion control are also important to prevent impacts to down-gradient surface watercourses.
It would be good to have some mention in the report about whether there are any nearby or in down-stream watersheds. And should include if there is a potential to impacts such water supplies – with mitigation proposed if there is.	Discussed in Section 6.3.1 and shown on Figure 6.3-1
Mention of Environmental Protection Plans, Stormwater Management Plans, Contingency Plans, or Water related Monitoring Plans should be included in some detail explaining how they will protect surface water resources.	These plans are already in place in the operating quarry. There are no direct pathways from the quarry to water courses. Detailed plans will be adjusted as a function of the amendment to the Industrial Approval.
The chemical analysis provided for surface water samples taken, should have the lab detection limits (dl) for TP and ortho –P set to the lowest level possible (generally dl of 0.001 to 0.005 ug/l) . The dl their lab has currently reported seems to be 0.010 ug/l as some ND (non-detect) values are reported. The chosen dl for P related parameters is not currently appropriate to properly and adequately characterize surface waters in NS.	Noted. Future surface water sampling will take this into account.

Comment	Response
Local land users with wells within the 2km impacted area should be notified of work being completed due to the development of the site and the potential impact to the safety and quality of their drinking water. Baseline water chemical testing should be provided for any potentially impacted well users with follow up water chemistry testing to be completed immediately after and also one year after construction is completed. Since blasting occurs every year, we would recommend regular sampling of residential water wells. If the company is not going to do so, they should at least advise residents to sample their water on a regular basis. Changes to water quality chemistry due to activities associated with the development of this project should be remediated. In addition, any spill or activity that impacts the ground water table should be immediately communicated to well owners within the potentially impacted area.	This is an existing quarry that has met the requirements for Industrial Approval. The proponent has had good communication with local residents and routinely meets with residents to discuss issues such as water related issues and blasting schedules. A water sampling program is conducted in the Spring and Fall of each operating year and the results are communicated to the land owners.
The document does not reference how the Proponent will deal with complaints/concerns from local residents during operations. It is recommended that the Proponent has a procedure in place to deal effectively with complaints from local residents to ensure the concerns raised are addressed and corrected.	This is an existing quarry that has met the requirements for Industrial Approval. Site personnel routinely discuss concerns with residents and site visitors. NSE has not, to date, indicated that additional measures need to be implemented. Amendments to the Industrial Approval may be required following receipt of EA Approval that could include a formal complaint resolution process..
No Environmental Protection Plan was discussed; however the components of an EPP were discussed. The Proponent should have a document in place for employees to follow in order to protect natural resources, as well as the health and safety of workers and the public.	This is an existing quarry that has met the requirements for Industrial Approval. Amendments to the Industrial Approval may be required following receipt of EA Approval.
High barium and turbidity were noted for a few drinking water samples – were the homeowners offered any information in regards to their water samples? It was also noted that most wells had issues with E. coli and total coliforms – were the homeowners offered any information in regards to this (health effects, remediation techniques, Boil water advice)?	Yes the results and NSE water quality and well construction information were provided. E.Coli and total coliform issues predate the quarry development and are known issues based on well type (dug - shallow till), underlying geology (gypsum) and condition of the wells (cover type, over growth, etc.).
High aluminum and cadmium were found in surface water testing but it was not noted if this was due to the operation of the proponent or naturally occurring. More information is needed.	Naturally occurring. A summary of results is provided in Section 6.2
There is no adequate consideration of potential effects of the project on migratory birds, including migratory bird species at risk and species of conservation concern.	Revised in Section 6.4
The revised EARD for the proposed project should clearly identify potential effects of the proposed project on migratory birds, including bird species at risk and species of conservation concern, as well as mitigation measures to address potential effects, and a monitoring plan to verify impact predictions and adequacy of mitigation measures for species at risk.	Revised in Section 6.4

Comment	Response
It should be clarified whether activities would be taking place at night, and if so, describe measures to avoid adverse effects on birds.	There are no planned activities at night. Typical work days in summer months may be from 7 am to 9 pm – during daylight hours – depending on demand.
If there is ultimately a need to decommission a building or structure used for nesting by gulls, swallows, or other species of migratory birds, Environment Canada's Canadian Wildlife Service (CWS) should be consulted in a timely manner in advance of any proposed decommissioning activities for species-specific considerations.	Noted. No permanent buildings or structures are located on or planned for the site.
Since Common Nighthawk and Bank Swallow may be attracted to habitats created by the proposed project, the proponent should describe how it would react should these species choose to nest in the project area during any phase of the project.	<p>Clearing will take place outside of the breeding bird season. Bank Swallows have not been observed on site and, given that this is a rock quarry, unlikely. Stockpiles of material are typically too coarse for these birds to nest in and stockpiles are moved frequently enough during the breeding season to make these unattractive for nesting. Bank Swallows prefer sand and silty sand of which there is little to none of this material in the overburden of the site or product stockpiles.</p> <p>If Common Nighthawk nests are identified on the project sight, a no work perimeter will be established and avoidance of the area will maintained until hatchlings have fledged.</p> <p>Neither bird has been identified during field studies.</p>
A variety of species of plants native to the general project area should be used in revegetation efforts. Should seed mixes for herbaceous native species for the area not be available, it should be ensured that plants used in revegetation efforts are not known to be invasive.	Noted.
It is the responsibility of the proponent to ensure that all reasonable measures are conducted to prevent the release of substances deleterious to fish from their proposed activities. In general, compliance is determined at the last point of control of the substance before it enters waters frequented by fish, or, in any place under any conditions where a substance may enter such waters.	Noted. No fish habitat is known on site in the proposed disturbed area and there are no other direct pathways to streams off site.
Hazardous materials (e.g. fuels, lubricants, hydraulic oil) and wastes (e.g. waste oil) should be managed so as to minimize the risk of chronic and/or accidental releases.	Noted. See Section 5.4 - Hazardous Waste; Petroleum, Oil and Lubricants (POL)
In order to satisfy minimum requirements the following subparagraphs require additional information, please ensure at least one document provides the name and signature of the Chief Executive Officer or a person with signing authority, if the proponent is a corporation.	See page 2 of the document.

Comment	Response
Subparagraphs (xiii) all steps taken by the proponent to identify the concerns of the public and aboriginal people, (xiv) a list of all concerns expressed by the public and aboriginal people and (xv) all steps taken or proposed to be taken by the proponent to address concerns of the public and aboriginal people under subclause (xiv).	See Section 4.0.
To facilitate review of a registration document, a concordance table detailing the response to government draft review comments is recommended.	This table addresses this comment.
You are reminded that the proponent is responsible for the publishing of the environmental assessment notice in two papers, one having local distribution and one having province-wide distribution within seven days of registration.	Notices will be placed in the Antigonish Casket and the Chronicle Herald.

4.2 Public Comments and Steps taken to Address Public Issues and Concerns

An important element of public consultation is to use the information in the final design of a project. Nova Construction recorded all comments made at the Public Information Session, and any emailed or phoned in concerns (see Table 4.3) and has used this feedback in the project's final design as noted in the table and throughout this document.

TABLE 4.3: SUMMARY OF COMMENTS AND CONCERNS RAISED BY STAKEHOLDERS

Question/Issue	Response
Will there be any/regular ground water monitoring/well testing in the properties surrounding the quarry?	Yes, monthly in the wells on the adjacent properties, or as specified by NSE.
Could additional wells be created between Nova Construction property and neighboring properties and tested regularly to act as an early warning system for any ground water contamination?	Nova Construction will install monitoring wells at the southern boundaries of its property in consultation with hydrogeologists and NS Environment.
Would Nova Construction consider adding a larger berm on the south side of the quarry to act as a sound barrier to neighboring properties?	Yes, this would be a cost effective and quick modification to reduce noise generated at the quarry during operations.
Would it be possible to convert the reverse beepers on the trucks to a strobe light at nighttime? Or to change the pitch of the beepers to a lower tone so it doesn't travel as far.	Nova Construction will review the requirements and legislation with NS Labour and Advanced Education to determine if other options are available.
Nearby homeowner complaint that the mobile pavement machine emits foul smell and blows over property and valley. Would like to have the emissions tested and ensure machine is working properly.	The machinery is new and testing is being completed to optimize the plant. This plant is mobile and will not necessarily be on this site unless there is local work for it to produce asphalt. The site has an operating permit – Industrial Approval 2013-086120 for the asphalt plant, which legislates environmental parameters that the operation must meet and the monitoring requirements of the facility.

TABLE 4.3: SUMMARY OF COMMENTS AND CONCERNS RAISED BY STAKEHOLDERS

Question/Issue	Response
Is Brierly Brook Rd. (a gravel road leading into the Quarry) going to be able to handle the truck traffic as a result of the expansion?	Yes. It has supported the truck traffic as a result of the quarry since inception in 2009. There will not be an increase in tonnage removed from the quarry per year so the current condition of the gravel road should remain. NSTIR has not indicated there are concerns with road design or operation of the quarry.
The trucks are sprayed with a solution for cleaning. Community members are worried that the solution is harmful to the environment/ground water.	This solution is biodegradable and will not harm the watershed. All products are reviewed and approved by NS Transportation & Infrastructure Renewal prior to use. Only trucks used in the asphalt operation are cleaned in this manner.
Are there going to be any additional, NEW activities at the quarry with the planned expansion?	No, it will be all the same operations as presently undertaken at the quarry.
Why didn't Nova Construction have the community engagement session in a more community centered location?	Nova Construction wanted the community to be able to see the site and understand the size and arrangement of it. Nova Construction wants to be as transparent as possible with the community in which they operate.
Is there a resolution policy in the event that something happens? (i.e. if well water is contaminated what will NC do?)	A Domestic Well Policy will be a likely requirement of any EA approval, if granted.
One community member counted 11 trucks in 3 minutes in both directions (2013). The concern is that there will be an increase in truck traffic on Brierly Brook Rd as a result of the expansion.	Although the quarry is expanding from 4 ha to 14 ha and is expected to be operational for an additional 20 years, the tonnage extracted from the quarry annually should not change. As such, there is no expected/planned increase in truck traffic on Brierly Brook Rd. Highway construction in the area has created periods of higher truck traffic, some of which originated from this quarry.
How large is the expansion going to be?	The quarry will be expanded from 4 hectares to 14 hectares, largely on the north side of the quarry. The site will be progressively reclaimed to minimize active areas.
How long does the reclamation process take?	The site will be progressively reclaimed as the site develops to minimize the operational footprint of the site. Final reclamation, which includes post-reclamation monitoring, could take up to three years after the cessation of extraction activities to return the site to a safe, stable and vegetated state.
How often will the blasting be? Can a notice be sent out?	There will be about 1-2 blasts per year. Yes, currently a notice is delivered to residents in the area (within 800 m and beyond) one (1) day prior to the blast.
Can a notice be sent out to a greater number of homes/community members in the area prior to each blast? (more encompassing)	Yes, Nova Construction will deliver a notice to more people in the area upon request.

TABLE 4.3: SUMMARY OF COMMENTS AND CONCERNS RAISED BY STAKEHOLDERS

Question/Issue	Response
Will truck traffic increase? Drivers need to be better trained/retrained to consider speed, especially during times of school bus pick up and drop off on Brierly Brook Rd.	Truck traffic is not expected to increase. Ongoing programs (e.g. toolbox meetings) to remind drivers of safety issues in the area will occur daily or as required. Nova Construction can only control their own truckers; contractors must be reminded of the safety rules. Also other pit and quarry operators are in the vicinity.
How many years will the quarry be in operation?	This expansion will increase the useful life of the quarry for approx. 20 more years given the predicted volume of rock able to be utilized in the expansion to 14ha.
Spilled gravel on Brierly Brook Rd has resulted in chipped windshields for community members. Is there anything Nova Construction can do to mitigate or compensate these individuals?	Truck covers will be used where available to reduce spillage. Contractors may not have covers on their trucks.
What is the normal workday schedule? What are typical work start and finish times; truck driver start and finish times?	Typically, during the construction season, the site will operate 7am to 7 pm 5 to 6 days per week depending on market demand. At other times of the year the site will have little activity except for security and maintenance.
Is it all rock? Or are there other materials being sorted out and the gravel extracted?	Aside from a few feet of topsoil and overburden, everything under the surface is rock, which can be used in its natural form once crushed to various desired sizes. Topsoil / overburden will be/is stockpiled and reused for reclamation purposes.

Section 5.0 Description of the Undertaking

5.1 Geographic Setting

The project site is located at civic address 319 Brierly Brook Rd, Brierly Brook, Antigonish County, Nova Scotia (Figure 1) which is approximately 6.5 km west of Antigonish and 43 km east of New Glasgow. The coordinates at the centre of the project site are 571360 E, 5050970 N (UTM Zone 20 NAD83 CSRS). The project property (PID 10111946) is owned by Nova Construction.

The site is located in a rural area of north-central Nova Scotia, classified as Nova Scotia Uplands Ecoregion – Pictou-Antigonish Highlands Ecodistrict. These Highlands are underlain by a block of complex Precambrian and Carboniferous aged crustal rocks which are bounded and transected by numerous faults that result in steep-sided hills and valleys where the faults cut across the resistant strata (Neilly et al, 2003).

The existing elevation of the property is 115 masl in the southeast corner to approximately 220 masl in the northwest corner. The elevation of the working and planned quarry area ranges from approximately 180 to 220 +/- masl. The site slopes to the southeast towards Brierly Brook which flows in an easterly direction to West River and then to Antigonish Harbour. Figure 3 provides local context of the project, quarry configuration and identifies adjacent land ownership.

5.2 Project Components

Nova Construction began the existing quarry operations in 2009 under a Nova Scotia Transportation & Infrastructure Renewal (NSTIR) exemption. Subsequently, an Industrial Approval for 4 ha was issued for the site in 2013.

The Project seeks environmental assessment approval for the quarry that has had an average annual production of approximately 100,000 tonnes of aggregate. The quarry will have a similar production rate, however, this may increase or decrease depending on market demand. No permanent infrastructure other than the construction and maintenance of settling ponds to control site runoff is required.

Site activities will include the blasting, extraction, crushing, stockpiling, loading and hauling of aggregate. The aggregate will be transported by trucks to existing markets as required over existing roads and highways. The operation will consist of a lay down area for the portable crushing equipment and screens, various aggregate stockpiles, and weigh scales, as well as the physical features of the site such as the quarry floor and active working faces, and site settling

pond(s). Nova Construction conducts their own drilling and blasting and is supplied with explosives to the site as required. No explosives storage is required on site.

Organic overburden (*i.e.* topsoil/grubbings) will be used in the progressive rehabilitation of the existing and proposed quarry or stockpiled for future rehabilitation activities.

Within 2 km of the quarry property there are 39 properties with structures. Given the rural/agricultural nature of the area it can be assumed that most of these locations are residential or have a well for potable water supply. Therefore, within a distance of the quarry property the following number of residences have been determined: 500 m – 2 (440 m); 800m – 4; 1.0 km – 5; 1.5 km – 8; and 2 km - 39.

The proposed active area of the quarry has been determined by using setbacks, as defined by the current Industrial Approval and provincial legislation, for water and wetland features (30 m), road right-of-ways, property lines where there is a structure on the adjoining property (30 m), property lines where no structure is on the adjoining property (15 m), and existing offsite houses/structures (90 m). No offsite structures are within 90 m of the site. Figure 3 identifies setbacks.

5.3 Site Preparation and Construction

The site is accessed from the graveled Brierly Brook Road and a paved (to help with sediment and erosion control) site access road is in place. Equipment used for grubbing the site will be required in the early phase of the project and subsequently throughout the project life as the quarry develops. Mobile equipment – drillers, excavators, loaders, crushing - will remain in place during operations.

The surrounding forested areas consist of a mixture of coniferous and deciduous trees of various age classes; however, the property contains mostly mixed regenerated forest species that include birch, maple, spruce and fir. Any merchantable timber on the site will be harvested prior to grubbing. Any remaining vegetation and wood material will be saved and used to the greatest extent possible for rehabilitation activities on site.

The removal of topsoil and grubbing will be completed in a progressive nature according to the development plan. This will minimize the extent of disturbed area at any one time. This material will be removed by excavators, trucks and dozers and then stockpiled for use during rehabilitation activities. Run-off from the site will be directed to a settling pond(s) to allow time for any suspended solids to settle prior to leaving the site.

There are no plans for the bulk storage of liquid petroleum fuels on site. No hazardous materials will be stored on site. Fuel will be transferred to quarry equipment by mobile fuelling

trucks as required. Should petroleum impacted soil or groundwater be identified, the affected material will be handled, transported and disposed of according to all applicable legislation.

5.4 Operation and Maintenance

The quarry (loading, crushing) will operate during daylight hours, however other site activity may occur in predawn or twilight hours. Twenty-four hour operation is not envisioned for this site. Load and haul activities may occur 12 months of the year. Crushing and stockpiling operations will normally be conducted during the construction season (May – October) or as demand requires.

Excavators and front end loaders will be the primarily used equipment to excavate material from the active working faces. Material will be processed onsite through a portable crushing plant. The various aggregate products will be stockpiled in adjacent areas within the quarry. Piles will be constructed so as to ensure segregation of material and prevent mixing of different piles. A combination of conveyor belts and front end loaders will be used to move material from the screens and classifier to the stockpiles. Front end loaders will be used to load stockpiled material onto trucks. Products will be weighed and transported from the quarry via highway class trucks. The average daily number of vehicle movements will be in keeping with current production volumes and future market demand.

Nova Construction is aware of spring weight restrictions and will adhere to them.

The equipment and accessories used in the operations will be fairly consistent through the life of the project and may include:

- excavators; front end loaders;
- portable crushing equipment;
- dump trucks;
- utility vehicles: pick-ups, mechanic service vehicles;
- tractor and float.

Final design of all aspects of the quarry will be in accordance with appropriate legislation.

Site Material

Site material will consist mainly of unusable aggregate, grubbing, and organics produced from the development of the quarry. This material from the quarry will be used, as appropriate, for infrastructure development and reclamation. All stockpiled materials will be stabilized as required.

Erosion and Sediment Control

Surface water management will be important during site development and operation to address erosion and sediment control. Sediment-laden stormwater runoff will be prevented from entering surface waterbodies. Surface water collected in the quarry will be directed to sediment control ponds that will be designed to allow sediment to settle from the water (treated) prior to the water being released to the environment.

Nova Construction is familiar with and routinely employs techniques recommended in NSE's Sediment and Erosion Control Handbook for Construction Sites. This document will be used in the design of all mitigative measures. In addition, industry best practices will be consulted and reviewed in the development of a comprehensive erosion and sedimentation prevention and control strategy. Typically, a 100-year return period storm event is used in design (however this may be dependent on the life of the project). Design criteria would be reviewed with NSE during the IA Amendment stage to ensure adequacy.

Ditching may be constructed to direct surface water runoff to settling ponds on the site as part of surface water management. Ditching may be vegetated to minimize erosion. As needed during establishment of grass cover, temporary erosion and sedimentation control measures will be in place (e.g., rock dams with geotextile, hay mulching, etc.). Existing and new berms are used at the site for drainage control, noise buffering and visual impact mitigation.

The maximum suspended solids concentration levels will be monitored for compliance as directed by the IA and mitigation will be implemented if non-compliance occurs.

An NSE approved Environmental Protection Plan and Spill Contingency Plan is currently in place for the operating quarry. Any requirement to amend these plans will be completed in conjunction with an amendment to the Industrial Approval.

Solid Waste

Garbage produced on the site will be picked up by an approved licensed contractor for appropriate reuse or disposal to a provincially approved waste disposal facility.

Liquid Effluents

No on-site sewage treatment system is or will be installed. Portable toilets may be used on site as required and will be maintained by Nova Construction or their subcontractors.

Airborne Emissions

Equipment exhaust and dust will represent the majority of air emissions from the site. Emissions produced will include carbon monoxide, carbon dioxide, oxides of nitrogen, sulphur dioxide, and dust. Emissions from the burning of hydrocarbons will be managed through the

use of clean burning, low-sulphur diesel fuel and propane. All equipment will be properly maintained and inspected and engine idling will be reduced when not in use to further decrease emissions from the site.

Dust will be generated in the quarry through most activities. Nova Construction will implement operational dust reduction methods (primarily through the application of water) to reduce potential fugitive dust emissions at the site. As required truck covers will be used to reduce the generation of dust during transportation of aggregate.

Noise Emissions

Noise emissions will result from drilling, extraction, processing, and transportation operations. The contributors to noise on site will be heavy equipment such as crushers, excavators, loaders and trucks.

Nova Construction will control operations and equipment to ensure that noise levels are kept within recommended limits for quarry operations. Site noise levels may be periodically measured at the property boundaries as directed by NSE. Nova Construction will investigate exceedances of noise guidelines attributed to Project activities. Certain equipment noises associated with extraction activities may have a specific regulated safety requirement such as back-up beepers. Other methods (*e.g.* strobes) could be used as warning indicators with the appropriate agency approval. Pre-blast warnings will be audible beyond the site for short durations within schedule timeframes.

Hazardous Waste

Materials needed for quarry site operations will be stored in accordance with applicable legislation. Explosives will be used on the site by Nova Construction as required. No explosives storage is required nor will be maintained on site.

Petroleum, Oil and Lubricants (POL)

Nova Construction is familiar with the requirements for petroleum management. The Project will require the use and handling of petroleum products such as fuel oil, gasoline and lubricants on site. Mobile equipment will be fueled within the quarry from local fuel supplier's trucks. No liquid petroleum storage will be maintained on site. If temporary storage of any POL is required, the activity will be conducted in compliance with applicable legislation for quantities and container types. Any location where refueling is taking place will be equipped with a spill kit and the operators will be trained in their use.

Within the context of the current site, the handling of bulk quantities of POL is administered by the following regulations that have been enacted within the *Nova Scotia Environment Act* (NSEA):

- Petroleum Management Regulations,
- Emergency Spill Regulations, and
- Used Oil Regulations.

Federal legislation and regulations exist that apply to the storage and handling of POL, however, they generally only apply to Federal sites and would not be applicable to the subject property. In general, the applicable provincial requirements mirror federal legislation and have been developed in consideration of them.

Nova Construction is aware of the legislation around POL and will comply with the current and any updated regulations.

5.5 Decommissioning and Rehabilitation

Rehabilitation, the final phase of the project, will return the area to a condition that is consistent with the natural surroundings and community use. Two types of rehabilitation could be completed - progressive (during operations on stable areas that are no longer required for production) and final rehabilitation (after the cessation of extraction and related activities), for any areas that are not reclaimed progressively.

The goal of rehabilitation is to produce a landscape that is safe, stable and compatible with the surrounding landscape and final land use. This is generally achieved by grading, contouring, capping with soil, revegetating, and time. Progressive rehabilitation is understood as an integral part of project planning that keeps potential future land uses in mind. Nova Construction considers the goal and responsibilities of reclaiming a quarry to be a key element of the project plan, and will return the land to a state equal to or better than that that existed prior to disturbance within the scope of existing industry practices.

Nova Construction plans to use their resources for rehabilitation activities. Dozers and excavators will be used to grade and contour the side slopes of quarry walls to ensure that they are stable and meet the legislated slope requirements. Rock lined ditches and drainage channels will be constructed as necessary to control run-off and prevent erosion of the exposed soils. Steeper slopes will be graded to 45° (1H:1V). The rest of the site will be gradual slopes; however slopes may be developed that are typical of the site prior to disturbance where practicable. The reclaimed site will typically be seeded with a naturalization mix of native grasses, fescue, trefoil, clover, and some native tree species will be planted.

It is anticipated that the rehabilitation program will be completed within a two to three year period from the end of the extraction phase being completed. Additional details on timelines

will be developed as part of the IA Amendment process and conditions of an EA approval if granted.

Section 6.0 Valued Environmental/Socio-Economic Components (VEC) and Effects Management

Conestoga-Rovers & Associates (CRA) conducted field studies from April 2013 to May 2014 to determine the existing baseline conditions of the quarry. From these studies CRA, in consultation with the proponent and regulators, was able to determine appropriate mitigation, as required to minimize environmental effects from the proposed development of the quarry. These surveys consisted of: plant survey; wetlands survey; and breeding bird survey. These surveys were undertaken by qualified biologists employed by or under contract to CRA. A desktop assessment and field reconnaissance of potential archaeological and heritage resources was undertaken by a professional archaeologist in July 2013.

Additional information, in support of the field studies, was gathered through a review of digital imagery, site mapping, Atlantic Canada Conservation Data Centre (ACCDC), and NSE.

Spatial boundaries are defined by the Project footprint, as directed by prescribed setbacks, and the immediate area surrounding it, within which the VECs are likely to interact with, or be influenced by, the Project. Temporal boundaries are of short duration, limited to the Project and post-Project (i.e. Rehabilitation) activities.

Potential environmental effects of a project and the significance of an effect consider the geographic extent, magnitude, frequency, and duration of each effect. The prediction of the residual environmental effect is developed through professional judgment and the application of proposed mitigative measures.

6.1 Geology

6.1.1 Existing Environment

Soils

The soils of the Antigonish Highlands are classified under the Thom Catena scheme (Figure 6.1-1). They are derived from shale, conglomerate, metamorphic rocks and sandy loam till. These soils are usually well drained due to the relatively high porosity and permeability. However, steep slopes in the region encourage runoff and depressions restrict water movement causing poorly drained soil (Cann, 1954). These are the principal soils found in the highlands of Antigonish. The soils are generally shallow, up to 20 inches, and overlie a shallow till on an undulating topography. The Thom soil series is associated with the Forest Ecosystem Classification - Soil Types ST2 and ST19. ST2 is mainly associated with fresh, coarse-loamy soils dominated by sandy loam texture. Site drainage ranges between rapid and moderately well depending on slope position, slope percent, and subsoil permeability. Talus rock deposits which are still relatively active or young characterize ST19. Bare, angular stones with pockets of

organic matter found on or between rock fragments are found at surface with are generally dry conditions. Overall drainage conditions can be variable due to seepage inputs. (Keys et al, 2011)

Surficial Geology

The Brierly Brook area is host to several major till types which all have strong relationships with parent material in terms of composition and distribution. The lowland area is mostly a silty till plain; however, there are known deposits of Cretaceous age unconsolidated white silica sand and kaolinite through the Brierly Brook valley (Stea et al, 1995). The uplands are predominantly glacially scoured, near surface bedrock with thin (1 - 4 m), discontinuous veneer of glacial till (Figure 6.1-2). Colluvial deposits, composed of water sorted sands with silt and gravel units, are found along the slopes between the uplands and valleys. The site exhibits both near surface bedrock and colluvial deposits.

Bedrock Geology

The Brierly Brook Quarry is situated on the James River Formation (Figure 6.1-3) of the Georgeville Group and forms the core of the northern highlands. This formation is composed of light green to green-grey to locally maroon, well laminated to thinly bedded, cherty siltstone, locally interbedded with minor grey to red fine- to coarse-grained sandstone and minor rhyolitic lapilli tuff (White, 2011). Murphy (1991) and others had assigned four different formation names to the area based on differences in sedimentary characteristics that White (2010, 2013) did not recognize consistently during more recent studies, thus reassigning these into a single formation. The Windsor Group is located to the south of the Brierly Brook site.

Acid Rock Drainage

Acid rock drainage (ARD) refers to the outflow of acidic water from (usually abandoned) metal mines or coal mines or disturbance from construction (highways, housing, commercial developments) in some environments where mainly iron sulphides may be exposed in the strata. When these environments are disturbed and come into contact with water, oxygen, and iron reducing bacteria, the sulphide minerals, become oxidized and acid is generated in the process. The presence of iron reducing bacteria serves as a catalyst that accelerates acid production and the potential for generation of acid rock drainage (ARD). There are no reports of Halifax Group slate, the main concern for generating ARD in Nova Scotia, in the area where the disturbance will occur and it is not intended that bedrock will be quarried if encountered. The carbonate host rocks underlying the aggregate resource are acid consuming and would buffer any ARD, if present.

Based on a review of available regional geological mapping, and a personal communication with NSDNR geologist Dr. Chris White, P.Geo., (2014) there are no known occurrences of acid generating rocks in the immediate project area. The geology and mineralization in the study area do not produce acid generating conditions such as in areas underlain by Halifax Group

rocks. Results of acid rock potential testing on a quarry sample in January 2014 indicates that the acid consuming ability is much higher than the acid producing ability of the rock, therefore making the rock a net acid consuming material (Appendix F). ARD is not an issue on this site but periodic testing of the materials excavated will occur.

Karst Topography

No Karst topography features are associated with the Project site (see above); however, as discussed herein, karst features are mapped within the region and an explanation is given for context. Karst is a topographic feature with distinctive characteristics of relief and drainage arising from a higher than normal degree of solubility in rock, especially carbonate rocks and evaporates (Jennings 1971), such as those found in the Windsor Group which accounts for about 5.5% of the province's geology. The solution processes developed over many thousands of years manifests itself at the surface in the form of sinkholes, vertical shafts or pipes, disappearing streams, and springs to complex caves and underground drainage systems. Solution caves are known to occur in gypsum and limestone areas (Davies & Browne 1996).

The Windsor Group karst development across the province can be variable. Several periods of glaciation have exposed, eroded and reburied earlier developed karst leaving a thick deposit of glacial drift over many of these beds. However, where the strata have become exposed at the surface, a distinctive highly karstified landscape is evident. Karst topography does not easily lend itself to development. Typically these areas are avoided for development because of the potential for sinkholes. The extent and distribution of karst landforms in Nova Scotia is unknown. In general, karst areas in Nova Scotia have remained, except for mining and farming activities, undeveloped.

As noted, no surface karst features have been identified on the proposed site, however, DeMont and Utting (2010) have shown that sinkholes do occur, especially in the Lower Windsor Group – Bridgeville Formation to the east of the site. White (2014) indicated that Deadman Lake, 1.3 km southwest of the site, is a series of sinkholes.

Paleontology

The Lower Windsor Group contains known marine fossils such as crinoids, brachiopods and corals. Prior to the glaciers covering this area, there was ongoing sinkhole activity in the gypsum and limestone rocks. Many prehistoric animal remains have been found in these Karst features throughout the province. The Project site is not located in the Windsor Group lithology so it is unlikely that paleontological resources will be found on the quarry property.

6.1.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-Up

Acid Consumption and Production in Bedrock

Acid rock drainage (ARD) is not expected to be an issue at this quarry. Nova Construction regularly tests rock for ARD potential to ensure that the material meets specifications for its clients requirements. All water collected in the quarry as a result of runoff will be directed towards a settling pond. Water leaving the site will be subject to an effluent monitoring program to ensure compliance with established performance standards for water quality.

Karst Topography and Paleontology

As noted, karst features, *i.e.* sinkholes, have been documented near the site (less than 2 km), however these are located in different bedrock material than is present at the quarry. No paleontological specimens or pre-historic remains have been reported on or near the project site. Nova Construction will report to, and work with, the Nova Scotia Museum and other interested parties if paleontological resources are found on the Project site.

6.2 Surface Water Resources and Wetlands

Surface Water Resources and Wetlands were selected as VECs because of the potential for Project activities to interact with the freshwater environment. Indicators of the VECs include aquatic life, fish habitat and surface water quality as well as potential water uses for agriculture, recreation, industry or potability. There are no agricultural, recreational, industrial or potable uses of the surface water located on the Nova Construction property. Agricultural lands are located directly south of the property.

Surface water samples were collected on August 13 and November 19 2013 at the locations indicated on Figure 6.2-1. Five surface waters were sampled although one of which was dry during the August sampling. The results from both sampling events have provided data which show normal levels for all tested substances. These surface waters represent the general surface water around the site and can continue to be tested as part of monitoring efforts. The baseline water quality data has been tabulated and is included as Appendix G.

6.2.1 Existing Environment

Regional

Nova Scotia contains an abundance of surface water features in all areas of the province. High annual rainfall and moderate to low evapotranspiration rates and a short summer period combine to make available a large volume of water for surface water bodies. The effects of glaciation have resulted in a multitude of wetlands and small lakes as well as a dense network of small streams. The province contains some 46 primary watersheds whose networks of streams and 6,670 lakes together cover about 215,000 hectares, or about 4% of the province.

The project site is in the Brierly Brook Watershed (3480 ha) that is part of the South and West River primary watershed (1DR - 90,000 ha) that flows to Antigonish Harbour and coastal areas. A southerly flowing tributary of Brierly Brook is located to the east of the property.

Local

There are no provincially mapped watercourses, lakes or areas of open water in the Project Area. Four unnamed watercourses were identified within the Project Area during field assessments. A description of the watercourses can be found in Appendix C. Watercourse 1 originates in Wetland 3 and flows southeast to the aforementioned tributary of Brierly Brook. Watercourses 2, 3, and 4 originate in seepage (WC2) and along the edge of the access road to the existing quarry (WC3, WC4). None of these watercourses are considered to be fish habitat or suitable habitat for other species. The extents of the WC2, 3, 4 were not mapped beyond the property boundary; however, it appears that the general flow is towards a tributary to Brierly Brook. These streams will be unimpeded in the development of the quarry. The relationship of site streams and wetlands to the surrounding environment are shown on Figure 6.2-2

The natural drainage in the area generally follows the surface topography and discharges into the watercourses. Surface water on the site is channeled towards the site settling ponds and treated water is released to the environment. There is no direct connection between settling ponds and streams that flow to Brierly Brook. Flow from settling ponds flow overland and is absorbed into the surrounding landscape. Any site drainage is directed to settling ponds for treatment prior to release to the environment.

There are no recorded surface water withdrawals permitted within the immediate area (pers. comm., Matlock, 2014).

Wetlands

Wetlands have been selected as a VEC because of potential interactions between the Quarry and the physical environment. Wetlands can have many functions, known as wetland functional attributes, which play important roles in natural ecosystems. Wetlands can minimize erosion and control flooding, and can reduce contaminant loads. Wetlands may also be closely linked to local hydrogeology, in that they may be groundwater recharge and discharge areas. They also perform various important biological functions, such as providing habitat for wetland species, as well as for upland species which require wetland habitat at some point in their life history. Humans also utilize wetlands for various recreational activities such as bird watching, hunting, and harvesting of wild plants, as well as commercial operations such as cranberry production and peat harvesting. In Nova Scotia, wetlands are protected under the provincial Environment Act and an approval is required for their alteration.

A wetland survey was conducted in Summer 2013. During field surveys across the Project Area, four wetlands were identified. Three of the four wetlands are located in the proposed quarry development area. These are small (1660 m² total area) isolated, treed swamps that passively collect drainage from the adjacent upland areas and variously drain to the east. The boundaries of all wetlands were delineated in the field to confirm wetland edges across the Project Area. Wetlands 2 and 3 are not hydrologically connected by obvious surface flow. Wetland 2 drains passively overland to Wetland 3, which is the headwater wetland for a tributary to Brierly Brook. Both wetlands 2 and 3 are small (601m² and 695m², respectively), with low water storage capacity, given their small sizes and lack of deep organic soil. Watercourse 1 is a small watercourse, with no significant input of flow into Brierly Brook.

These wetlands are shown on Appendix C- Figure 3, and all wetland data determination forms and functional assessment summary documents are provided in Appendix C- Appendix III.

No rare species were identified in the wetlands.

6.2.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-Up

Potential Effects

Suspended sediment and silt in site runoff is the main concern that could potentially cause adverse effects to the receiving environment. The existing conditions at the site are such that there are no direct pathways (streams, ditches) to Brierly Brook, drainage occurs via overland flow from the existing quarry. The receiving environment is further buffered from the project site by a minimum 30 m setback from undisturbed areas (stream, wetland or property boundary). For those wetlands that will be disturbed in the development of the quarry, a wetland compensation plan will be developed as required.

Given the low water storage capacity in Wetlands 2 and 3, and the minor input of flow from Watercourse 1 into Brierly Brook, project activities are not likely to have any significant impact on stream flow and biota within Brierly Brook. Watercourse 1 is not fish habitat, and provides little habitat for other species.

Proposed Mitigation

Water quality will be maintained through the use of re-vegetated slopes, drainage ditches and temporary settling ponds to capture and re-direct surface water. Drainage ditches and swales will be utilized to the greatest extent practicable to divert surface water, originating up-gradient of the property, around the quarry perimeter, thereby minimizing contact of water with the quarry floor and working faces. A settling pond will capture surface flow and allow for suspended sediment to settle out of the water column. A spill way is constructed in the settling pond to allow treated water to return to the surrounding environment. Rehabilitation may

proceed incrementally as operations continue. Decommissioning and rehabilitation plans are described in Section 5.5.

Setbacks (30m) through of undeveloped buffers around watercourses and wetlands will be observed in the development of the quarry. The wetlands noted above that cannot be avoided by the development will need to be compensated through a wetland compensation program. Nova Construction prefers to replace these wetlands through construction of replacement wetlands and will file compensation plans with NSDNR and NSE as part of the Industrial Approval amendment process if the EA Approval is granted.

Monitoring

All water discharged the site from settling pond (s) will be monitored and results compared as required by NSE. An Industrial Approval (IA 2013-085263) is currently in place and requires monitoring at a frequency and locations as determined by NSE. As an amendment to the IA, Nova Construction will suggest appropriate locations for monitoring for consideration by NSE. Typical surface water parameter would include Total Suspended Solids (TSS) and pH. During operations, where areas that are currently vegetated are disturbed, it will be particularly important to follow NSE *Sediment and Erosion Control Handbook* techniques for ensuring surface water quality is not degraded.

6.3 Groundwater Resources

Groundwater quality and quantity has not been studied extensively in the region. Some regional work was completed for the reconstruction of Highway 104 but the results are not transferable to this project. The major hydrostratigraphic units within the regional area are:

- Georgeville Group – clastics and volcanics
- Windsor Group - clastics and evaporites
- Surficial Deposits – sand and gravel, and till

The Georgeville Group of rocks generally yields little water as the mudstones and siltstones are of low permeability and porosity while the volcanics allow groundwater flow through limited secondary porosity. Water sourced from these rocks would have a high potential for elevated Fe, Ti, and other heavy metal levels due to the mineralogy of the volcanics present.

Windsor Group strata generally do not yield water which is suitable for domestic purposes due to the elevated total dissolved solids, hardness, sulphate, and iron.

Sand and gravel surficial deposits in the valley can yield large quantities of water (> 500 Lpm) of good to excellent water quality, but these deposits are underutilized. The tills generally yield

adequate quantities and quality of water within 3 to 8 metres of the surface and thus have been highly utilized in the region for domestic water supplies but are prone to elevated hardness and presence/exceedance in the acceptable level of bacterial matter (fecal and total coliform).

6.3.1 Existing Environment

Domestic Well Water Survey

Domestic wells in the area were surveyed between August 20th and September 5th 2013. Six homes (Figure 6.2-1) were included in the survey, three of which are within 800m of the project property. One home within 800m of the site was not surveyed as the owner was not available during the survey.

All homes rely on dug wells for drinking and domestic water. One house within 800m of the property also has a drilled artesian well that reaches a depth of approximately 58 meters with 33.5 meters of 150mm casing. Three of the houses draw water from sand and gravel horizons in the overlying till at depths less than five meters. Two more houses are located in colluvial sand, silt, and gravel deposits next to small streams in steep terrain. The final house is located in a low lying area with low permeable soils. This location has two dug wells reaching a maximum depth of greater than eight metres.

In general, water quality and quantity in the area is excellent. Water quality data has been summarized and is tabulated in Appendix G. However, all wells sampled reported coliform and or e-coli impacts. In all cases, general maintenance and or construction flaws that allow surface water entrance are considered the most likely source of these impacts.

Regional Water Supply

The supply of water for the Town of Antigonish and surrounding area is from the James River Watershed, which is protected under the Nova Scotia *Environment Act - James River Watershed Protected Water Area Regulations* (2006). The Protected Watershed is approximately 3 km due west of the Brierly Brook Quarry; however the quarry is located downstream of the Protected Area in an adjoining sub-watershed (Figure 6.3-1). No impacts to the protected watershed are anticipated.

Hydrogeology

The local hydrogeological regime can be characterized as two separate systems with the degree of interaction between the two systems highly dependent on the topography and local geology. In the surficial materials, groundwater movement is between the individual soil grains and moves under gradients controlled by topography. In the deeper bedrock aquifers, groundwater flow is dependent upon the degree to which fractures and voids within the strata are connected and the hydraulic head differences between these openings. In many areas, these

systems will act completely separately from each other as groundwater in the near surface systems discharges directly to surface water bodies e.g. Brierly Brook. In some areas, the bedrock groundwater system will receive direct recharge from the surface system as water migrates downward. At the quarry site there is exposed bedrock that would receive this direct recharge as described above.

6.3.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-Up

Potential Effects

Potential impacts to water wells from quarry operations are generally a function of the quarry development plans, distance from the quarry, location of a well with respect to groundwater flow directions, and individual well construction details (dug vs. drilled). There are four private wells on properties adjacent to the project site (800 m). Potential impacts from an extraction operation may include water quality deterioration of down-gradient wells from surface runoff and/or accidental releases of deleterious substances, such as petroleum, oil or lubricants (POL) within the quarry area. All wells noted are down-gradient to the site.

Mitigation

Lowering of the groundwater table and decreasing well yield is not expected (either temporary or permanent). Any surface water resulting from precipitation or snowmelt events will be controlled by means of quarry floor grading, berms, and ditching.

Effects to the groundwater quality as a result of construction, operation and rehabilitation of the site will be limited in areal extent and groundwater chemistry changes they create due to earth moving and changes in surface water flow patterns. Any release of POL will be dealt with effectively by immediately removing the impacted sediments and those sediments disposed of in an approved manner and in accordance with provincial legislation. An Industrial Approval (IA 2013-085263) is currently in place for the site that requires Nova Construction to replace any water supply, at their expense, that has been lost or damaged as a result of aggregate extraction. It is anticipated that an amendment to this IA will maintain a similar requirement.

Monitoring

Water quantity impacts are not predicted for domestic wells. There have been no complaints filed with the company with respect to water quality or quantity from previous work in the area. Nova Construction will continue to have a clear line of communication through the General Manager for domestic well complaints to be recorded and evaluated in accordance with legislation and NSE specific requirements.

6.4 Flora and Fauna

The field components of the biophysical environmental assessment were initiated in the spring of 2013 and carried through the winter of 2014, in order to complete winter species at risk monitoring for Mainland Moose. These studies were aimed at highlighting the ecological linkages within the Project Area, as well as with the habitats surrounding the Project Area. This work included:

1. Vegetation surveys for priority species across the Project Area (summer 2013);
2. Wetland and watercourse identification and surveys across the Project Area (summer 2013) (Discussed in Section 6.2 above);
3. Spring and fall bird migration surveys 2013; Breeding bird surveys (summer 2013); and,
4. Opportunistic herpetofauna and mammal survey for priority species across the Project Area (summer 2013), as well as specific transects for Mainland Moose (June 2013, and winter 2013/2014).

Flora

Flora and flora habitat is considered a VEC because of its contribution to regional biodiversity and potential interactions between project activities and the physical terrestrial environment. The presence of rare flora may be indicative of rare habitats which may support unusual assemblages of plants and animals.

Fauna

The fauna, including birds, mammals, herpetofauna, and other priority species, in this survey are considered a VEC due to their role in biodiversity and ecological integrity. Many faunal species are protected under the Nova Scotia Wildlife Act (1989) or the Migratory Bird Convention Act (MBCA) (1994). In Nova Scotia, a species is considered rare when it is listed as rare or sensitive to anthropogenic disturbance by the province (NSDNR General Status Ranks of Wild Species or the NSESA), or listed nationally by COSEWIC or SARA. In Nova Scotia, legislation protecting birds includes the MBCA and the Nova Scotia Wildlife Act. The MBCA protects migratory birds and their nests. Most bird species present in Nova Scotia are listed under the MBCA; however, it does not include avian predators such as raptors and introduced species such as European starlings (*Sturnus vulgaris*). The Nova Scotia Wildlife Act specifically protects raptors including eagles, ospreys, falcons, hawks and owls.

The details from this Assessment, including methodologies, are provided in Appendix C.

6.4.1 Existing Environment

Much of the Project Area has been disturbed, either through existing aggregate extraction or previous forest clearing.

Flora

Outside of the existing aggregate quarry, three major habitat types exist: open mixed wood forest, young tolerant hardwood forest, and disturbed habitat in early stages of re-growth following disturbance such as timber harvesting. The entire Project Area was surveyed for priority species through field assessments in 2013. In total, 118 vegetation species were identified within the Project Area; none of which were priority species.

Appendix C provides details on the flora surveys.

Birds

Avian use assessments were completed through spring migration, summer breeding season, and fall migration in 2013. There are no major concentrations of birds which occurred in the Project Area. In total, ten priority bird species were identified; one of which is legally protected by provincial and legislation. The Yellow-bellied Flycatcher, Black-backed Woodpecker, Rose-breasted Grosbeak, Boreal Chickadee, Golden-crowned Kinglet, Ruby-crowned Kinglet, Pine Siskin and Killdeer are listed as 'yellow' under NSDNR's general status ranks. The Eastern Wood Pewee is listed as 'vulnerable' under NSESA, and is listed as a 'species of concern' by COSEWIC, and the Olive-sided Flycatcher is listed by COSEWIC, SARA and NSESA as 'Threatened'. The Project Area does not offer any rare or unique habitat types upon which these species rely. Preferred habitats for all of the avian species at risk and species of conservation interest is present and intact through the Pictou-Antigonish Highlands, and the Eigg Mountain - James River Wilderness Area.

Overall, avian activity within the Project Area is consistent with expectations based on available habitat types and local species abundance and distribution. Throughout all completed seasonal monitoring, the Project Area was used most extensively by a common assemblage of passerines (songbirds). The project area does not provide any rare or unique habitats for nesting, foraging, or migration stop-over.

The habitat available within the Project Area is present across an expansive area in the Pictou-Antigonish Highlands, and is not unique or confined to the proposed Project Area. Within this Ecoregion, well drained drumlins and hummocks provide an opportunity for pure stands of tolerant hardwoods, such as yellow birch, sugar maple and beech, to thrive on the crests and upper slopes. Within the Project Area, immature tolerant hardwood forests are interspersed with uneven aged, mixed wood, regenerating forests and wetlands. As such, the removal of habitat within the Project Area and potential indirect effects on habitat surrounding the Project Area are not likely to significantly impact migratory birds, or bird populations (including species at risk and species of conservation interest), given the relatively small footprint of the project area inside the broader context of the Pictou-Antigonish Highlands.

Appendix C provides the bird survey location summaries and complete species lists.

Mammals

The Project Area is located within a Mainland Moose Priority Area, and Moose have been observed in the general vicinity of the project, as documented by NSDNR. A pellet group inventory survey and ongoing winter moose track surveys have not identified any sign of Mainland Moose, including tracks, scat or browse. It is not likely that moose use the project lands in any significant manner.

Details of the Mainland Moose Survey are provided in Appendix C.

Other Priority Species

Suitable habitat for other priority species, specifically the Wood Turtle, Snapping Turtle, Little Brown Bat, Northern Long-eared Bat, and Eastern Pipisterelle was not identified within the Project Area. The desktop analyses, field assessments, and subsequent conclusions of this assessment indicate there are no concerns related to priority species, rare or unique habitat types, within the Project Area.

Appendix C provides further information related to bat and herpetofauna surveys conducted in the project area.

6.4.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-Up

Project-related effects on flora, fauna and habitat are limited due to the fact that the vast majority of the area proposed has already been disturbed through forestry, or quarry related activities. Loss of habitat will occur in the extraction areas but will have minimal impact due to the availability of similar replacement habitat in the general area. Many of the faunal species in the area have a familiarity (OPERATIONS BEGAN IN 2009) with quarry operations and the infrastructure which may reduce typical mortality issues with industrial activities.

Bank Swallows are attracted to areas with steep facies of sand and gravel, suitable for excavating burrows for nesting. The proposed project activities do not involve exposed sand or gravel, as the resource being extracted is primarily rock. If sand or gravel deposits in the thin overburden (<1 m) are encountered, they will be sloped appropriately to deter Bank Swallows from constructing nest burrows. Should any nest borrows be identified during breeding season, the area will be cordoned off to protect the nest colony.

Common Nighthawk are attracted to open gravelly areas for nesting. Should a Common Nighthawk nest be identified within the Project Area, it will be cordoned off to protect the nest

until fledged. Current land use within the Project Area includes an active quarry, and neither Bank Swallows nor Common Nighthawk has been identified within the Project Area to date.

Best management practices will be employed in managing stockpiles (maintaining appropriate slopes to prevent bird nesting, for instance). Spill management procedures are outlined in the NSE approved Environmental Protection Plan/ Spill Contingency Plan that is currently in place for the site, including prevention, identification, reporting, response, and remediation. Nova Construction has a preventative program in place and extensive Health, Safety and Environment training to reduce the number of incidents, and the extent and duration of impact on the environment. Field personnel are well trained to respond quickly to remediate spills in the unlikely event that they occur. The Project Area is not in close proximity to surface water features frequented by migratory birds. There is no open water, lakes, ponds or major rivers within or adjacent to the Project Area, so the risks posed to Migratory Birds by a controlled release is minimal. The Proponent will adhere to Sections 5.1 (1) and (2) of the Migratory Birds Conventions Act. Operational lighting could attract various bird species. Twenty-four hour operations are not envisioned for the site; however site lighting during the breeding season will be minimized where practicable.

Nova Construction is aware of requirements relative to clearing of lands during nesting/fledgling season for bird species and will adhere to these. To avoid destroying nesting or breeding species during breeding timeframes, clearing of vegetation will not occur between April 15 and August 30.

Nova Construction recognizes the value of species-at-risk and will take steps as required to mitigate those species found on the site through consultation with ecologists and NSDNR. Ongoing issues of importance to local flora and fauna species will likely be brought forward by the community, academia or regulators. Nova Construction commits to an open and consultative approach to seeking resolutions on all issues raised.

6.5 Atmospheric Conditions/ Air Quality

6.5.1 Existing Environment

Particulate Monitoring Methodology

A total of three (3) particulate monitoring locations were selected based on accessibility and the location of Site boundaries for the purpose of capturing baseline particulate concentrations surrounding the Brierly Brook Quarry. Table 6.5-1 below provides a description of the air monitoring locations. Site locations are also depicted on Figure 6.2-1. Total suspended particulate (TSP) sampling was conducted at the three (3) locations from October 9-10, 2013.

TABLE 6.5-1: PARTICULATE MONITORING LOCATIONS

Sample Location ID	Description
Location #1	East of processing plant. (0571441 N 5050805 E)
Location #2	Along the north edge of the quarry boundary adjacent to the tree line. (0571247 N 5051034 E)
Location #3	Along the west Site boundary in the vicinity of an off-Site gravel road. (0571136 N 5050821 E)

The monitoring program for TSP was carried out in accordance with USEPA CFR 40 Part 50 - Regulations for Ambient Particulate Sampling. Sampling equipment utilized by CRA consisted of three (3) high volume (HI VOL) air samplers equipped with 8 inch X 10 inch glass fiber filters for sample collection. The HI VOL samplers were electrically powered by connection to portable generators. The HI VOL samplers were calibrated according to the above referenced method as well as manufacturers' specifications.

Approximately 40 cubic feet per minute of ambient air was drawn through each HI VOL sampler over a 24-hour sampling period, trapping particulate on a pre-weighed glass fiber filter. After the 24-hour sampling event the filters were removed from the sampler, placed in an envelope and stored in a clean dry area. A total of one (1) sample was collected at each sample location. Sampler flow calibration sheets and calculated flow rates are provided in Appendix E. Upon completion of the program samples were shipped to Maxxam Analytics in Sydney, Nova Scotia for analysis in accordance with the appropriate method. Additionally a blank unused filter was submitted to the laboratory for quality control quality assurance purposes. The laboratory results and certificate of analysis are provided in Appendix E.

Weather Conditions

The weather throughout the monitoring period was mainly clear with periods of cloudy conditions. Meteorological conditions were collected from Environment Canada's Tracadie, NS weather station. Tabulated weather data and the prominent wind direction for the monitoring period (depicted by the particulate wind rose diagram) are included in Appendix E.

A brief summary of weather conditions during the air monitoring period is provided in Table 6.5-2 below.

TABLE 6.5-2: SUMMARY OF WEATHER CONDITIONS DURING PARTICULATE MONITORING

Date	Average Temperature	Daily Wind Gusts	Direction of Daily Wind Gusts	Daily Wind Speed Range	Prominent Wind Direction for the Monitoring Period
October 9, 2013	10.2°C	33 km/hr	North Northwest	6-22 km/hr	South West
October 10, 2013	13.1°C	37 km/hr	West Southwest	4-24 km/hr	

Total Suspended Particulate Monitoring

Total suspended particulates include dust, dirt, soot, smoke and liquid droplets directly emitted into the air by sources such as factories, power plants, cars, construction activity, fires and natural windblown dust. Particles formed in the atmosphere by condensation or the transformation of emitted gases such as SO₂ and Volatile Organic Compounds (VOCs) are also considered particulate matter.

Quarry activities such as blasting, on site vehicle operations, crushing, processing, and wind erosion from rock piles all can contribute to increased particulate levels. Based on Nova Scotia Air Quality Regulations; a significant adverse environmental effect with respect to total suspended particulate is one that would reduce air quality, such that the level of total suspended particulate matter exceeds 120 µg/m³ over a 24 hour averaging period or 70 µg/m³ over an annual averaging period.

All calculated values were reported below the maximum permissible ground level concentration of 120 µg/m³ outlined in Schedule A of the Nova Scotia Air Quality Regulations. Total suspended particulate values measured at the three (3) monitoring locations ranged from 5.7 µg/m³ to 105.5 µg/m³. The highest TSP value was recorded at Location #1 (adjacent to the crushing circuit) which is primarily related to the quantities of airborne particulate released from the crushers. Prominent wind directions for the monitoring period were blowing from the south west.

Total suspended particulate measurements compared to applicable criteria are presented in Table E-1, Appendix E.

Other Pollutants and Greenhouse Gases

For this project, on site trucking, mobile equipment and utility vehicles have the potential for producing emissions of other air contaminants including carbon monoxide (CO), nitrogen oxides (NO_x), sulphur dioxide (SO₂), ozone, hydrogen sulphide (H₂S) and other greenhouse gases.

These are currently regulated through the EPA National Ambient Air Quality Standards (40 CFR Part 50) and the Nova Scotia Air Quality regulations (N.S. Reg 187/2010).

6.5.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-Up

Temporal boundaries for the assessment of air quality have been developed for the time periods during which Project air emissions will have the potential to degrade the local air quality in and around the Quarry site. The Quarry is expected to have a marketable life for 20 years. Local ambient air quality will be affected throughout that time period. Process emissions will be generated throughout the life of the project. The quarry operations are seasonal; therefore there are marked temporal boundaries to air emissions throughout the life of the project.

The spatial boundary is the zone of influence of emissions from the quarry and existing processing operations that will affect the local ambient air quality. The closest residence is 500 m from the Quarry property boundary.

Air-borne particulate will be generated during the development and operational phases of this project. On site vehicle operations, as well as trucking operations can contribute to overall dust, as well as increased emissions of nitrogen oxides (NO_x), sulphur dioxides (SO₂), carbon monoxide (CO), ozone, hydrogen sulphide, and greenhouse gases including methane and carbon dioxide (CO₂). The following mitigative measures will be utilized to reduce project emissions:

- Wet suppression controls on unpaved surfaces;
- Speed reduction to keep dust levels at minimum;
- Hardened surfaces where practical;
- Equipment maintained in good working order;
- Use of properly sized equipment to maximize overall processing efficiency;
- Low sulphur diesel fuel;
- Reduced idling; and
- Incorporating native shrubs and trees in the rehabilitation plan to further reduce carbon dioxide levels and other green house gases.

The National Pollutant Release Inventory (NPRI) is a federally administrated program that collects data on annual on-site emissions of substances released to the air, water and land, as well as offsite transfers of substances for disposal or recycling. NPRI reporting is a requirement of sub section 46(1) of the Canadian Environmental Protection Act (CEPA). Nova Construction is aware of the legislation and will comply with reporting requirements.

Rehabilitation

Progressive rehabilitation will be integrated in the overall quarry plan. Dust and exhaust type emissions will be produced from equipment and machinery used for rehabilitation, re-contouring and overburden relocation. Mitigative measures, including wet suppression of unpaved surfaces and roads, will help reduce dust impacts from these activities. Regular machinery maintenance, the use of low sulphur fuel, the overall distance of the reclaimed areas from sensitive receptors and the natural buffers of the rehabilitation areas will help reduce emissions and dust impacts associated with the equipment utilized in the rehabilitation process.

In summary, assuming appropriate mitigation to minimize dust generation and transport, significant Project-related effects, on air quality, are not likely to occur during further development, operation, and rehabilitation phases. Monitoring of particulate emissions will be conducted as required by NSE. Particulate monitoring can be conducted utilizing a Beta Array Monitor or High Volume Sampling.

6.6 Noise

Noise is defined as any unwanted sound which may be hazardous to health, interfere with speech and verbal communications or is otherwise disturbing, irritating or annoying. Noise is measured as sound pressure levels (SPL) in decibels (dB). This scale is "A" weighted to approximate the way the human ear hears. Noise measurements are therefore represented as dBA units. In general an increase in noise levels from 1 to 3 dBA will not be noticeable, 3 to 5 dBA will be noticeable by most people, 5 to 7 dBA will be easily heard and an increase of 7 to 10 dBA will be considered by most to be twice as loud (USEPA Reference-1974). Because the decibel scale is logarithmic, doubling of the number of noise sources will increase noise levels by 3 dBA. A tenfold increase in the number of noise sources will add 10 dBA to the noise level.

Table 6.6-1 lists some common noises and typical dBA levels. Extremely low levels of sound are in the 20 to 35 dBA range, while sounds causing immediate and noticeable disturbance start at 70 to 80 dBA. A quiet location such as library or inactive residential area will register a sound level of approximately 35 dBA. A tractor-trailer passing at a distance of 10 to 15 metres will create 80 dBA, similar to that of shouting at a distance of one metre.

TABLE 6.6-1: COMMON NOISES AND TYPICAL dBA LEVELS

NOISE LEVEL (dBA)	TYPICAL OUTDOOR NOISE LEVELS	TYPICAL INDOOR NOISE LEVELS
140	Threshold of pain on the human ear	
130		
120		
110	Gas mower at 1 metre	Nightclub music
100		
90		
80	Semi-truck at 10-15 m - travelling 70 to 90 km/hr	Shouting at 1 metre
70	Autos at 10-15 m - travelling 70 to 90 km/hr	
60	Normal conversational speech at 1 metre	
50		
40	Rural daytime	Library
30		
20	Rural night time	
10		Recording studio
0	Threshold of hearing	

Table 6.6-2 outlines some typical noise ranges for heavy construction equipment. Noise levels for stationary construction equipment will decrease by approximately 6 dBA at a doubling of the distance from the source.

TABLE 6.6-2: TYPICAL NOISE LEVELS 15 M FROM HEAVY CONSTRUCTION EQUIPMENT

Type of Equipment	Noise Level Range (dBA)
Front Loaders	70-85
Backhoes	70-95
Trucks	85-95
Excavator	85-95
Reference: "Traffic Noise Analysis and Mitigation Manual" Environmental Section, Oregon State Highway Division, 1990	

6.6.1 Existing Environment

Noise Monitoring Methodology

A total of three (3) noise monitoring locations were selected based on accessibility and the location of Site boundaries for the purpose of capturing baseline noise surrounding the Brierly Brook Quarry. The noise monitoring locations are in the same vicinity as the particulate monitoring locations. Table 6.6-3 below provides a description of the noise monitoring locations. Site locations are also depicted on Figure 6.2-1.

TABLE 6.6-3: NOISE MONITORING LOCATIONS

Sample Location ID	Description
Location #1	East of processing plant. (0571441 N 5050805 E)
Location #2	Along the north edge of the quarry boundary adjacent to the tree line. (0571247 N 5051034 E)
Location #3	Along the west Site boundary in the vicinity of an off-Site gravel road. (0571136 N 5050821 E)

Noise is measured as a sound pressure levels (SPL) in decibels (dB). This scale is "A" weighted to approximate the way the human ear hears. Noise measurements are therefore represented as dBA units. The noise meter was programmed to record continuous 1-minute sound level measurements taken with the detector in slow response using the A-weighting (dBA scale) and reported as average Leq dBA readings at each of the three (3) monitoring locations.

Sound level measurements were collected using a Quest Sound Pro SE/DL sound level meter, equipped with data logging capabilities. The device was calibrated at 114 decibels (dBA) before and after each measurement period using a Quest QC-10 Calibrator. The sound level meter was equipped with an outdoor casing and foam covering to protect the microphone from adverse weather conditions.

Weather Conditions

The weather throughout the monitoring period consisted of mainly clear conditions with an occurrence of rain on October 1st. Meteorological conditions were collected from Environment Canada's Tracadie, NS weather station. Tabulated weather data and the prominent wind direction for the monitoring period (depicted by the noise windrose diagram) are included in Appendix E. A brief summary of weather conditions during the noise monitoring period is presented in Table 6.6-4 below.

TABLE 6.6-3: SUMMARY OF WEATHER CONDITIONS DURING NOISE MONITORING

Date	Average Temperature	Daily Wind Gusts	Direction of Daily Wind Gusts	Daily Wind Speed Range	Predominant Wind Direction for the monitoring program
October 1, 2013	13.8°C	<31 km/hr	Not Applicable	0 - 15 km/hr	West
October 2, 2013	16.1°C	33 km/hr	West South West	7 - 26 km/hr	
October 3, 2013	14.7°C	<31 km/hr	Not Applicable	7 - 26 km/hr	
October 4, 2013	12.1°C	54 km/hr	West North West	11 - 32 km/hr	

Noise Monitoring

Blasting, on site vehicle operations and crushing can contribute to excessive noise levels. As specified in the Noise Measurement and Assessment Guidelines, L_{EQ} values should be within the following limits:

- ≤ 65 dBA between the hours of 0700 and 1900 hours;
- ≤ 60 dBA between the hours 1900 and 2300 hours; and
- ≤ 55 dBA between the hours of 2300 and 0700 hours.

Noise monitoring values measured at the three (3) monitoring locations over each 24-hr period ranged from 41.3 dBA – 56.9 dBA between the hours of 07:00-18:59; 33.2 dBA – 49.6 dBA between the hours of 19:00-22:59 and 39.9 dBA- 51.0 dBA between the hours of 23:00-06:59. All measured sound level values were reported below the maximum permissible sound levels of the Environmental Noise Measurement and Assessment Guidelines (1990).

The lowest sound levels were recorded along the north edge of the quarry boundary (Location #2). The highest sound levels were recorded adjacent to the crusher (Location #1). Prominent wind directions for the monitoring period were blowing from the west. The sound level measurements compared to applicable criteria are presented in Table E-2, Appendix E.

6.6.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-Up

Sources of quarry site related noise may include onsite blasting, heavy equipment, truck traffic and operation of the crushing equipment and an asphalt plant. Temporal boundaries for the acoustic environment would be the time periods during which related site noise will have the potential to degrade the local air quality in and around the site. The quarry life is expected to be 20 years. The acoustic environment will be affected throughout that time period. Most of the noise impacts will result from heavy equipment and vehicle operations. Impacts will occur during site operations as the project proceeds, and as a result of decommissioning and rehabilitation. Operations will be intermittent throughout the year, therefore there are no significant seasonal boundaries.

A technical blast design will be prepared by a qualified person who ensures that the prescribed ground vibration and air concussion limits are achieved. All blasts will be monitored to compare to those limits. Only 1 or 2 blasts will be required per year. Blasting will only occur on those days and times as prescribed by an amended Industrial Approval.

The spatial boundary is the zone of influence of noise emissions from the quarry area that will affect the local ambient air quality. The nearest resident is approximately 500 m from the quarry property boundary.

A significant adverse effect occurs where the project increases background noise levels at a residential area above the NSE guidelines or by more than 10 dBA. An adverse effect that does not meet these criteria would be considered as not significant. A positive effect would be project-related activities that decrease the ambient noise levels.

The level of noise will vary according to the type of development activity. Noise from the equipment and lack of effective mufflers is a source of noise. Regular maintenance of the equipment will reduce noise levels. This measure will adequately mitigate potential noise impacts. All noise emissions will meet the NSE *Pit and Quarry Guidelines* (1999). Monitoring stations can be set up at any time throughout the project should noise complaints arise.

Nova Construction will control operations and equipment to ensure noise levels are kept within the *NSE Pit and Quarry Guidelines* (1999).

The nearest residence to the quarry property is approximately 500 m away. Appropriate mitigation to minimize noise levels to reasonable levels will be made. All noise emissions will meet the specifications outlined in the IA, as well as the *Guidelines for Environmental Noise Measurement and Assessment*, 1990.

Monitoring stations can be set up at any time throughout the process should noise complaints arise or as required by NSE. In order to capture the worst case scenario for noise generation, noise monitoring equipment will be placed along the boundary of the expanded quarry foot print, during peak truck traffic when on-site equipment is operational and the highest truck traffic is expected.

Rehabilitation

Noise impacts from the rehabilitation processes will result from equipment and machinery used in rehabilitation, re-contouring and overburden relocation. Some blasting may be required to shape final slopes. Regular machinery maintenance, the overall distance of the rehabilitated areas from sensitive receptors and the natural buffers of the rehabilitation areas will help reduce impacts of noise associated with the equipment utilized in the rehabilitation process. Rehabilitation activities and the equipment used will not be significantly different than during operations so no difference will likely be noticed by residents.

6.7 Socio-Economic Environment

6.7.1 Existing Conditions

The Project is located in Brierly Brook, a small unincorporated community in Antigonish County. Brierly Brook is directly west of the Town of Antigonish, and is surrounded by several other small rural communities. The population of the surrounding area that falls within the broader “community” of James River (as defined by Nova Scotia Finance – Nova Scotia Community Counts (2013) includes Post Road, Addington Forks, Beaver Meadow, Beaver Mountain, Brierly Brook, Brierly Brook Back Road, Glen Bard, James River and St. Joseph) is 1075 persons (2011 Census). About 27% of the population is under 20 years of age and 12.2% is 65 years of age or older. Population growth between 1996 and 2011 was about 3%. The statistics indicate that 81% of residents are Nova Scotian. English is spoken by over 91% of the population. The average family income (2006 Census) is \$76,081 per annum as compared to the provincial average of \$66,032. A post secondary education has been obtained by 61% of the population, while 22.4% have attained a high-school diploma only.

Within 2 km of the quarry property there are 39 properties with structures. Given the rural/agricultural nature of the area it can be assumed that most of these locations are residential or residential farms. Therefore, within a distance of the quarry property the following number of residences have been surmised: 500 m – 2 (440 m); 800m – 4; 1.0 km – 5; 1.5 km – 8; and 2 km - 39.

In the local area there is a range of land uses focused on resource based industries such as agriculture, forestry and mining. The quarry site is located in an agricultural area that extends from the Antigonish. Agricultural land use accounts for approximately 5 % of the Brierly Brook area.

The regional area is primarily forested with mixed use (mainly residential and small business) located along the secondary roads. Forested lands are primarily privately owned.

The Quarry project will use existing public roads that require no upgrading or changes in infrastructure (i.e. bridges). The primary route used will be Brierly Brook Road to Highway 4 and routes beyond.

Spring weight restriction periods on roads may reduce site activity.

6.7.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-Up

The effects of the Quarry project to the local socio-economic conditions will be observable in several key areas.

Local Employment and Economic Activity

The socio-economic impacts of the quarry to the local economy will be limited but positive because of the small nature of the site and utilization of existing Nova Construction resources. Impacts that may require mitigation are reduced residential and land values due to industrial activities. Given the relative life of this project, the conceptual rehabilitation plan, and that the existing operation has been in the area since 2009 along with other nearby extractive resource operations, it is unlikely the project will impact current land values.

Recreational Activity

Recreational use of the site has been limited to local use. No evidence of use by off road ATVs was seen during site reconnaissance. The future final land use of the site will be determined in conjunction with the needs of the local community. After closure of the quarry, final rehabilitation is intended to return the site to a condition that reflects the surrounding landscape. Disturbed areas will be regraded and revegetated or put to other uses as warranted by future plans for the site.

Visual Impacts

Effects to visual quality of the local area that result from construction, operation, de-commissioning and rehabilitation of the Quarry include changes to the short term and long term views in the local area. The roadways, settling ponds, and stockpiles are already in existence and there will be no change in the visual environment related to these items. The expanding may become more visible from a distance however, a barrier of trees within the prescribed setbacks may partially shield the site from view. The resultant landscape will mimic the existing rolling hill topography with variety of cover (grass, trees, etc.).

Land Use

Quarry operations often involve changing the land use of an area. In some cases a quarry will require lands that may have been used for recreation, agriculture or other purposes. In the case of this Quarry, the existing land use is confined to two types: forested (although the site is small and the amount of forestry may have been limited to gathering firewood) and previous quarry related operations from the current operator. The land is already owned by the proponent. During operations public access to the remainder of the site has not been restricted except when production is underway. Future land use will depend on the needs of the proponent and the community, *i.e.* returned to a natural state with access.

6.8 Archaeological and Cultural Resources

Archaeological screenings and reconnaissance of the Project site was conducted by Boreas Heritage Consulting Inc., in accordance to the terms of Heritage Research Permit A2013NS063, to research, locate and identify archaeological resources within the proposed impact area, and

to offer resource management recommendations. Background research was conducted in July 2013 to identify the archaeological potential based on environmental setting, site history, and Native land use. Reconnaissance fieldwork, consisting of a visual inspection, was conducted on 1 August 2013. The Archaeological Screening & Reconnaissance Report (Appendix D) summarizes the findings and recommendations for the site.

6.8.1 Existing Conditions

The primary purpose of the visual inspection was to evaluate the archaeological potential of the proposed development area and to investigate any topographical or cultural features identified during the background study. A cursory examination of the proposed development area revealed that the active quarry operation has created a disturbed area within the western portion of the property. As a result, visual inspection was focused on areas that had not been previously disturbed by extraction activities.

Vegetation within the study area is characterized by a mixed regenerated forest, consisting primarily of white and yellow birch, maple, spruce and fir. In areas that displayed evidence of previous clearing and tree-harvesting activity, thick undergrowth, consisting of young birch and maple, as well as various ferns and shrubs, was noted. The presence of raspberry bushes was observed in several areas.

With the exception of the northwestern corner, which was generally level to gently sloping, the majority of the study area can be described as moderate to steeply sloping, particularly in the southeastern portion of the property. At the eastern edge of the study area, the terrain sloped steeply to the east, down to a small, shallow, unnamed stream, a tributary to Brierly Brook that flows southeast just outside the eastern limits of the study area. Visual inspection also revealed that the majority of the study area constituted a mix of undulating and hummocky woodland that would have been unsuitable for occupation and/or work areas associated with resource exploitation by Precontact peoples.

Another, small, ephemeral stream, in the northeastern portion of the property, originates as a dry, stony streambed, that flows southeast and turns into a deeply cut ravine before merging with the above-mentioned watercourse. Both streams are unnavigable and are considered to have had minimal influence on the suitability of the area for settlement. Furthermore, the terrain in the vicinity of these streams is steeply sloping with low archaeological potential.

Careful attention was paid to areas adjacent to a historic woods road alignment, leading to a large clearing overgrown with dense vegetation. Although signs of past tree-harvesting activity were observed throughout the study area, no evidence of archaeological resources or areas of elevated archaeological potential were encountered and no indication of significant historic cultural modification was identified.

Based on the undulating and generally sloped nature of the terrain and poorly drained soils, the distance to a significant water source, and the lack of evidence indicating significant cultural modification, the Brierly Brook Quarry study area is considered to exhibit low potential for encountering significant archaeological resources.

6.8.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-Up

The Quarry project is not likely to have significant adverse effects on archeological and historical features in the area.

Based on results noted above, the following management recommendations are offered for the Quarry area:

1. It is recommended that the study area be cleared of any future requirement for archaeological investigation.
2. In the event that archaeological resources are encountered during construction activities associated with the Brierly Brook Quarry, immediate contact made Sean Weseloh-McKeane, Coordinator of Special Places, Communities Culture and Heritage at 902-424-6475.

The Nova Scotia Communities, Culture and Heritage, Special Places Program has accepted the recommendations from the October 2013 Archaeological Screening & Reconnaissance Report (Appendix D).

Personnel involved in all ground disturbances related to the site preparation and quarry activities will be made aware of the potential for archaeological and/or cultural resources and the appropriate actions to be taken in identifying and reporting such features.

No additional work or mitigation is required to allow the project, as described, to proceed.

6.9 Other Projects in the Area

6.9.1 Existing Conditions

The proponent is aware of several existing extraction operations within 20 km of the site.

Nova Construction operates a small gypsum quarry (Non-mineral registration MP0008) approximately 1 km from the project site. The quarry is currently in care & maintenance mode with no active extraction.

Alva Construction has received (January 2012) an environmental approval for an extension to its Northumberland Rock Quarry in Georgeville, Antigonish County, Nova Scotia. The Alva site is approximately 22 km north of Brierly Brook. Dexter Construction and Chapman Brothers operate pit and quarry operations within 8 km of the site. The potential exists for other aggregate deposits within the area; however, the development of these will depend on market demand for product.

NSDNR has designated some areas within 10 km of the site as Crown Limestone Reserves. None of these are currently being exploited.

Several exploration licenses (NSDNR 2013) are located in the Barney's River area about 20 km from the project site.

Beyond 20 km there are numerous mineral occurrences that are in various stages of exploration. The specific status of these sites has not been investigated; however, according to Natural Resources Canada a mineral deposit has a 1 in 10 000 chance of being brought into production. This is controlled by market demand, the price of the commodity and the ratio of associated costs of mining to expected returns.

6.9.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-Up

Significant adverse project-related effects in conjunction with other undertakings in the area are not likely to occur, assuming the effective application of mitigative measures as outlined in this document.

Section 7.0 Effects of the Project on the Environment

The Project has operated as an aggregate quarry under an existing NSE Industrial Approval and that resource has been nearly exhausted under the terms & conditions of that IA. Activities associated with the quarry operation will be conducted in accordance with terms and conditions of the EA, an amended Industrial Approval, adherence to the *Nova Scotia Pit and Quarry Guidelines* (NSEL 1999), and specific mitigative measures described in this assessment and all other applicable legislation, policies, and guidelines.

Assuming the mitigative, monitoring, and progressive rehabilitation 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. Effects are expected to be of small magnitude, low frequency, short duration, and/or limited geographical extent. Continued operation of the quarry will result in economic benefits, including employment and an economic source of quality aggregates to local demand markets.

Environmental effects will include the loss of some habitat within the proposed quarry property area. The property has been the subject of past forestry activities.

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

Section 8.0 Effects of the Environment on the Project

The surrounding environment may contribute to adverse effects on the Project; however discussions on potential environmental effects on the Project are usually limited to climate and meteorological conditions. Climate change is more likely to affect projects with much longer durations, however, reclaimed workings or temporary storage piles may be affected by future severe weather events if not planned for properly. Climate change is not anticipated to significantly affect the operation of the quarry over its lifetime. Short period events, *e.g.* heavy rainfall, blizzards or thunder storms, may temporarily shut down operations for safety reasons. Precipitation (rain, snow) and associated runoff may cause temporary delays in some activities such as construction, operation (extraction, processing, transportation), and rehabilitation.

The national average annual temperature has increased by 1.6E C since records began in 1948, however, in Atlantic Canada, the annual average temperature has only increased by 0.5 C for the same period (1948 – 2013) (Environment Canada 2013). The Atlantic Region has experienced slight cooling in the last 50 years due in part to the melting of the ice caps in Greenland and Northern Canada. The cooler air and water temperatures associated with the melted ice that have been flowing past Atlantic Canada are causing the cooling trend. As oceans warm and water expands, the melting ice may accelerate sea-level rise in the region, however given the elevation of this Project this is not a concern here. Annual precipitations have tended to be wetter since the mid 1970s (Environment Canada 2013).

During the various project phases (construction, operation, rehabilitation) numerous mitigation measures may be employed to minimize potential effects of the environment on the Project. These measures may reduce the risk to acceptable levels through the installation of engineered controls that account for projected storm events. Scheduling of activities should also account for weather interruptions and since the activities of this Project are all conducted out-of-doors the weather has been and will be a factor.

Earthquakes are mapped by Natural Resources Canada. Although Nova Scotia is a relatively quiet earthquake zone, larger quakes have been reported in the historical past. Only 41 quakes, with a maximum magnitude (M) of 3.2 (near Bridgewater in 2007), have been recorded in Nova Scotia or the continental shelf in the last 11 years (Jan 2003 to Dec 2013) (Natural Resources Canada 2013). No earthquakes have been recorded in the Antigonish area since 1985. No significant earthquakes (M <5.0) have occurred in Nova Scotia between 1600 and 2006 (Lamontagne et al 2008). There is, therefore, little likelihood of earthquakes being an effect on the project.

Wildfires are limited in Nova Scotia but there is the potential for this to affect the project by limiting when work may be conducted during such an event. There are no permanent

structures planned for the site, however, on-site equipment may be lost if it can not be evacuated before an approaching fire. The site is stripped of vegetation but is surrounded by forested areas. Fire protection may be available from water in on-site ponds.

The site is elevated from major water courses thus will not be affected by any seasonal flooding events. Extreme precipitation may cause a temporary rise in local groundwater elevations and excessive surface water runoff – thus affecting operations.

The regional area has karst potential (*Lower Windsor Group-Bridgeville Formation*) and potential for karst features (*i.e.* sinkholes) to occur in the bedrock (gypsum, limestone, etc). No karst features have been identified on the site; however sinkholes have been identified within 1.5 km of the site. Given the bedrock type at the quarry, karst features would not be encountered on the Project Site.

Section 9.0 Other Approvals Required

The Proponent is required to register this Project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. Other relevant provincial regulations include the Activities Designation Regulations, which requires an amendment to the existing Industrial Approval from Nova Scotia Environment for the extended quarry operation.

No municipal approvals are required.

There are no known triggers for environmental assessment under the Canadian Environmental Assessment Act (CEAA).

Section 10.0 Funding

This project will be 100% funded by Nova Construction Co. Limited. No federal or provincial funding is required or sought.

Section 11.0 Additional Information

No additional information is provided in support of this document.

Section 12.0 References

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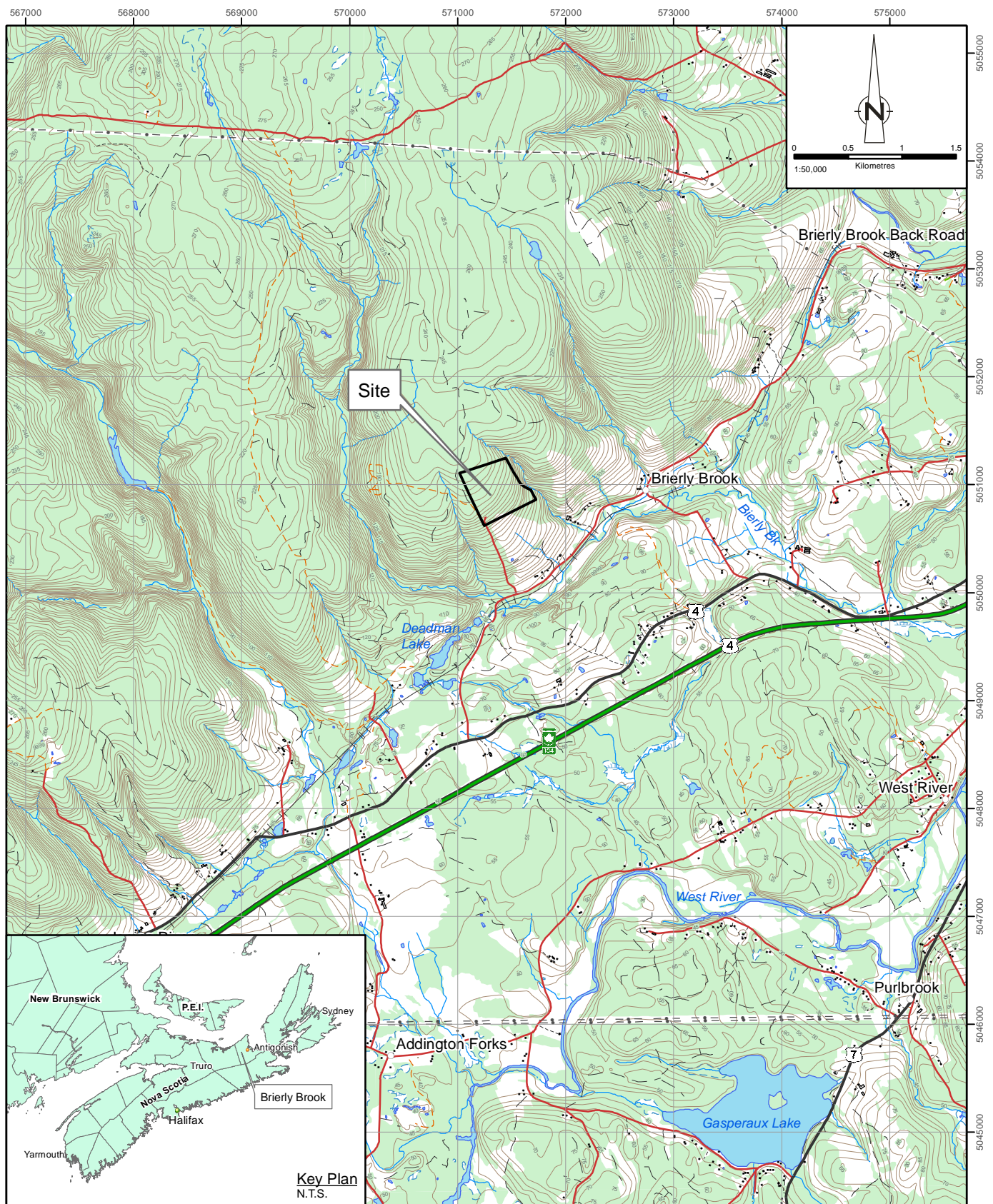
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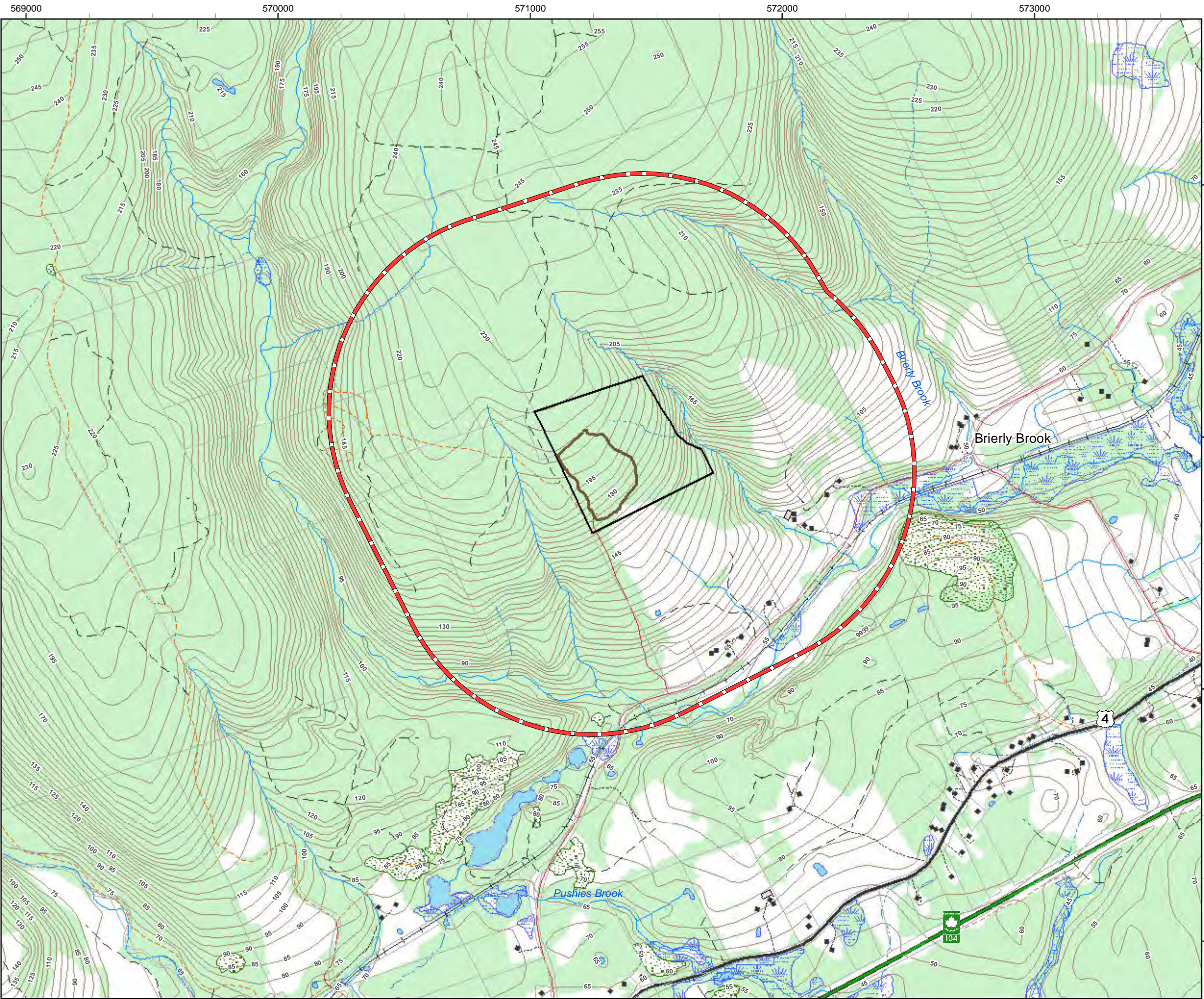
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Source: Service Nova Scotia & Municipal Relations Projection: UTM Zone 20 NAD83 CSRS



figure 1
SITE LOCATION
BRIERLY BROOK QUARRY
NOVA CONSTRUCTION CO LTD
Brierly Brook, Nova Scotia



- LEGEND:**
- 800 m Property Buffer
 - Property of Interest
 - Property
 - Existing Quarry
 - Other Pits & Quarries
 - Buildings
 - Buildings
 - Trans-Canada Highway
 - Trunk / Arterial
 - Local
 - Dry Weather / Seasonal
 - Diveways (>300 m)
 - Track
 - Trail
 - Railroad
 - Streams
 - Stream (intermittent)
 - Water
 - Wetlands (NSGC, NSE)

SOURCE:
Base Map: SNSMR

0 100 200 400 600 800
Metres

PROJECTION: UTM z20 NAD83	DRAWN / CHECKED BY: JJP / PO	MAP ANGLE: 0° North
SCALE: 1:15,000	DATE: MAY 6/2014	PROJECT NO: 081464 (01)
081464 (01) GIS-DA002		

figure 2
PROJECT LOCATION
BRIERLY BROOK QUARRY
NOVA CONSTRUCTION CO LTD
Brierly Brook, Nova Scotia



LEGEND:

- Proposed Qaurry Extent
- Exisitng Quarry Extent
- Property of Interest
- Property

SOURCE:

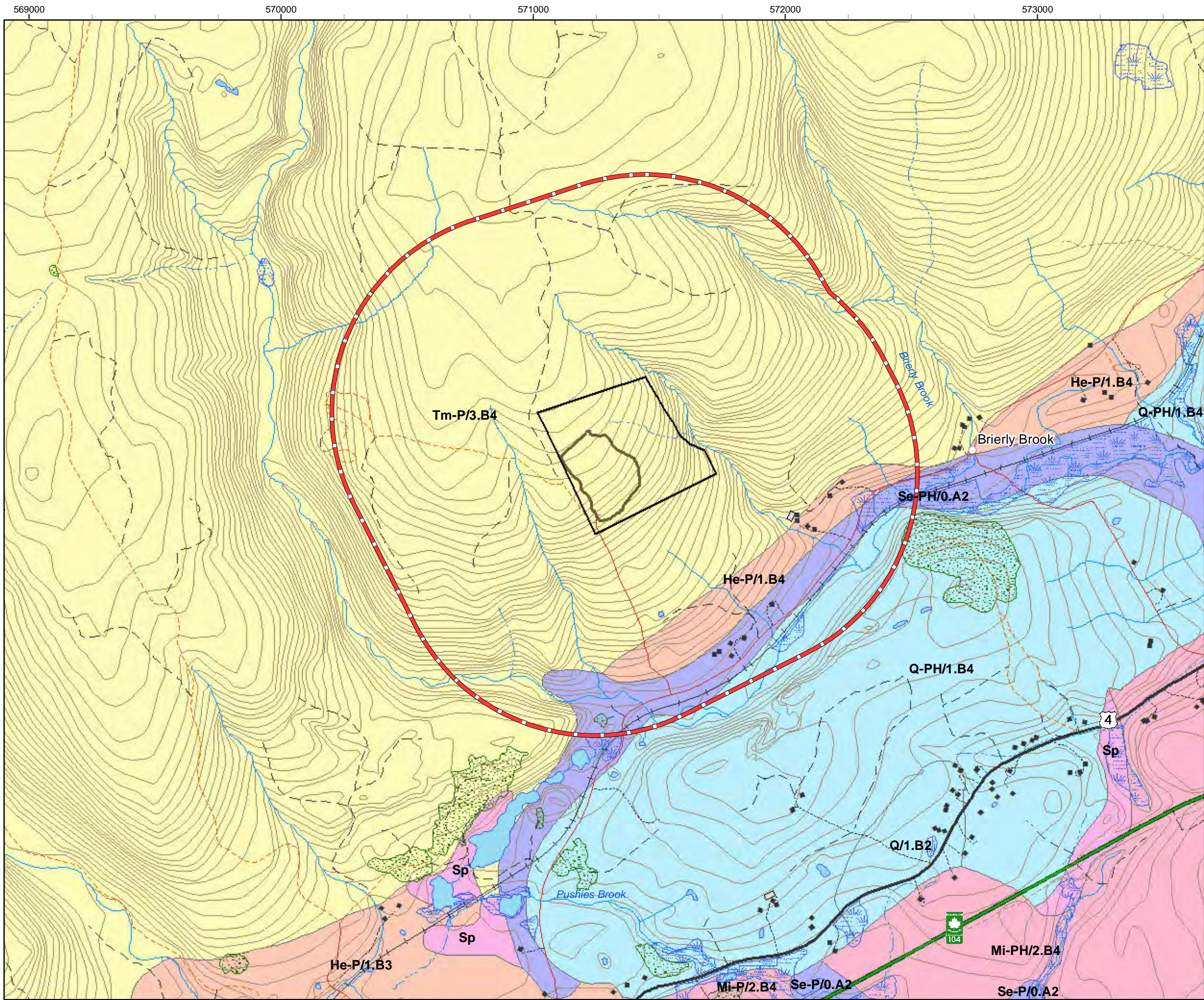
Base Map: SNSMR
Aerial: Bing 2012

0 50 100 200 300
Metres

PROJECTION: UTM z20 NAD83	DRAWN / CHECKED BY: JJP / PO	MAP ANGLE: 0° North
SCALE: 1:5,000	DATE: MAY 11/2014	PROJECT NO: 081464 (01)
081464 (01) GIS-DA003		

figure 3
PROJECT BOUNDARIES
BRIERLY BROOK QUARRY
NOVA CONSTRUCTION LTD
Brierly Brook, Nova Scotia

**CONESTOGA-ROVERS
& ASSOCIATES**



LEGEND:
Soil Series
He Hebert
Mi Millbrook
Q Queens
Se Stewiacke
Sp Swamp
Tm Thom
800 m Property Buffer
Property of Interest
Existing Quarry
Other Pits & Quarries

Symbol = $\frac{\text{Catena} - \text{Drainage}}{\text{Stoniness.Topography}}$ e.g. HE-P/1.B4
Drainage
P - Well drained
PH - Imperfectly drained
Stoniness
0 - Stone free
1 - Slightly stony
2 - Moderately stony
3 - Very Stony
Topography
Bx- Complex slopes, irregular or rough surface
2 - very gentle slope 0.5-1.5%
3 - gentle slope 2 - 5%
4 - moderate slope 6 - 9%


SOURCE:
Base Map: SNSMR
Soils: Agriculture Canada

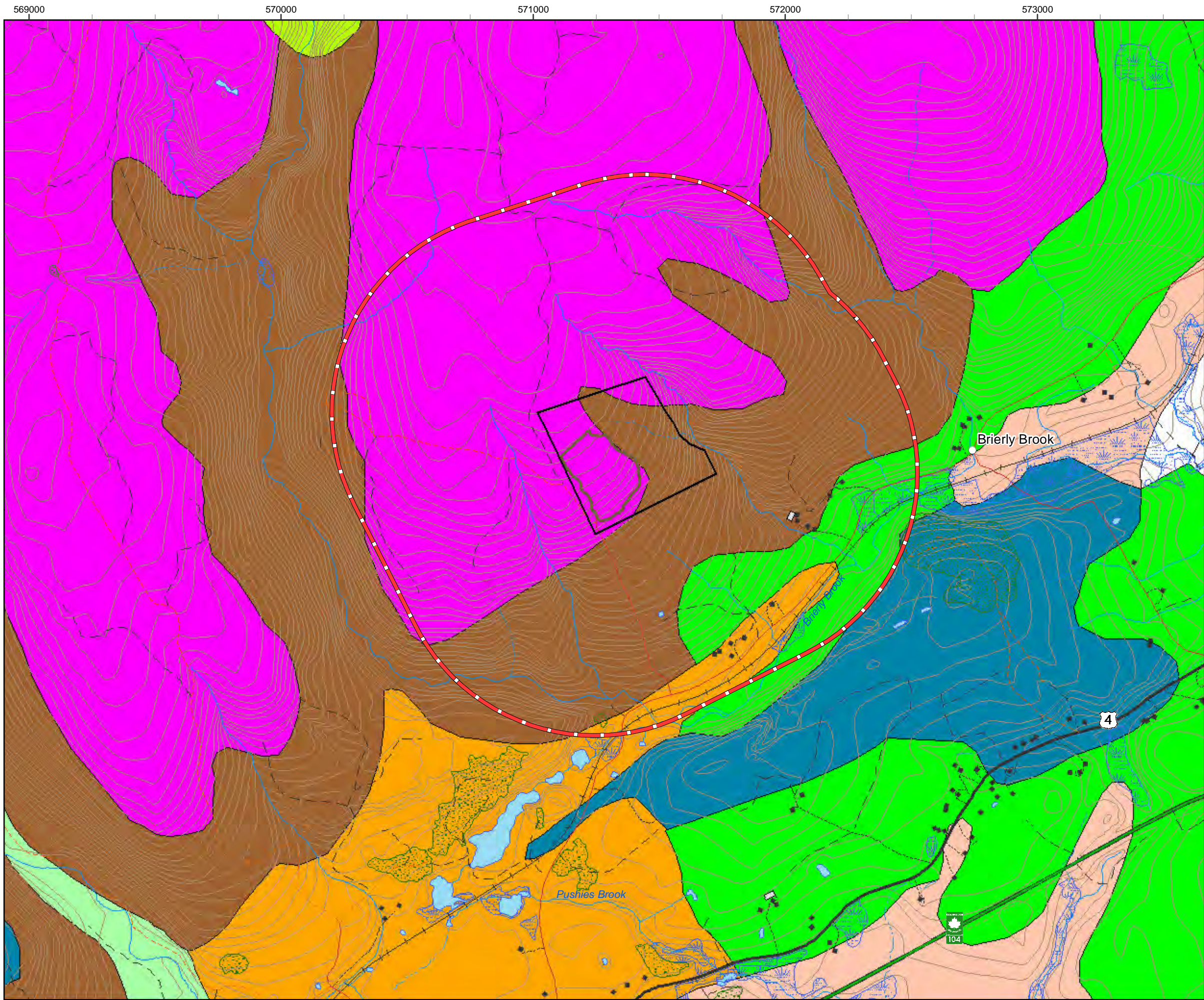
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PROJECTION: UTM z20 NAD83	DRAWN / CHECKED BY: JJP / PO	MAP ANGLE: 0° North
SCALE: 1:15,000	DATE: MAY 6/2014	PROJECT NO: 081464 (01)

081464 (01) GIS-DA611

figure 6.1-1
REGIONAL SOILS
BRIERLY BROOK QUARRY
NOVA CONSTRUCTION CO LTD
Brierly Brook, Nova Scotia

 **CONESTOGA-ROVERS & ASSOCIATES**



LEGEND:

- Colluvial Deposits
- Glaciofluvial Deposits (Outwash Fans)
- Glaciofluvial Deposits (Kames and Eskers)
- Hummocky Ground Moraine
- Stony Till Plain (Ground Moraine)
- Silty Till Plain (Ground Moraine)
- Ice Stratified Drift
- Residuum
- Bedrock
- 800 m Property Buffer
- Property of Interest
- Existing Quarry
- Other Pits & Quarries

SOURCE:
Base Map: SNSMR

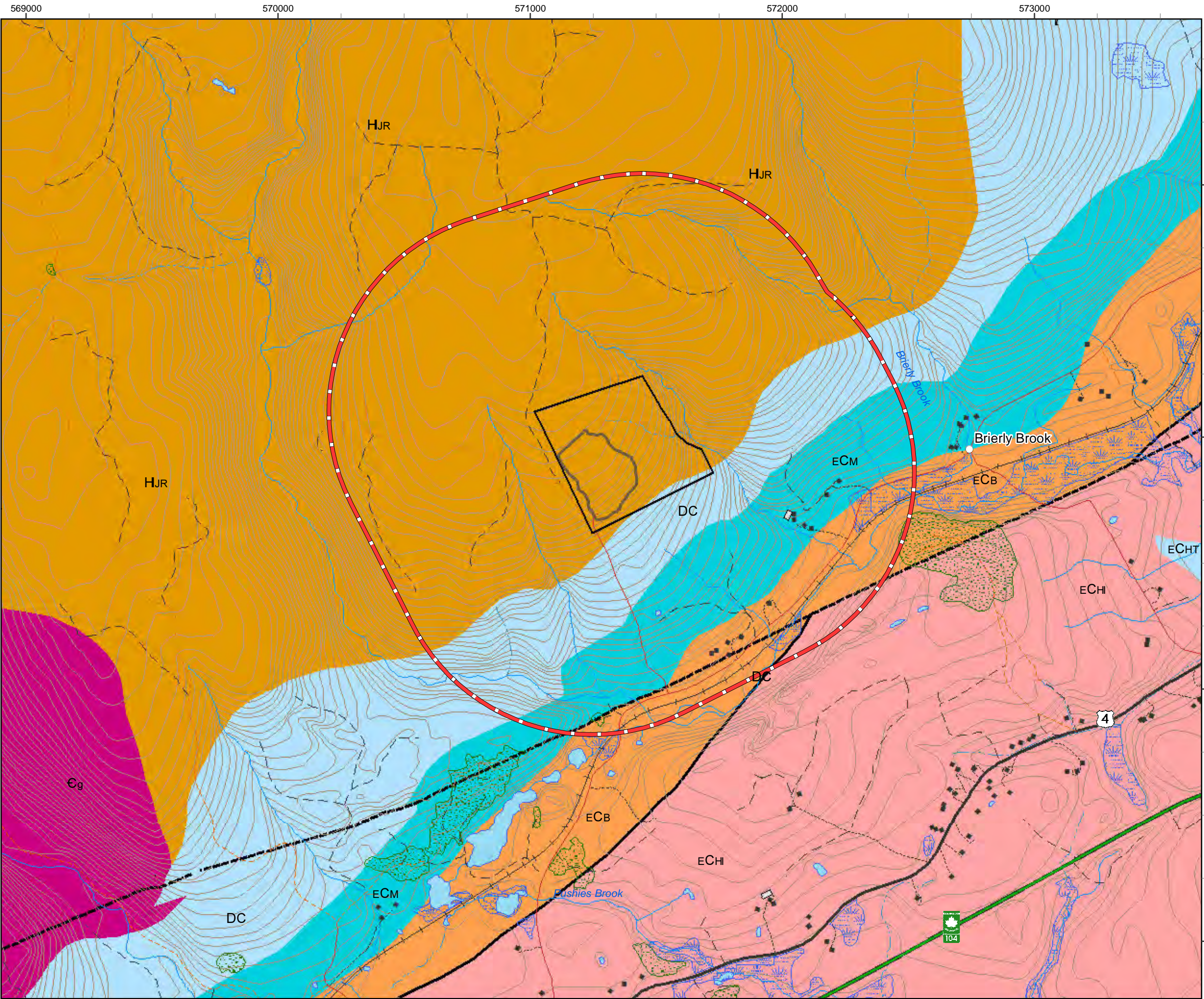
0 100 200 400 600 800
Metres

PROJECTION: UTM z20 NAD83
DRAWN / CHECKED BY: JJP / PO
MAP ANGLE: 0° North
SCALE: 1:15,000
DATE: MAY 6/2014
PROJECT NO: 081464 (01)

081464 (01) GIS-DA612

figure 6.1-2
SURFICIAL GEOLOGY
BRIERLY BROOK QUARRY
NOVA CONSTRUCTION CO LTD
Brierly Brook, Nova Scotia

CRA CONESTOGA-ROVERS & ASSOCIATES



LEGEND:

Bedrock Geology

- ECH Hood Island Formation
- ECB Bridgeville Formation
- ECM Macumber Formation
- DC Devono-Carboniferous undivided
- Eg James River Pluton
- HJR James River Formation

fault: approximate

thrust fault line

800 m Property Buffer

Property of Interest

Existing Quarry

Other Pits & Quarries

SOURCE:
Base Map: SNSMR

0 100 200 400 600 800
Metres

PROJECTION: UTM z20 NAD83

DRAWN / CHECKED BY: JJP / PO

MAP ANGLE: 0° North

SCALE: 1:15,000

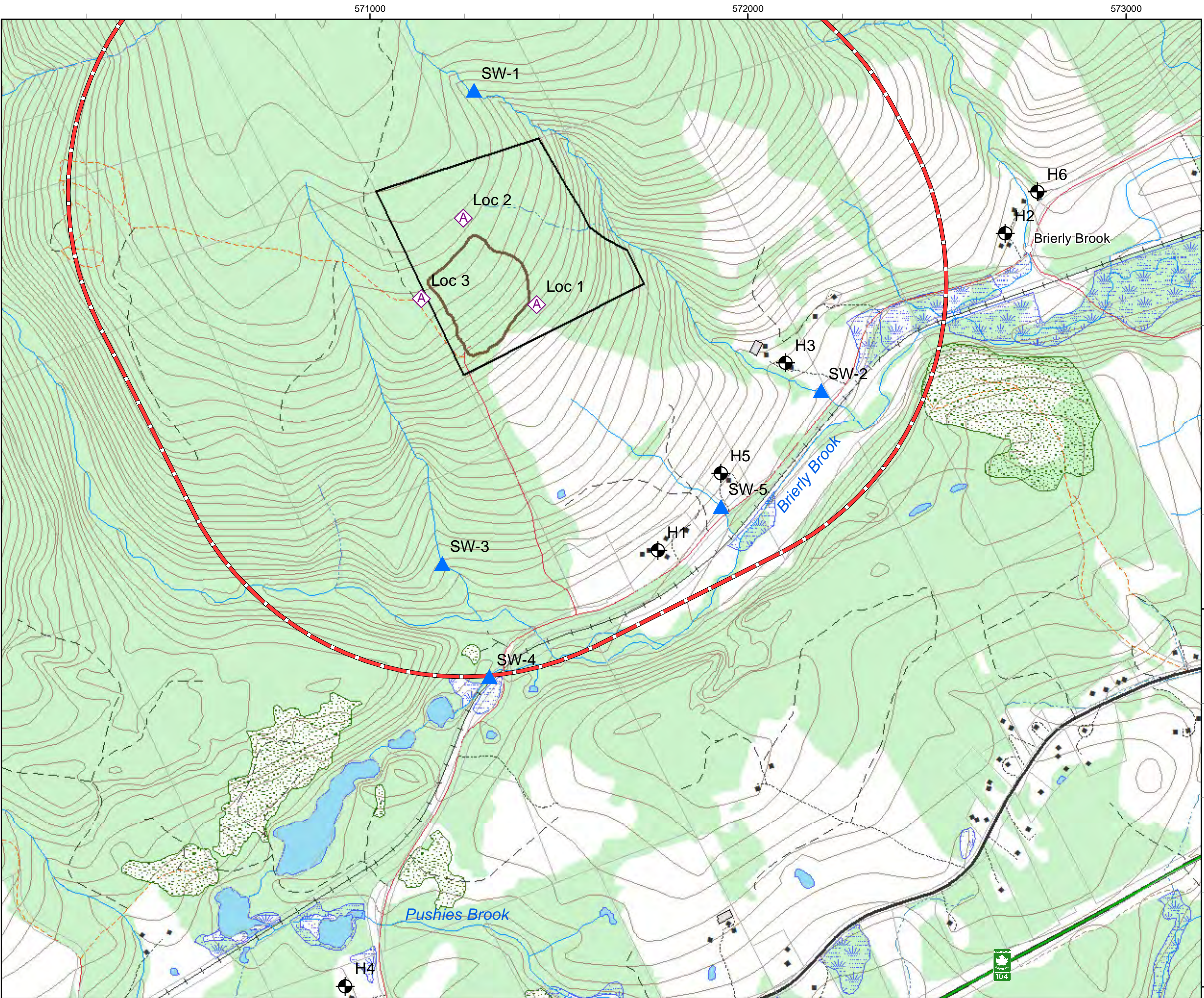
DATE: MAY 6/2014

PROJECT NO: 081464 (01)

081464 (01) GIS-DA613

figure 6.1-3
BEDROCK GEOLOGY
BRIERLY BROOK QUARRY
NOVA CONSTRUCTION CO LTD
Brierly Brook, Nova Scotia

CRA CONESTOGA-ROVERS & ASSOCIATES



LEGEND:

- ▲ Surface Water Monitoring Locations (SW)
- ⊗ Groundwater Monitoring Locations (H)
- ◊ TSP and Noise Monitoring Location (Loc)
- 800 m Property Buffer
- Property of Interest
- Ⓐ Existing Quarry
- Ⓐ Other Pits & Quarries
- Buildings
- Buildings

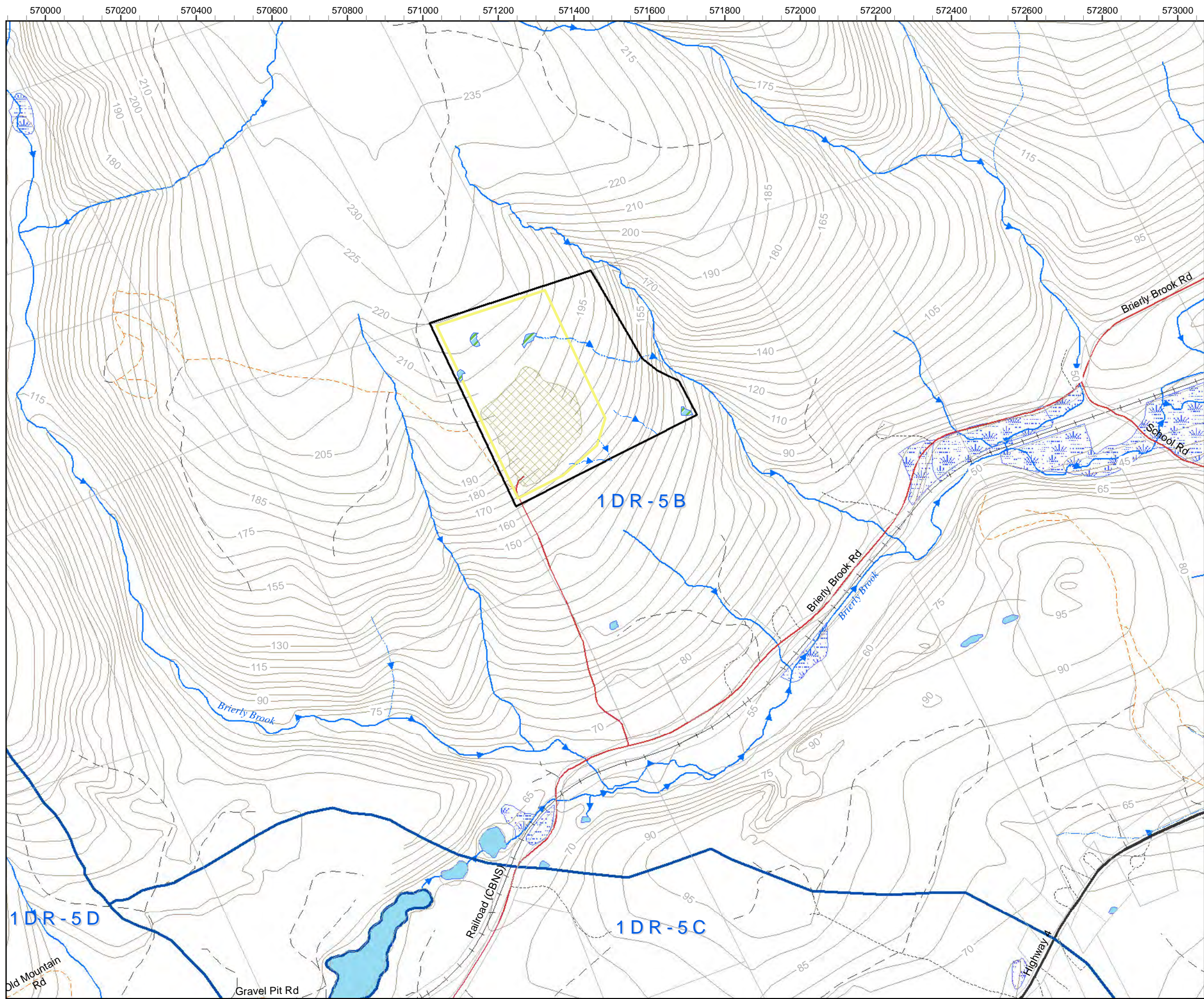
SOURCE:
Base Map: SNSMR

0 100 200 400
Metres

PROJECTION: UTM z20 NAD83
DRAWN / CHECKED BY: JJP / PO
MAP ANGLE: 0° North
SCALE: 1:10,000
DATE: MAY 6/2014
PROJECT NO: 081464 (01)

081464 (01) GIS-DA621

figure 6.2-1
SAMPLING LOCATIONS
BRIERLY BROOK QUARRY
NOVA CONSTRUCTION CO LTD
Brierly Brook, Nova Scotia



LEGEND:

- Streams
- Intermittent Streams
- Wetlands (Field Identified)
- Wetlands
- Watersheds (1DR-5B)
- Proposed Quarry Extent
- Property of Interest
- Other Property
- Existing Quarry
- Contours (5 m)

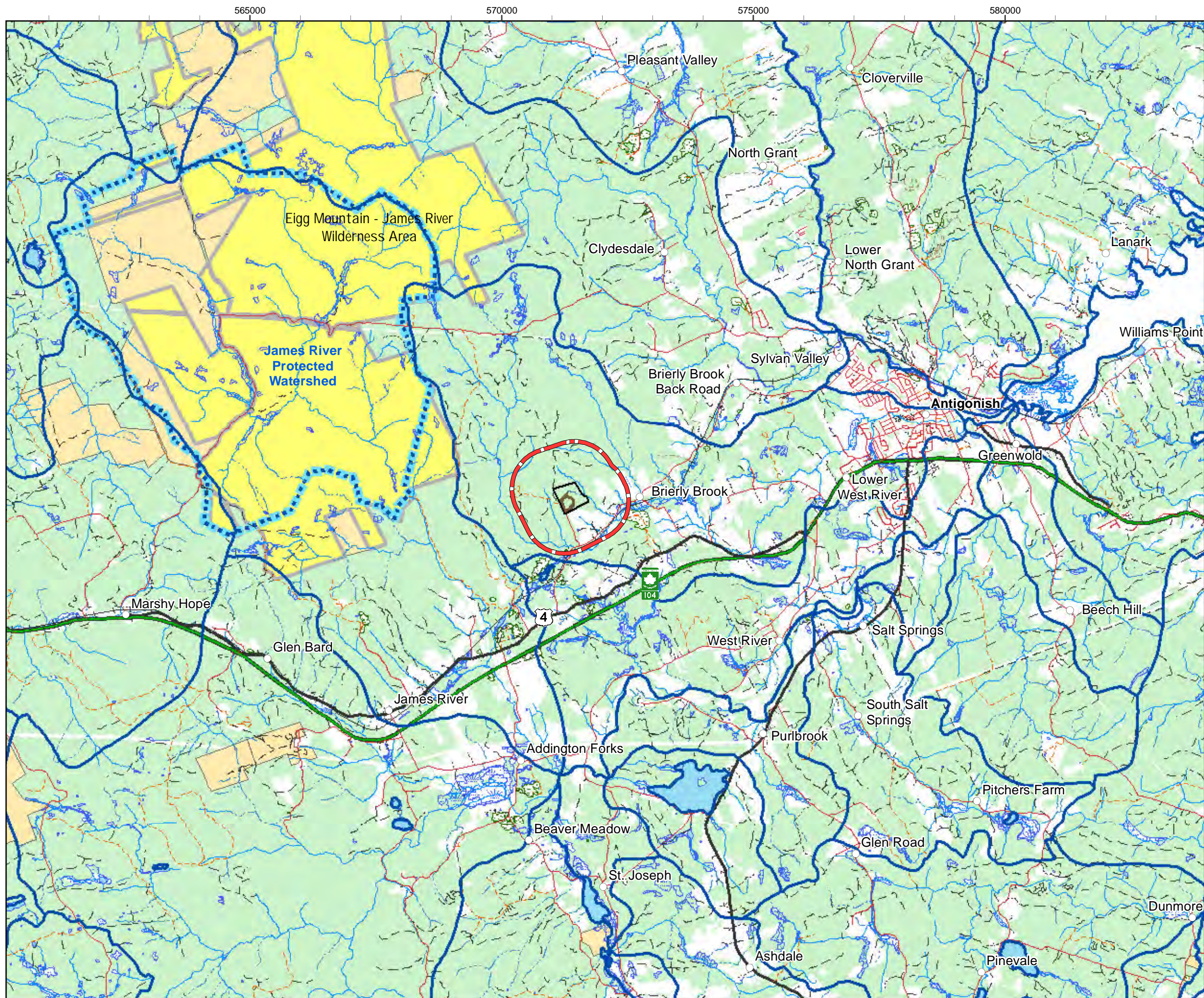
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Base Map: SNSMR
Photo: Bing Maps Apr 2013

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Metres

PROJECTION: UTM z20 NAD83
DRAWN / CHECKED BY: JJP / MM
MAP ANGLE: 0° North
SCALE: 1:10,000
DATE: December 10, 2014
PROJECT NO: 081464
081464 (01) GIS-DA0622

figure 6.2-2
LOCAL HYDROLOGY
BRIERLY BROOK QUARRY
NOVA CONSTRUCTION LTD
Brierly Brook, Nova Scotia

CRA CONESTOGA-ROVERS & ASSOCIATES



LEGEND:

- 800 m Property Buffer
- Property of Interest
- Streams
- Stream (intermittent)
- Existing Quarry
- Other Pits & Quarries
- Designated Water Supply
- Watersheds
- Wilderness Areas
- Candidate Protected Areas
- Water
- Wetlands (NSGC, NSE)

SOURCE:


Base Map: SNSMR
Themes: NSE

0 1 2 3 4 5
Kilometres

PROJECTION: UTM z20 NAD83	DRAWN / CHECKED BY: JJP / PO	MAP ANGLE: 0° North
SCALE: 1:75,000	DATE: December 10/2014	PROJECT NO: 081464

081464 (01) GIS-DA0631

figure 6.3-1
REGIONAL OVERVIEW
BRIERLY BROOK QUARRY
NOVA CONSTRUCTION CO LTD
Brierly Brook, Nova Scotia

**CONESTOGA-ROVERS
& ASSOCIATES**