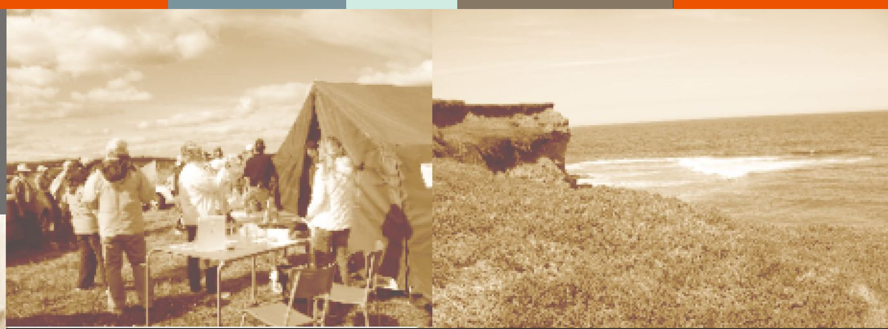
DONKIN UNDERGROUND EXPLORATION PROJECT



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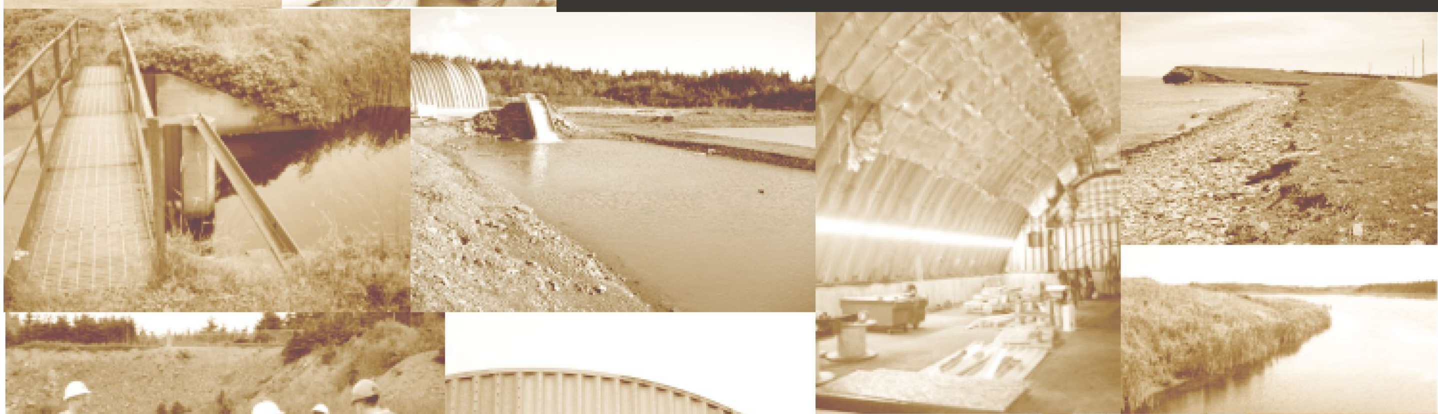


REPORT

Prepared For: Xstrata Coal

Prepared By: CBCL Limited

Project No.:081235.01

OCTOBER 2008

CBCL LIMITED
Consulting Engineers

xstrata coal

ENVIRONMENTAL ASSESSMENT

Contents

Appendices

List of Figures

List of Tables

List of Acronyms

AADT	Average Annual Daily Traffic
ADCP	Acoustic Doppler Current Profilers
ADIP	Atlantic Dragonfly Inventory Protocols
ALARP	As Low As Reasonably Practical
AMSL	Above Mean Sea Level
ARBS	Analysis of Roof Bolts System
ARMPS	Analysis of Retreat Mining Pillar Stability
Atlantic CDC	Atlantic Canada Conservation Data Centre
ATV	All Terrain Vehicle
BBRA	Broad Brush Risk Assessment
BBS	Breeding Bird Survey
CBC	Christmas Bird Count
CBRM	Cape Breton Regional Municipality
CCME	Canadian Council of Ministers of the Environment
CDC	Conservation Data Centre
CLC	Community Liaison Committee
CMRR	Coal Mine Roof Rating
COSEWIC	Committee on the Status of Endangered Life in Canada
CWS	Canadian Wildlife Service
DEVCO	Cape Breton Development Corporation
DO	Dissolved Oxygen
DT	Donkin Tenements Inc.
EC	Environment Canada
EG	Erdene Gold Inc.
EIA	Energy Information Administration
EMP	Environmental Management Plan
EMS	Environmental Management System
EPP	Environmental Protection Plan
EPT	Ephemeroptera + Plecoptera + Trichoptera
FWAL	Freshwater Aquatic Life
GHG	Greenhouse Gas
GPS	Global Positioning System
HSEC	Health, Safety, Environment and Community
HU	Hydrostratigraphic Units
ICCM	International Council on Mining and Metals
IEO	International Energy Outlook
ISO	International Standards Organization
ISQG	Interim Sediment Quality Guidelines
IUCN	International Union for Conservation of Nature
JOHSC	Joint Occupational Health and Safety Committee
kV	Kilovolt
MAL	Marine Aquatic Life

mbg	metres below grade
MCC	Motor Control Centre
MEK	Mi'kmaq Ecological Knowledge
MGC	Membertou Geomatics Consultants
MPS	Municipal Planning Strategy
Mtpa	Million Tonnes Per Annum
MRC	Maximum Reasonable Consequence
MSDS	Material Safety Data Sheets
MVA	Megavolt Ampere
NCS	National Contaminated Site
NIOSH	National Institute for Occupational Health and Safety
NSDEL/NSE	Nova Scotia Department of Environment (and Labour)
NSDNR	Nova Scotia Department of Natural Resources
NSPI	Nova Scotia Power Inc.
NSTIR	Nova Scotia Department of Transportation and Infrastructure Renewal
OHSAS	Occupational Health and Safety Assessment Series
PID	Property Identification
POL	Petroleum, Oils and Lubricants
Project	Donkin Underground Exploration Project
RDA	Rural Development Association
ROM	Run-of-Mine
SARA	*Species at Risk Act*
SCR	Sydney Coal Railway Inc.
SHACI	Significant Habitats Atlantic Coast Initiative
SLAM	Stop, Look, Assess and Manage
SYSCO	Sydney Steel Corporation
TARP	Trigger Action Response Plan
TIS	Traffic Impact Study
tpd	Tonnes per Day
tph	Tonnes per Hour
TSS	Total Suspended Solids
TSP	Total Suspended Particulate
UC	Undifferentiate Complex
UN	United Nations
VEC	Valued Ecosystem Component
vpd	Vehicles per Day
vph	Vehicles per Hour
WHMIS	Workers Hazardous Materials Information System
XCD	Xstrata Coal Donkin Limited
XCDM	Xstrata Coal Donkin Management Limited

Chapter 1 **Introduction**

1.1 Registration Requirements

Project Name:
Donkin Underground Exploration Project ("Project")

Project Location:
Donkin Peninsula, Cape Breton Regional Municipality (CBRM), Nova Scotia

The following are the names and coordinates (address, telephone, fax and e-mail) of contact persons from whom the regulatory authorities can obtain additional information.

Proponent Contact:	**Environmental Assessment Contact:**
Mr. Val Istomin, Project Manager Xstrata Coal Donkin Management Limited Suite 201 633 Main Street Glace Bay, NS B1A 6J3 Phone: 902 849 9235 Fax: 902 849 1641 E-mail: vistomin@xstratacoal.com	**Ms. Ann Wilkie, VP Environment** CBCL Limited 1489 Hollis Street Halifax, NS B3J 3M5 Phone: 902 492 6764 Fax: 902 423 3938 E-mail: annw@cbcl.ca

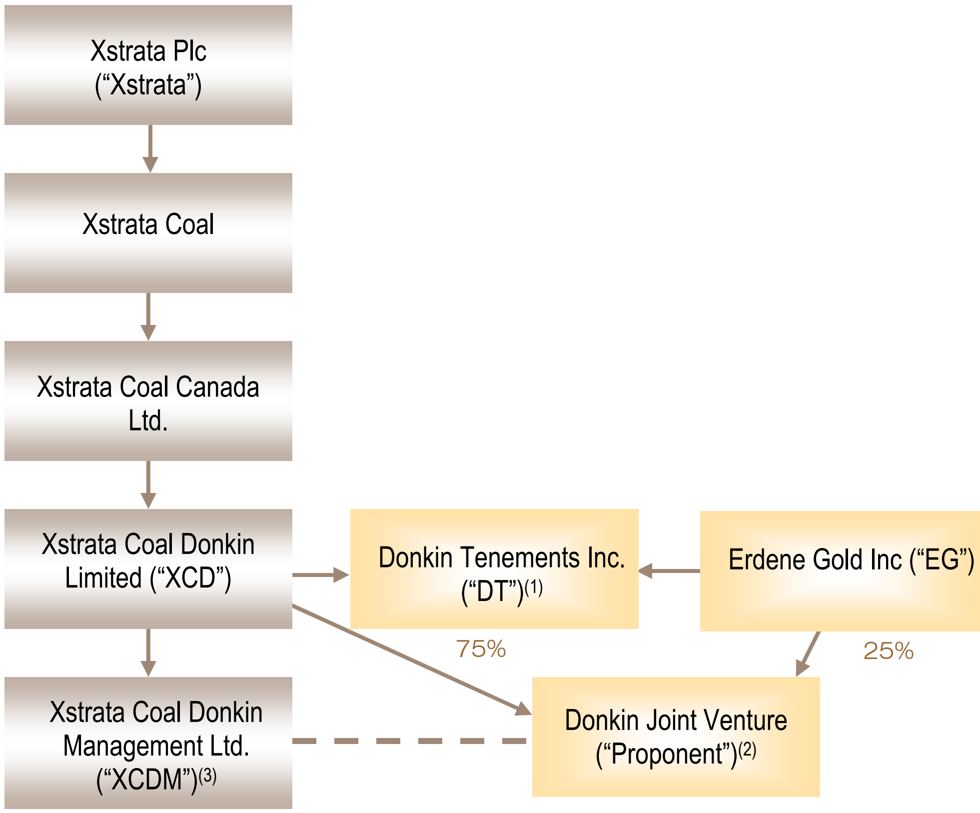
The following documentation presents the materials required for a Class I environmental assessment of the Project; this material has been prepared in accordance with the requirements of the Nova Scotia *Environment Act* and associated regulations.

Val Istomin	Anne Wilkie
Signature of Proponent Contact	Signature of Environmental Assessment Contact
21/10/08	21st October 2008.
Date	Date

1.2 Proponent Information

The underground exploration and associated surface works to be undertaken from the Donkin peninsula in Cape Breton are being executed by a joint venture of two subsidiary companies that form the Donkin Joint Venture, i.e., the Proponent. These companies are Xstrata Coal Donkin Limited, with a 75% controlling interest, and Erdene Gold Inc. with a 25% balancing interest. Through a series of subsidiary companies, Xstrata Coal Donkin Limited is managed by Xstrata Plc. Xstrata Coal Donkin Management Limited ("XCDM") is the Project Manager for the Proponent and a subsidiary of Xstrata Coal. Figure 1.1 depicts the corporate structure.

Xstrata Plc is a major diversified mineral producer listed on the London and Swiss stock exchanges. The company has a market capitalization value of $89 billion USD and employs 56,000 people worldwide. As the world's leading exporter of thermal coal, Xstrata Plc is committed to the goal of sustainable development by balancing social, environmental and economic considerations in their management practices. Since September 2006, Xstrata Plc has been listed on the Dow Jones Sustainability Indexes.



1 Donkin Tenements is owned 75% by Xstrata PLC through subsidiaries and 25% by Erdene Gold through subsidiaries. The Special License No. 2/06 under the Mineral Resources Act and the Coal Gas Exploration Agreement 07-31-01-01 under the *Petroleum Resources Act* were both granted to Donkin Tenements Inc.
2 The Donkin Joint Venture is an unincorporated joint venture between Xstrata Coal Donkin Limited and Erdene Gold to explore and potentially develop and operate the Donkin Coal Resource Block.
3 Xstrata Coal Donkin Management Limited is the Manager of the Donkin Joint Venture. The owner of the land (formerly owned by the Cape Breton Development Corporation) is Xstrata Coal Donkin Management Limited.

Figure 1.1: Corporate Structure

CBCL Limited has been contracted by the Project Manager, XCDM, since mid 2006 to provide environmental services and to assist with public consultation. They have worked with the Proponent to:

- design and execute the surface works necessary to dewater and reopen the tunnels[1];
- create and implement a comprehensive consultation program;
- liaise with the engineering design team, including Sandwell Engineering, to integrate social and ecological aspects into the engineering design; and
- determine the regulatory route for the environmental assessment, design and execute the requisite environmental field programs and prepare the documentation necessary to attain the permits,

[1] The tunnels had been successfully dewatered by the week of August 20, 2007. Maintenance pumping, as required, continues.

authorizations and approvals required to develop and operate the mine, including the underground exploration phase.

1.2.1 Business Principles and Policies

Xstrata's underlying philosophy for all projects is:

- to be a fatality and serious injury free business;
- to become the employer of choice;
- to be recognized for their commitment to sustainable development; and
- to be a profitable coal mining operation.

This design philosophy is underpinned by the total commitment of Xstrata to their Sustainable Development Framework. In 2007, Xstrata undertook a wide-ranging and in-depth external and internal review of their sustainable development governance framework which was initiated in 2004. The revised Sustainable Development Framework was approved by Xstrata's Executive Committee and Board at the end of 2007. Compliance to this Framework assures performance to international sustainability standards, beyond regulatory compliance. Xstrata's corporate vision and commitment to Health, Safety, Environment and Community ("HSEC") values remain intact.

Xstrata's Sustainable Development Framework has been mapped to international standards including the International Council on Mining and Metals ("ICMM") and United Nations ("UN") Global Compact principles, Voluntary Principles on Security and Human Rights, International Standards Organization ("ISO") 14001, the international standard for environmental management, and Occupational Health and Safety Assessment Series ("OHSAS") 18001, the international safety management standard. The framework is supported by Xstrata's independent Sustainable Development Assurance Programme. Every operation and project managed by Xstrata is independently audited through this programme against Xstrata's Business Principles, Sustainable Development Policy and 17 Standards at least every three years, based on risk.

Xstrata's 17 Sustainable Development Standards are as follows:

- *Standard 1: Leadership, Strategy and Accountability*
- *Standard 2: Planning and Resources*
- *Standard 3: Behaviour, Awareness and Competency*
- *Standard 4: Communication and Engagement*
- *Standard 5: Risk and Change Management*
- *Standard 6: Catastrophic Hazards*
- *Standard 7: Legal Compliance and Document Control*
- *Standard 8: Operational Integrity*
- *Standard 9: Health and Occupational Hygiene*
- *Standard 10: Environment, Biodiversity and Landscape Functions*
- *Standard 11: Contractors, Suppliers and Partners*
- *Standard 12: Social and Community Engagement*
- *Standard 13: Life Cycle Management – Projects and Operations*
- *Standard 14: Product Stewardship*
- *Standard 15: Incident Management*

- *Standard 16: Monitoring and Review*
- *Standard 17: Emergencies, Crises and Business Continuity*

Each of the standards listed above link to more detailed information on its intent, requirements and expectations from Xstrata's Sustainability Website (http://www.xstrata.com/sustainability/reporting-standards/sustainable-development/).

The Sustainable Development Policy derived from the above is attached in Appendix A. These policy statements commit Xstrata's operations and projects world wide to be undertaken to the highest standards of health and safety, environment, sustainable communities and employee relations. Xstrata also issues annual Sustainability Reports that describe the steps and actions that the company has instigated and taken to further their operating principles on sustainability. These are widely available via Xstrata's corporate website (www.xstrata.com/sustainability/publications/annual).

As part of the overarching Sustainable Development Policy, the Proponent intends to collaborate with the Province to consider strategies to ensure the sustainability of the Province's natural capital in the mining sector as set out in section 4(2)(u) of the *Environmental Goals and Sustainable Prosperity Act.* The Donkin Resource Block is an important component of the region's natural capital. The Proponent will ensure that, if economically viable and approved, it is developed in a manner that brings maximum benefit to the local area and to the Province not only with minimum impact on the receiving environment, but in a manner that leaves a positive legacy.

In addition to these commitments, the Proponent is taking the initiative not only to pursue goals with respect to climate change, sustainability, and a commitment to biodiversity, but also to execute and support pertinent research in these fields, to lead by example and to embrace these objectives throughout their operations including the work that will be undertaken at Donkin. The following outlines corporate approaches to key challenges relating to the coal extraction industry; specific application to the Underground Exploration Project is presented in Section 2.4.

1.2.1.1 Climate Change

As a significant producer and consumer of energy, Xstrata seeks to contribute to the global challenge of satisfying the world's growing energy needs while reducing carbon emissions. Xstrata's role in the development of 'clean coal' technology is viewed as an opportunity to responsibly include coal in the energy mix in a carbon-constrained world.

By proactively improving the energy efficiency of its operations, reducing direct emissions and investing in research and demonstration of clean coal technologies, including carbon capture and storage, Xstrata continues to help reduce emissions generated from the use of coal as an energy source.

In 2007, the carbon intensity of Xstrata operations improved by over 20%, due in part to enhanced methane abatement at underground coal mines. Xstrata is on track to invest $75 million in clean coal technology by 2010 and two major demonstration plants are under way in 2008.
Xstrata is currently reviewing its intensity targets, continuing to contribute towards the demonstration of clean coal technologies, improving energy efficiency and implementing the findings of an independent

study into the potential physical impacts of climate change on operations. Their current target is to reduce carbon intensity by 5% over 2005 levels by 2010.

For more information on Xstrata's approach to climate change go to:
www.xstrata.com/sustainability/environment/climate

1.2.1.2 Carbon Neutrality

The Proponent will seek to achieve a goal of carbon neutrality for the overall development of the longwall mining operation which is subsequent to this Project. One example of a recent Xstrata plc undertaking is the abatement strategy for greenhouse gas ("GHG") emissions from the Bulga Complex in Australia. The primary emphasis is to convert 85 percent of the methane in the drainage gas from the underground workings to carbon dioxide. In addition, it is planned to establish additional woodland as part of the mine site rehabilitation program; this would further mitigate the carbon footprint at the Bulga complex.

1.2.1.3 Commitment to Biodiversity

Xstrata commits to the long-term health, function and viability of the natural environments in which its operations exist through a process of identification, analyses, evaluation and elimination of all significant potential and actual impacts of its activities and operations on the environment, biodiversity and landscape functions. During 2007, biodiversity conservation plans were implemented at all of Xstrata's operations, and they are on track to implement plans at all acquired operations within 24 months of their acquisition. The plans establish the existing conditions of biodiversity and landscape function, identify the potential impacts of proposed activities and identify opportunities for prevention, mitigation, improvement or compensation (e.g., offset areas).

Xstrata's 2008 target is the prevention of the loss of any International Union for Conservation of Nature ("IUCN") red list or endangered species from the sites of any Xstrata managed operations and all other sites in biodiversity-rich areas will investigate implementing biodiversity offsets.

For more information on biodiversity conservation please see:
www.xstrata.com/sustainability/environment/biodiversity.

1.3 Context and Background

1.3.1 Historic Coal Mining in Sydney Coal Field

The first coal mine in North America was located in the village of Port Morien, some 6 km from the Project site. The exposed coal in this area was extracted by French settlers in 1720 (Nova Scotia Museum, 1996); this site is a designated Special Place under Nova Scotia's *Special Places Protection Act*. Over the ensuing years, surface and underground coal mining became an important local industry employing many thousands of people. Coal from the mines supplied local power stations with fuel stock, and a proportion was used by the Sydney Steel Corporation ("SYSCO") which operated a large steel plant in the region. Some coal, both thermal and coal of coking quality, was sold into the export market.

In the mid 1960s, the mining and associated steel industry faced wide scale downsizing as the predominant employer, the Dominion Steel Company, reduced operations. The Cape Breton Development

Corporation ("DEVCO") was established in 1967 with a mandate to acquire and manage many of the local coal mines and to explore for new resources, including the Donkin Resource Block. Until 1987, DEVCO invested both time and funds to explore and evaluate the potential of the coal resource at Donkin. This culminated with the construction of two 3.7 km tunnels offshore from the Donkin peninsula to intersect with the Harbour Seam. In 1992, as a consequence of changing market conditions, DEVCO decided not to proceed with the further development of the resource. In 1992, the tunnels were sealed and allowed to fill with water. A partial clean up of the area was undertaken, and the industrial site was abandoned. The only subsequent use of the Donkin peninsula has been by the local community for recreational purposes.

The last working underground mine in the Sydney Coal Field, the Prince Colliery Mine, ceased operation in 2001. With this closure, the coal preparation and washing plant that had been developed in the 1970s at Victoria Junction closed; much of this site has since been remediated and tidied. All that remains of the industrial infrastructure are the pad, i.e., lifting and banking centre, and the rail shops. The former has the capacity to accommodate up to 1 million tonnes of coal, and the latter are considered state of the art and have room for expanded operations. The entire site at Victoria Junction is identified for industrial purposes in CBRM's Municipal Planning Strategy ("MPS") and has the potential capacity to be an important handling centre in the region. At present, the rail shops are used by Sydney Coal Railway Inc. ("SCR"). The SCR continues to operate the railway between the International Pier on the Sydney waterfront and the power generating plant at Lingan operated by Nova Scotia Power Inc. ("NSPI").

1.3.2 Exploration Agreement and License

On December 13, 2004, the Province issued a Call for Proposals for the exploration and development of the Donkin Resource Block. This Block, estimated to contain over 200 million tonnes of high quality coal, is located under the Atlantic Ocean, 3.5 km north of the Donkin Peninsula. The coal, typical of coal in Cape Breton, is characterized as a highly volatile (30%-35%) bituminous coal with low to medium ash content and strong coking characteristics.

In December 2005, the Proponent was granted exclusive rights by the Nova Scotia Department of Natural Resources ("NSDNR") to apply for a Special License to conduct exploration activities designed to determine a business case for the potential development of an undersea coal mine. NSDNR and the Proponent entered into an agreement dated May 31, 2006 for Special License No. 2/06. On January 31, 2007, the Province, as represented by the Minister of the Department of Energy, and the Proponent entered into a Coal Gas Exploration Agreement (No. 07-31-01-01) which authorized the Proponent to explore for coal gas in the Donkin Resource Block. The Special License allows the Proponent to conduct exploration activities to determine the business case for coal mining options and to identify and assess environmental issues. The undertaking described in this submission is within the context of this Special License.

The award of the Special License allowed the Proponent to access the Donkin industrial site previously operated by DEVCO. The area had been cleared of all vegetation and disturbed physically by the works undertaken during the 1980s. Access to the site is presently from the beach road, i.e., Schooner Pond Beach Road, that runs parallel to Schooner Pond Cove. Since award of the Special License, the Proponent has established a secure and clean site, has undertaken exploratory work, has dewatered the two existing subsea tunnels and executed an extensive range of environmental field programs. The proponent has instigated community consultation and has established a Community Liaison Committee ("CLC").

1.4 The Project

1.4.1 Project Location and the Resource Block

As depicted on Figure 1.2, the Project is located on one of Nova Scotia's most easterly peninsulas on Cape Breton Island within District Two of CBRM, the second largest municipality in the Province; the Donkin peninsula is situated approximately 11 km southeast of Glace Bay and 32 km to the east of Sydney, which is the economic centre of Cape Breton. The communities surrounding the Project site include Donkin, Big Glace Bay, Long Beach, Port Caledonia, Port Morien and Schooner Pond. Based on the 2006 population census Donkin, as part of the community of Port Morien, has a population of approximately 2,400[2].

The Project is located within the Sydney Coalfield which is a large coal basin of Carboniferous age. The basin extends north and northeast from the northern part of Cape Breton Island under the Atlantic Ocean towards Newfoundland. The Donkin area is the most easterly part of the coalfield that may be accessed from the coast. The landward portion of the coalfield constitutes less than 5% of the total coal measure sequence. Up to 11 coal seams are recognized in the Donkin area, and three of those may have potential for eventual underground extraction, namely the Lloyd Cove, Hub and Harbour seams (in descending stratigraphic order). At this stage, only the Harbour Seam has been considered by the Proponent in the feasibility study for the development of the Donkin Resource Block by longwall mining.

The Proponent has identified that Harbour Seam coal from the resource block has the potential to supply an acceptable product to both thermal and metallurgical markets. A 400 kg sample from this seam was removed in 2007, and the resultant data from its analysis was used to supplement existing data from other sources, e.g., prior bores, etc. Nevertheless, additional data and its analysis is required before the resource can be determined to be commercial and sales arrangements and markets fully established for longwall development; this is the purpose of this undertaking, i.e., the Donkin Underground Exploration Project. Should the resource be proven to be economically viable, the Proponent has indicated that coal from a Donkin longwall mine would be available for purchase by NSPI on a competitive commercial basis as well as to purchasers elsewhere. It is anticipated that the annual production of a longwall mining operation would range between 3.7 and 5.2 million tonnes per annum ("Mtpa"). The estimated life of the mining operation beyond the exploration phase is estimated to be between 20 and 30 years. By comparison, the estimated extraction of coal during this undertaking, i.e., the exploration phase, is estimated to be less than one million tonnes over three years, which includes one year of prepatory activities.

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[2] Local community boundaries have changed since the 2001 Census; the Port Morien area includes Big Glace Bay, Birch Grove, Broughton, Donkin, Homeville, Long Beach, Marconi Towers, Morien, Morien Junction, Port Caledonia, Port Morien, Round Island, Sand Lake, Schooner Pond, South Port Morien, Waddens Cove. Source: Nova Scotia Community Counts.

1.4.2 Land Holdings

The Proponent currently owns approximately 99% of the land on the Donkin Peninsula; the balance including Baileys wetland, is held by the Province. The peninsula, once divided into eight blocks of land, was purchased by the Proponent from DEVCO. The parcels of land purchased on the peninsula involved the following Property Identification ("PID") numbers: 15496326, 15277106, 15496334, 15496292, 15496342, 15496300, 15277072 and 15496318 (see Figure 1.3); the surface works on the Donkin Peninsula will take place on the lands acquired by the Proponent.

1.4.3 Project Parameters

Under the rights granted by the Special License, the Proponent proposes to complete an underground exploration phase, i.e., the Project, to determine a business case for the potential development of a subsea longwall mine. The objective is to provide the Proponent with sufficient information and confidence in data with respect to the geology, coal quality, hydrology and methane gas regime in the mine to determine the commercial viability of developing the Donkin Resource Block using longwall mining techniques.

The Project will be executed in two distinct phases: the first, which will be executed in year 1, will involve preparatory works both on the surface and subsea; the second will involve the use of a continuous miner system for a period of up to two years, i.e., in years 2 and 3, to remove an average of 2,000 tonnes of coal per day (estimated as approximately 0.5 Mtpa). The Project will be in operation five days per week with on-site work taking place 24 hours per day; trucking of coal will occur on the public roads up to 12 hours per day. The expected staffing will be about 45 full time equivalent positions. The anticipated capital investment in the Project is about $100 US million.

The Project includes augmenting the existing surface infrastructure on the Donkin peninsula to enable the operation of a continuous miner and the handling of the coal on the surface; this includes the provision of power, the management of water and improvements to road access to accommodate the trucking of the coal from the Project site to various destinations via public highways. It is proposed that a single continuous miner will drive into the Donkin coal block with access to and from the subsurface coal face attained from the existing entry tunnels. The infrastructure will include a run-of-mine ("ROM") conveyor that will stack the coal directly onto a small stockpile. A loader will transfer the coal through a mobile crushing plant from where the stockpiled coal will be loaded onto the trucks that will haul it off site.

This Project as defined does not include the development of the longwall mine and associated dedicated transportation corridor. A separate Nova Scotia Class I Environmental Assessment will be completed for the development of the longwall mine at Donkin and associated infrastructure including the dedicated transportation corridor that is proposed pursuant to the Nova Scotia *Environment Act.*

The outcomes of the underground exploration phase, i.e., the Project, and the subsequent environmental assessment process for the longwall mining development, including the ongoing community consultation and environmental surveys, will be evaluated by the Proponent in order to determine the viability of longwall mine development of the Donkin coal lease. A positive outcome would result in the potential commencement of the longwall coal mining project in 2012 with longwall production in 2014.

1.4.4 Existing and Proposed Site Infrastructure

The work conducted by DEVCO on the Donkin peninsula during the 1980s disturbed a large area of the headland, i.e., approximately 37 hectares or 9.4% of the headland. Several site roads, two waste rock disposal piles, a settling pond and a power transmission line are all still clearly evident on the site. There are also three structures on site left from the DEVCO period; these are the two structures that serve as the portals to the subsea tunnels and a former machine storage shed, i.e., Quonset hut. These structures have been refurbished and are currently being used as part of the Proponent's activities.

Current surface facilities on the site include a gate house, access road, site office facility, fuel storage, laydown area and the two tunnel portals that provide access to the underground workings. Power at the site is currently provided by diesel generators. A fence has been installed to prevent trespassing on the active site, and all access to the site is controlled. A small borrow pit used by DEVCO in the early 1980s is located to the south east of the site (pers.comm. Joe Shea, 2008); this borrow pit is no longer in use.

A new sedimentation pond, i.e., the serpentine pond, was constructed as part of the treatment program for the tunnel dewatering operations. This system discharges into existing infrastructure including the drainage channel to the DEVCO settling pond, the discharge channel and the outlet to the Schooner Pond Cove.

The existing road along Schooner Pond Cove, i.e., Schooner Pond Beach Road, has been used to access the site and by vehicles transporting the machinery required for the preliminary feasibility portion of the project. This road, however, is not suitable for continued use as a haul road, and design work is being completed for the construction of a new two lane access road to the site from a point on Long Beach Road approximately 1 km south of the existing access road. The alignment of the existing cut for this access road generally aligns with the existing power line as shown on Figure 1.3. The latter figure also identifies the facilities referenced above.

1.4.5 Completion of Tunnel Dewatering

Immediately after the Proponent took control of the site, the priority was to dewater the tunnels to enable further evaluation of underground conditions and to allow for more detailed investigations of the coal resource. After discussions with federal and provincial regulators and community interests, including consultation with local fishers, an approach to the dewatering of the tunnels was agreed upon and implemented. With the removal of 470 million litres of water, the tunnels were successfully dewatered. This water was handled onsite prior to being discharged to Schooner Pond Cove.

As shown in Figure 1.4, the wastewater treatment system consists of cascade aeration and passage through a constructed sedimentation pond, i.e., the serpentine pond, a drainage channel and the former DEVCO settling pond prior to discharge to Schooner Pond Cove. The cascade aeration system consists of a set of concrete steps (8 m in height x 2 m wide) over which the tunnel water was diffused, thereby oxidizing the iron present in the water. The system was constantly monitored, as per sample locations, such as MP-1, etc., and was demonstrated to be effective. A summary of the water quality monitoring undertaken and the results are provided in Section 4.3.5.3.

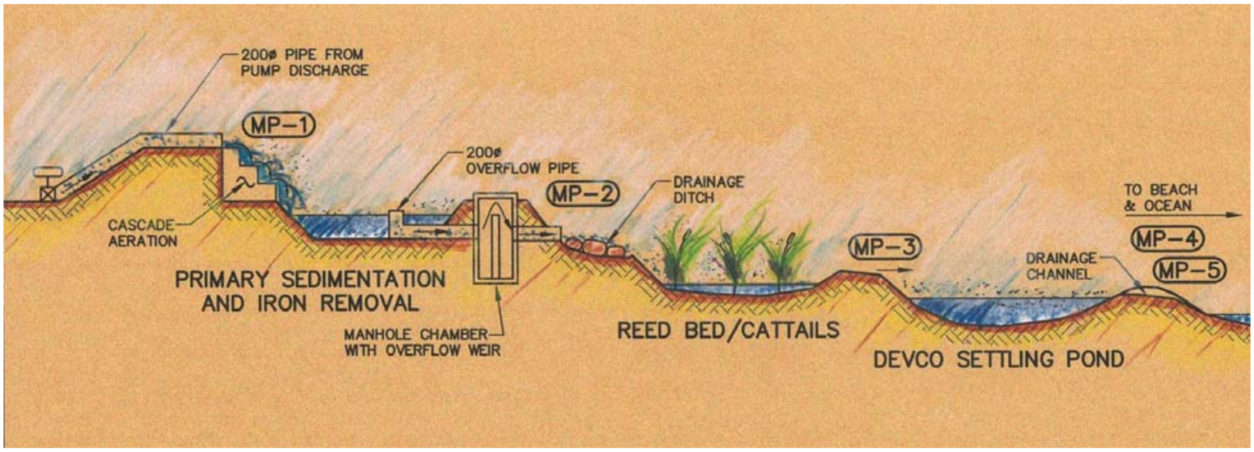


Figure 1.4: Tunnel Dewatering Treatment Process

1.5 Project Justification

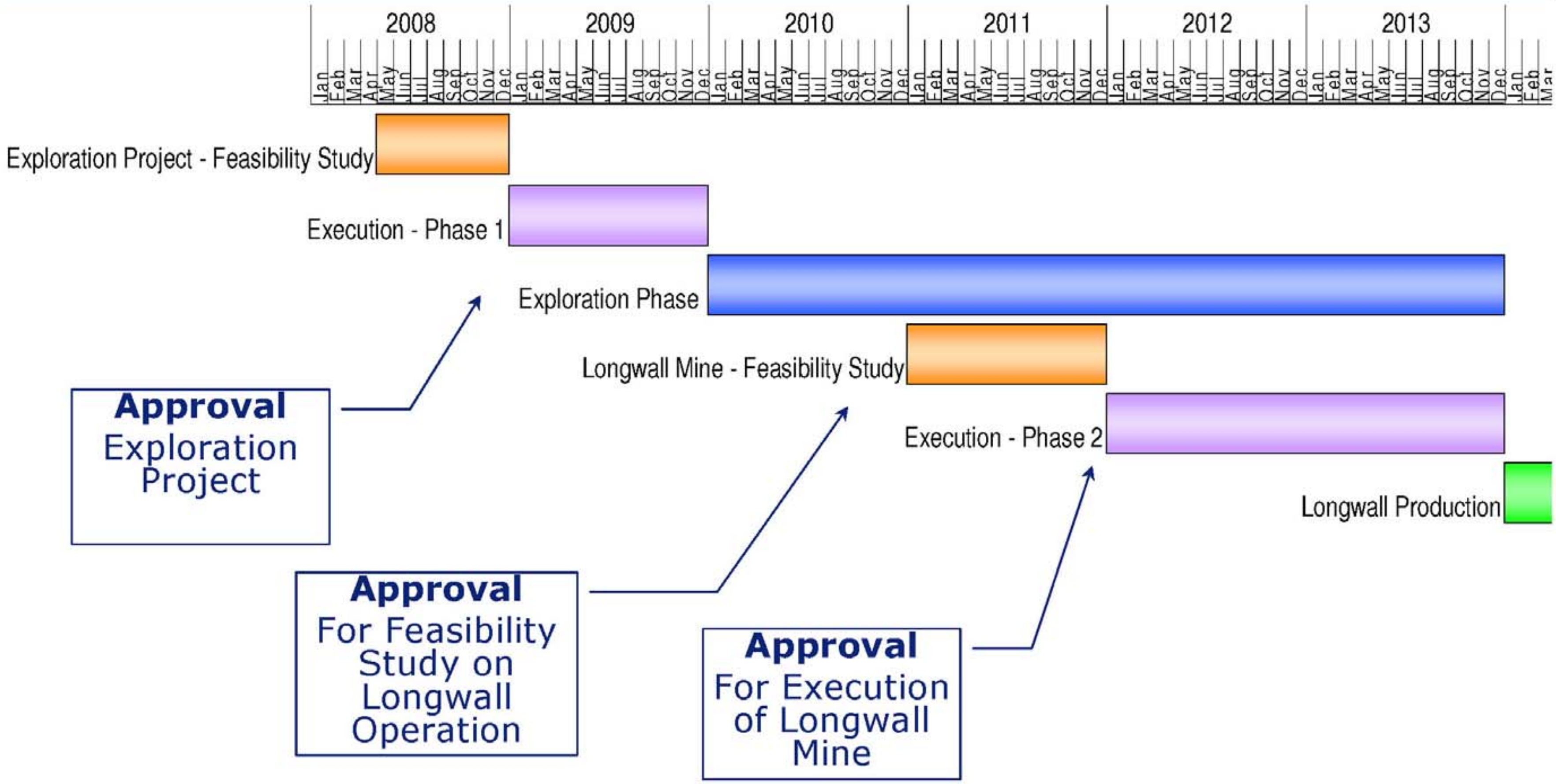
The objective of the proposed exploration program is to gather additional information on the coal quality and to perform geotechnical modelling. During the initial exploration of the coal block by DEVCO more than 30 years ago, 11 boreholes were drilled across the resource block. For a coal block the size of Donkin, approximately 120 boreholes would be required by current standards to gather sufficient data on geology, coal quality and marketability. This is a serious impediment to the assessment of the development of the Donkin Resource Block and has resulted in the development of the proposed program for further underground exploration.

Given the location of the resource beneath the Atlantic Ocean, it is neither commercially viable nor practical to drill the number of holes required from the surface. To gather the necessary information, the Proponent proposes to explore underground using a continuous miner system for a period of up to two years after about a year of prepatory works. The objectives are to:

- Confirm geology;
- Confirm coal quality;
- Confirm geotechnical qualities;
- Confirm mining conditions;
- Understand methane gas regime;
- Understand hydrology;
- Provide ongoing seam channel samples for analysis; and
- Provide bulk samples for customers' assessments.

The results of this Project are pivotal to enable the Proponent to determine whether to proceed with the development of a longwall mine. The Donkin Underground Exploration Project will commence in 2009 and run parallel with the environmental approval processes for the anticipated longwall mining operation and dedicated transportation corridor. Dovetailing these activities will facilitate a smooth transition into a longwall mining operation should this prove viable. Figure 1.5 depicts the timing of the Project within the overall context of the Proponent's master schedule for the execution of the longwall mine at Donkin.

Figure 1.5: Donkin[1] Project Schedule



Project Timing is subject to :

- the findings of the Exploration Project
- Approvals process including environmental approvals

16

1 This schedule presents the Underground Exploration Project in the context of the Proponent's master schedule for the execution of the long wall mine at Donkin

1.6 Spatial and Temporal Boundaries

The study area for this environmental assessment includes the footprint of all works associated with the execution of the planned exploratory program and those areas within which project-environmental interactions could reasonably be expected to occur. It is not possible to establish a single study area boundary that accurately accommodates the spatial characteristics of the potential project-environmental interactions. For example, the primary footprint is the area immediately adjacent the existing mine portals, including the already disturbed lands and the lands in the vicinity of the serpentine pond, i.e., the active yard. Consideration, however, in the presentation of ecological and avian field data has been given to the peninsula as a whole; similarly a larger geographical area as been taken into account in the evaluation of the truck movements from the Project site to a number of potential destinations in CBRM and beyond.

Temporal project boundaries are restricted to the duration of the exploratory activities, i.e., a period no longer than 36 months.

1.7 Regulatory Context

The focus in this section is to identify the environmental and land use authorizations, permits and approvals necessary to enable the necessary works for the Donkin Underground Exploration Project. Requirements of the various levels of government for approvals, authorizations and permits are identified.

1.7.1 Provincial

In 1994, the Province initiated a "One Window" process to review, permit and monitor mine-related projects. The general intent was to streamline necessary interactions between different provincial government departments and the proponent, to increase regulatory efficiency and to reduce jurisdictional overlap. The principal government departments involved include NSDNR, as the lead agency, and Nova Scotia Department of Environment ("NSE"), who provides leadership and direction for the required provincial environmental assessment process.

Schedule A of the Environmental Assessment Regulations made pursuant to the *Nova Scotia Environment Act* categorizes "*a facility engaged in the extraction or processing of -- coal--*" as a Class I Undertaking. Such a project shall be registered; may be the subject of a focus report; terms of reference and an environmental assessment report. It may also be referred to the Nova Scotia Environmental Assessment Board. This submission is made in accordance with the requirements of these regulations.

The Provincial legislation and requirements associated with the Project are listed in Table 1.1.

Table 1-1: Applicable Provincial Legislation and Associated Requirements

Legislation	Regulation/Reference	***Activity***	***Government Department***	***Requirement***
Environment Act	Environmental Assessment Regulations	Development and operation of mine for exploration program	NSE	Class 1 assessment
Environment Act	Approvals Procedure Regulations; and Activities Designation Regulations	Alterations to water courses, stormwater and wastewater management, industrial process	NSE	Designated Activities Approval, including Division I Water Approval, Division III Municipal Waste Approval, and Division V Industrial Approval
Environment Act	Petroleum Management Regulations	Storage of fuels on site for refueling equipment, etc.	NSE	Compliance / registration
Environment Act	Solid Waste Resource Regulations	Disposal of waste materials at municipal solid waste disposal sites	NSE	Compliance
Environment Act	Water and Wastewater Facility Regulations	Any new or altered water treatment facility; wastewater treatment and effluent streams	NSE	Compliance / registration
Endangered Species Act	Species at Risk Regulations	Any activity that threatens or disturbs designated endangered species and their habitats	NSDNR	Compliance
Special Places Protection Act		Any activity that threatens or disturbs sites declared special places under the act.	NSDNR & Nova Scotia Museum of Natural History	Compliance/ archaeological research permit for surveys

Legislation	Regulation/Reference	*Activity*	*Government Department*	*Requirement*
Beaches Act	Beaches Regulations, including Port Morien Beach Designation	Any activities that take place between high and low tide mark, including access by equipment	NSDNR	Approval
Mineral Resources Act		Exploration of lands for specified minerals	NSDNR	Special License
Occupational Health and Safety Act		Working conditions	Nova Scotia Labour	Compliance

1.7.2 Federal

A federal environmental assessment is required when a federal authority:

i) is the proponent of the project;

ii) makes or authorizes payments or provides a guarantee for a loan or any other form of financial assistance to the proponent for the purpose of enabling the project to be carried out in whole or in part;

iii) sells, leases or otherwise disposes of federal lands or any interest in those lands for the purpose of enabling the project to be carried out in whole or in part; or

iv) exercises a regulatory duty such as issuing a permit or licence that is included in the Law List Regulations, grants an approval or takes other action for the purpose of enabling the project to be carried out in whole or in part.

Based on the parameters of the Project, items i), ii) iii) and iv) above do not apply to the Project, and no federal environmental assessment is required. There is federal legislation, however, with which the Project must comply. The pertinent acts are identified in Table 1.2.

Table 1-2: Applicable Federal Legislation and Associated Requirements

Legislation	*Regulation/Reference*	*Activity*	*Government Department*	*Requirement*
Fisheries Act	Section 36 (3) – Deleterious Substances	Effluent discharge	Environment Canada (“EC”) -Environment Protection Service	Compliance
Migratory Birds Convention Act	Migratory Birds Regulations	Physical disturbance, destruction of a migratory bird, nest or egg	EC – Canadian Wildlife Service (“CWS”)	Compliance

Legislation	Regulation/Reference	Activity	Government Department	Requirement
Species at Risk Act (SARA)	Measures to protect listed wildlife species	Alteration or disruption of wildlife habitat	EC - CWS	Compliance

1.7.3 Municipal

CBRM provides the following municipal services to the communities in the study:

- maintenance, construction and operation of streets and rights of ways;
- integrated solid waste management;
- potable water treatment;
- supply and distribution of water;
- sanitary sewer collection and distribution; and
- storm water management and control.

Not all of these services are available to residents and businesses due to the extensive land area of the municipality. At the Project site, for example, the Proponent will be responsible for the installation and maintenance of all the site services required to support the exploration program.

CBRM is also responsible for municipal planning and the issuance of development permits pursuant to the *Municipal Government Act*. No development permit will be required from CBRM to execute the Project.

1.8 Study Team

By virtue of the legislation that has been referenced, it has been determined that a Class 1 environmental assessment pursuant to the Nova Scotia *Environment Act* is required for the execution of the Project. This assessment has drawn upon:

- pertinent research including the secondary ecological data accessible from the federal and provincial government departments with respect to the site and surrounding area;
- pertinent data from previous environmental and related studies executed at the site;
- the execution of selected field programs; and
- the professional experience of members of the study team.

Table 1.3 identifies the lead specialists who have contributed to the preparation of this environmental assessment.

Table 1-3: Lead Environmental Specialists

Name	Credentials	Topic
Ann Wilkie, CBCL Limited	M.A., M.Sc., LL.B., MRTPI	Project Manager and Lead Environmental Impact Assessor
Janis Rod, Environmental Engineer	P.Eng.	Environmental Impact Assessor
Andrew McIntosh, CBCL Limited	B.SC., M.Civ. Eng., P.E.	Environmental Engineering Coordinator

Name	*Credentials*	*Topic*
Annabelle Singleton, CBCL Limited	B.Sc.	Environmental Impact Assessor
Lorna Campbell, CBCL Limited	P.Eng.	Community Liaison Coordinator
Clinton Pinks, CBCL Limited	B.Sc., B. Design., M.L.Arch	Habitat assessment, vegetation mapping, wetland classification and plant identification
Ian Bryson, CBCL Limited	B.Sc., Dip.Eng., Dip.GIS	Habitat delineation, Species at Risk, Forest & Landscape Ecology GIS Analyst
Colin Walker, CBCL Limited	B.Sc., M.Sc., Hydrogeology	Ground and Surface Water Field Programs and Modeling
Leanda Delaney, CBCL Limited	B.SC., M.Sc.	Aquatic Field and Monitoring Programs
Ian MacLaren	Ph.D	Avian and Monitoring Programs
Jason GooGoo, Membertou Geomatics Ltd.	B.A., Dip. Computer Science	Mi'kmaq Ecological Knowledge Study
Hugh Broders, St. Mary's University	Ph.D	Bat Field and Monitoring Programs
Steve Davis, Davis Archaeological Consultants Ltd.	Ph.D	Archaeological Field Programs
Paul Brunelle	Ph.D	Odonata Field Program
Barry Taylor, St. Francis Xavier University	Ph. D	Habitat assessment and Botanical surveys

1.9 Structure of the Document

The purpose of this document is to provide sufficient information to the Minister of Environment to support an environmental assessment approval subsequent to Terms and Conditions issued by the NSE in accordance with the requirements of the *Nova Scotia Environment Act* and related regulations.

This document consists of the following sections and appendices:

- Chapter 1 provides an introduction to the Project, to the Proponent and to the regulatory context within which this submission is being made;
- Chapter 2 provides further detail on the Project as it has been defined;
- Chapter 3 outlines the environmental work program that has been executed
- Chapter 4 provides the environmental baseline, i.e., the results of the work described in Chapter 3;
- Chapter 5 provides information on the community engagement and stakeholder consultation program that has been instigated;
- Chapter 6 outlines the approach that has been adopted to execute the environmental evaluation undertaken;
- Chapter 7 presents the environmental analysis;
- Chapter 8 introduces the elements that will be developed to ensure effective environmental management; and
- Chapter 9 presents the conclusion of the environmental evaluation.

The text is supported by the following appendices:

- Appendix A – Xstrata Plc. Sustainable Development Policy
- Appendix B – Traffic Impact Study Scoping Document
- Appendix C – Tunnel Dewatering TARP
- Appendix D – Species at Risk and of Conservation Concern
- Appendix E – Groundwater Monitoring Results
- Appendix F – Surface Water and Sediment Monitoring Results
- Appendix G - Odonata Survey 2008 (Damselflies and Dragonflies)
- Appendix H – Archaeological Permits and Authorizations
- Appendix I – Mi'kmaq Ecological Knowledge Study
- Appendix J – Bird Species Identified on the Donkin Peninsula
- Appendix K – Peninsula Plant Species List Identified
- Appendix L – Stakeholders Identified, Concerns Raised and Engagement Techniques
- Appendix M – Community Liaison Committee Guidelines
- Appendix N – Environmental Management Framework

Chapter 2 The Project

2.1 Evaluation Process

The Proponent is currently working pursuant to the Special License issued by the NSDNR in 2006 to conduct exploration activities on the Donkin Resource Block that are designed to determine a business case for the potential development of a subsea longwall coal mine. The Donkin Underground Exploration Project, i.e., the Project, being presented and evaluated in this submission is required to gather sufficient data to determine the commercial viability of the coal resource to support the development of the longwall mine.

By driving exploratory mains into the licensed coal block, extracting and testing the product and conducting appraisals of the subsurface conditions, a more comprehensive database will be obtained. Critical data sets that will be attained from such work are referenced in the following sections.

2.1.1 Coal Quality and Quantity

The need to further assess coal quality is one of the principal reasons underlying the need for the Project; three types of sampling will take place:

- Channel samples which will be taken methodically through the full seam height from floor to roof - these coal samples will be removed, logged and sent for laboratory analysis;
- Core samples which will be collected using in seam drilling equipment that can provide coal samples from up to 1 km distant; and
- Bulk samples which will be provided to potential customers for trial processing and evaluation.

The tonnage of coal that is expected to be removed during the proposed exploratory phase is in the range of 0.5 Mtpa in each of 2010 and 2011. Based on the limited data presently available to the Proponent, the percentage of ash content in the coal ranges from about 11.4 to 13.7 and the percentage of sulphur from 4.8 to 5.5; these parameters will be checked as a consequence of the work undertaken. No coal from any of the samples will be washed or otherwise processed on site as part of the Project.

The bulk samples will also be tested by potential customers for both thermal and coking characteristics. The analysis undertaken will test for parameters including, but not limited to, calorific value, total moisture and sulphur. The results of this sampling and testing is critical to the determination of the marketability of the coal.

2.1.2 Geotechnical

The collection of additional subsurface geotechnical information is also important in order to determine both the feasibility of the anticipated works and to facilitate the design of the underground mining operation, including the roof, floor and roadway pillars. A range of methods will be used to obtain the necessary geotechnical information from within the exploratory driveages; these include:

- the execution and testing of roof samples to understand the strength and type of the roof material; and
- the study of the roof and floor conditions by experts, including geologists and mining engineers, to evaluate the mining environment.

The compilation of the resultant information will allow the rock mechanic properties of the critical roof and floor strata to be determined. The results of the Project will permit the evaluation of the work both dip down and on strike driveages, including:

- roof stand up times before bolting;
- bolting patterns for both the roof and the ribs;
- potential cut lengths;
- observations for any impacts of horizontal stresses;
- impacts of water if water exists on the floor; and
- the potential for out-of-seam dilution.

2.1.3 Gas Regime

As an integral part of the Project, data will be compiled and work undertaken to better understand the gas regime associated with the Harbour Seam coal. A standard atmosphere monitoring system will be used to monitor at all appropriate points for methane, carbon monoxide, oxygen, smoke, air velocity and differential pressure. Particular attention will be paid to methane gas output levels.

The quantities of methane that will be emitted and ventilated to the atmosphere cannot be quantified for the Project based on existing available data. One outcome of the Project, however, is the better understanding of the subsurface gas regime which, in turn, will allow the anticipated quantities of methane to be determined with respect to the future potential development of a longwall mine at the site.

2.1.4 Hydrology

The volume and quality of the water pumped from the tunnels and the face will be measured and logged to better understand and interpolate water conditions. This is especially important as the exploratory mains approach the inferred Donkin Fault; the latter is identified on Figure 2.1. The works associated with the handling and treatment of underground tunnel water are discussed in Section 2.6.3.

2.1.5 Underground Work Conditions

The execution of the Project will allow the working conditions associated with the future development of a longwall mine to be better understood from a safety perspective. This understanding will allow the most appropriate underground work processes to protect worker health and safety to be determined.

2.2 Physical Components

The Project involves one year of planning and preparatory work and the execution of a two-year room-and-pillar mining operation that is designed to determine the mineability and marketing potential of the coal resource. The average annual production for the proposed two-year period mining operation is expected to be approximately 0.5 Mtpa, or up to 2,000 tonnes per day (“tpd”).

The Project involves:

- the establishment of a single continuous – miner operation driving into the resource block from the two existing entry tunnels, including the installation of the required supports, equipment and ventilation;

- the development of the necessary surface facilities to handle the extracted coal and to support the underground activities associated with the continuous – miner operation, including coal loading facilities and coal stockpiles;
- the construction and/or rehabilitation of offices, a small workshop and associated utilities, such as electricity, road and parking on site, security and water supply; and
- the trucking of coal from the site on existing public roadways to several destinations for onward transportation to laboratories and potential customers.

The proposed works associated with the Project are designed to be consistent with the ultimate objective of a longwall mining operation, such that all works will be within the boundaries of the final mining operation site layout. The physical components associated with the Project are described below.

All emissions which may be generated by the Project, including dust, site runoff, water pumped from the tunnels, underground discharges, sanitary sewage, solid wastes, hazardous materials, noise and light, are discussed in Section 2.6.

2.2.1 Continuous Mining Equipment and Infrastructure

The proposed two-year underground exploration layout, i.e., 2010 and 2011, is shown on Figure 2.1. This plan shows how the proposed mains integrate into the potential longwall mining operation should the latter proceed. Access to the Donkin Resource Block is from the two existing tunnels[3], i.e., Tunnel No. 2 and Tunnel No. 3; these are shown in the two photographs in terms of the drill and blast section and the tunnel boring machine circular section.

Drill and Blast Section

Tunnel Boring Machine Section

In the first year of coal extraction, i.e., 2010, the intent is to explore the north-south set of mains that effectively divide the resource block into east and west blocks. Exploration will continue in 2011 into the entries to the west submain and the east submain areas, as well as extend further into the north-south main.

[3] Typically, underground tunnels are named to allow additional tunnels on either side; if a new tunnel were to be proposed at some future date to the west of the two existing tunnels, for example, it would be Tunnel No. 1.

During these underground exploration works, a three-entry, place change continuous mining system will be employed. This particular layout will closely resemble a three-entry head and tail gate development for a future longwall panel, as longwall mining is the most likely alternative in terms of future resource extraction. This will facilitate the transition at the end of this Project into a full mining operation should the proposed works be deemed commercially viable and all approvals are attained.

2.2.1.1 Main Development and Supports

The proposed widths for both the entry and cross cuts for exploration development are expected to be 5.2 m, and the proposed cut length before bolting is expected to be 6 m. If the roof conditions allow, the cuts may extend up to 12 m. The full seam height will be taken when mining on the down dip. The intent is to extract in-seam when cutting on strike. If possible, the roof and floor coal will be removed during the mining sequence. Adjustments to the geometric mining parameters will be made in order to accommodate the mining conditions, but will be designed to meet the ventilation requirements of a future longwall mining operation.

Based on the eleven holes drilled by DEVCO, Marston Mining Engineers and Consultants characterized both the roof rock and the geotechnical conditions utilizing the National Institute for Occupational Health and Safety ("NIOSH") Coal Mine Roof Rating ("CMRR") system. The average CMRR was determined to be 50.7, which is within the moderate rock strength category. Marston considered that the rocks would be self-supporting for sufficient time to enable a normal place change continuous mining system, but it would be critical to roof bolt as soon as possible after mining, and all roof should be bolted before work ends for the day.

A NIOSH program for roof bolt analysis was used to determine a possible bolting plan for the proposed mining configuration. The program, Analysis of Roof Bolts System ("ARBS"), was developed specifically for the more difficult conditions where the roof is weaker and/or the stress is higher. The program starts with the most important factors that determine the performance of a roof bolt system; these are:

- the roof quality as measured by the CMRR;
- the depth of cover (which correlates with stress); and
- the intersection span.

The horizontal stress as a function of depth is also considered by the program. The ARBS suggested design values for the intersection span, the bolt length and the bolt capacity and pattern. This approach will be augmented as necessary with secondary supports, such as rib bolting, wire mesh and strapping.

The pillars in the mains that will be installed during the exploration mining have been sized to support the longwall mining plan because the intent is to proceed from this Project into the operation of a longwall mine, should the latter be determined to be commercially viable. The NIOSH program, Analysis of Retreat Mining Pillar Stability ("ARMPS"), was used to study the pillar stability at intervals of 250 m in the main entries. At each location, the mining height and the depth of overburden were noted and the stability evaluated. The mining height was taken as the seam height in this analysis instead of the reduced height, because mining in the mains will be more closely on the true dip, i.e., the entries will be mined to their full thickness. Based on this analysis, pillar sizes are typically proposed at 35 m by 20 m with 35 m by 50 m in the larger pillars.

2.2.1.2 Equipment

A place change, continuous mining section is proposed as the primary means of underground exploration in the Project. A continuous miner, two shuttle cars and a double-headed roof bolter will be used in the development mains. The continuous miner will be equipped with an exhaust scrubber and the appropriate water spray equipment to manage dust in the tunnels. If roof conditions are poor, then bolter-miner technology will be considered, i.e., using a dual function piece of equipment which both bolts and mines. Two load-haul-dump vehicles, i.e., scoops, and the electrical system, i.e., a power centre and feeder breakers, will be used to support the continuous mining section.

Other major equipment that will be deployed includes the belt conveyor system and transportation within the tunnels and mains. The belt conveyor system is designed to carry 500 tonnes per hour ("tph"). This rating is based on one section being worked by the continuous miner. The transportation of personnel in the tunnel and mains will be via one of two utility vehicles.

Diesel-powered equipment is proposed for all personnel transportation, section supply and coal cleanup at the development faces. All use of diesel powered machinery will be in accordance with Canadian standards pertaining to the utilization of diesel equipment in coal mines.

2.2.1.3 Ventilation

Efficient ventilation is paramount in the design of the mains which will be developed as part of the Project. The ventilation design will also take into account the needs of the future mine plan. At the face, ventilation will be supported by an auxiliary fan and ventilation tubing. The ventilation system will be designed to provide a high volumetric capacity with sufficient pressure provided by multiple surface fans to deliver a minimum flow of 30 m^3/s in the exploration mains.

A world class expert on mine ventilation and gas drainage, Dr. Roy Moreby, provided advice to the Proponent on the design of the ventilation program for the Project. It is proposed that intake and return ventilation will be provided by the two existing tunnels. The conveyor will be located in the return tunnel for the purposes of segregation, i.e., Tunnel No. 3. The three-heading exploration phase development panel will be configured on a standard North American system with twin intakes and single return. Intake ventilation will be heated during the winter months.

Although the gas drainage requirements will clearly be significantly less than would be required for longwall production, the main function of the gas drainage program will be to minimise emissions from the ribs. To ensure the safe use of diesel equipment, the maximum return methane concentration will be 1.0%. There will be insufficient volumes of methane for recovery during the Underground Exploration Project.

Provision is also made in the proposed design for outburst control, including gas content testing, stress measurements and the detection of geological structures. An appropriate outburst management plan will be required if, or when, seam gas content and stress regimes match those in which outbursts have occurred in other local mines. Because of the current lack of detailed seam characterization, geometry and gas content, prior to the execution of the proposed program, both ventilation and gas management systems have been structured to ensure sufficient capacity to manage credible scenarios.

2.2.2 Coal Handling Infrastructure

Minimal surface coal handling facilities are required to support the Project. The ROM coal will be stockpiled and will subsequently be loaded into trucks. These surface works are depicted on Figures 2.2 and 2.3.

2.2.2.1 STOCKPILES

The Project involves the handling of relatively low tonnages and product rates. Overall, the stockpile capacity is not expected to exceed 30,000 t ROM which represents close to five weeks of storage at average production. ROM coal will be conveyed directly to a small stockpile from the drift conveyor. Crushing and stacking would be done by a mobile crusher/stacker unit. The movement of coal will be managed by a single front end loader. The larger stockpile will store the coal for truck transport off the site. Figure 2.4 shows the arrangement of the stockpile and coal handling infrastructure, including the drift conveyor and a truck loading loop.

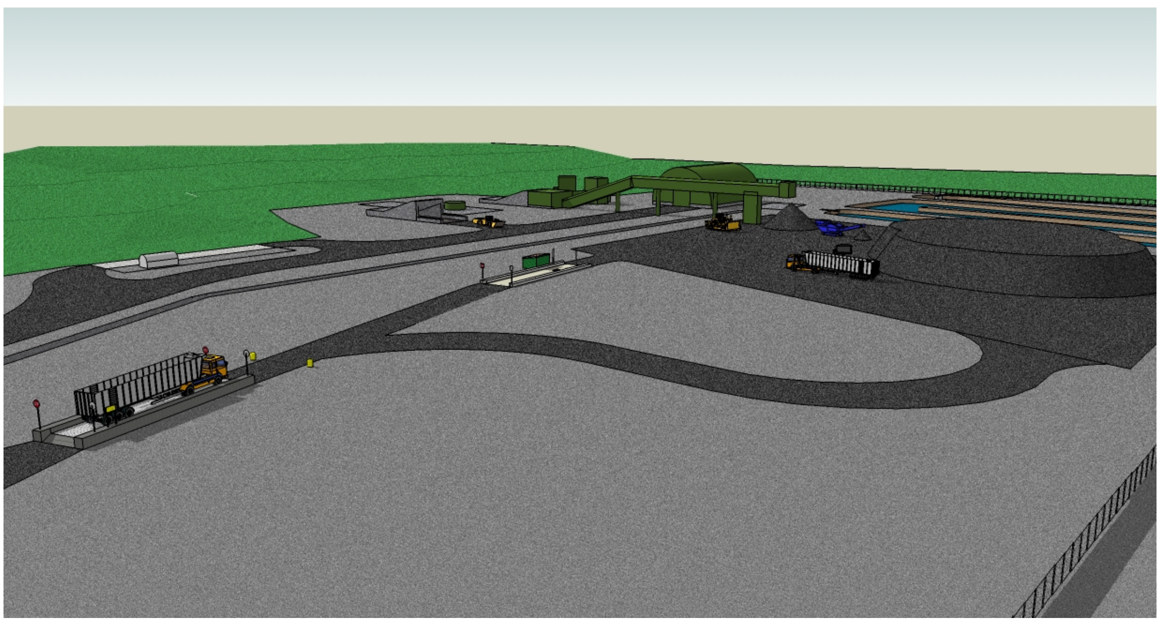


Figure 2.4: Coal Stockpile Layout

While the coal stockpile provides a capacity of approximately 30,000 t, it is not expected to operate above an average volume of 7000 t, i.e., the production rate for a typical week. The design capacity of 30,000 t has been sized to provide for haulage delays due to weather, road works, or other unforeseen issues.

2.2.2.2 COAL HANDLING PAD

A coal pad will be installed to provide a base for the coal handling activity on the surface; the pad will accommodate a drift conveyor and sufficient area for the stacking, crushing, stockpiling and loading of

coal. The pad is designed with an impermeable layer of bentonite matting topped with approximately 0.5 m of granular rock. The granular material will be recovered from the site waste rock stockpiles.
The drainage around and from the pad will be managed in bentonite lined drainage ditches and diverted into the upgraded serpentine pond via the yard drainage ditch as shown on Figure 2.3. Additional detail on handling site run-off can be found in Section 2.6.2.

2.2.2.3 Equipment

Heavy machinery, e.g., front end loaders, trucks, etc., will be used for coal movements. A mobile crusher /stacker will crush the ROM coal to 50 mm. It is expected that the Proponent will tender the surface coal management and trucking in one contract. This tender will be performance based, and non-compliance with environmental and social protection requirements, e.g., defined dust control requirements, truck speed, etc., will not be tolerated by the Proponent.

2.2.2.4 Access Road

The site roads and parking area will be gravel surfaced. The new access road from the Long Beach Road to the active yard area will be 9 m wide and raised with ditching and culverts, where required, to facilitate drainage. This access road, approximately 2,200 m in length, starts at the Long Beach Road, follows the alignment of the existing power line, and terminates at the guard house and employee parking area. It is an integral part of the truck haul route. Figures 2.2 and 2.3 show the alignment of the access road.

The roadway is conceptually designed with a minimum 100 m radius horizontal curves, minimum k value of 50 for vertical curves, and with a 1m drainage ditch for cut areas. The intersection with Long Beach Road is a simple tie-in with triple-radius curb returns and a 1,200 mm culvert.

The alignment of the proposed access road was determined by reference to the environmental conditions in the area. No watercourses will be crossed, and no wetlands will be impacted, by the proposed works. Natural drainage will be maintained via appropriate culvert installation. Two 1,200 mm diameter culverts will be located between the two waste rock piles; this area will be built up with granular material and the culverts installed to facilitate the continued flow of water from the serpentine pond to the DEVCO settling pond. This drainage channel was used as an integral part of the drainage program associated with the successful dewatering of the tunnels and is a component part of existing site drainage; it will continue to fulfill this function.

The roadways and parking lots, including the site vehicle roads, will be delineated by either/or a combination of graded berms, concrete abutments and guide posts with reflective indicators.

The existing access adjacent to Schooner Pond Cove will be maintained as a gated emergency route to the site and for public access to the beach and headland, but it will not be used to transport coal.

2.2.3 Civil Works and Utilities

A number of ancillary structures are required at the site to support the Project. These include a workshop and warehouse facility, parking, security fencing, drainage ditching, water supply, power, and lighting.

2.2.3.1 Workshop and Warehouse Facility

The workshop, warehouse and maintenance facilities will be located in the existing Quonset hut. This building is approximately 20 x 25m and is fully insulated. Onsite offices and washrooms are currently located within this Quonset hut with sufficient room for muster, some warehousing and vehicle maintenance. This facility will meet the anticipated needs of the proposed maximum shift size of 15 persons. The warehouse will allow for security of supplies, provide a location for the controlled distribution of materials and enable the installation of a system to control inventory.

A small amount of lubricants, oils, and cleaners will also be stored in this building. Material safety data sheets (“MSDS”) for all such materials will be kept on-site. The volume of any dangerous or hazardous materials will be small and limited to current use.

The workshop will be outfitted with the tools necessary to carry out small mechanical repairs and maintenance; larger repairs and major overhauls will be contracted out.

2.2.3.2 Administration, Bathhouse and Laydown Area

The administration and bathhouse facilities will be housed in a new modular style building which will include a control room and a lamp room.

There will be an equipment staging area adjacent to this administration building. This lay down area will be used to store non-weather sensitive materials and to park site vehicles; it will be outfitted with electrical receptacles for vehicle block heaters to facilitate diesel engine start-up in cold weather. This area will also house a storage silo for dry materials, including the limestone dust that is used in the mining process. A 4,000 litre diesel storage tank with a dispensing station for fuelling the diesel equipment will be sited on the existing concrete pad located near Tunnel No. 2.

2.2.3.3 Miscellaneous Buildings

There are a number of miscellaneous structures that are associated with the Project. These include the guardhouse and the electrical substation buildings. The existing guardhouse structure will be relocated.

Two new electrical sub-station buildings are required to house the necessary electrical components and associated equipment. These buildings will be located in a fenced compound adjacent to the administration/bathhouse building and will be constructed as light duty, insulated, metal clad buildings on an engineered concrete slab complete with housekeeping pads for the electrical equipment, ventilation, electric heat, a pedestrian door and a double door to facilitate the installation of electrical equipment.

2.2.3.4 Parking

The parking lot has been designed to accommodate 30 vehicles based on a maximum shift size of 15 full time staff, plus space for miners and contractor vehicles; the parking lot will be provided with security lighting as necessary. This number of spaces allows for parking by both shifts. The parking area will be gravel surfaced to the same standard as the access road.

2.2.3.5 Security Fencing

Fencing and designated control points will secure the site to protect public safety and to secure the site from theft and vandalism. Security fencing has been placed around the perimeter of the entire site. The fencing has been located to limit the active yard's footprint on the headland and to minimize the length of fence required. A truck gate will be installed across the Schooner Pond Beach Road.

2.2.3.6 Drainage

There will be two primary sources of site generated wastewater: site runoff and underground tunnel water. It is anticipated that these two sources will exhibit similar chemical characteristics including a high sediment load, neutral pH and a presence of heavy metals. The quality of the wastewater is not expected to be dramatically different from that of the 470 million litres of water that was removed from the tunnels during the dewatering process in 2006/2007. This water was successfully treated and discharged. Other than the lining of the serpentine pond, the treatment and monitoring system proposed for the Project will be comparable to that undertaken through the dewatering of the tunnels.

Site runoff will be collected through a series of ditches and culverts and the runoff directed, via the yard drainage ditch, towards the existing serpentine pond on the eastern edge of the site (see Figure 2.3). The underground infiltration will be piped directly to the serpentine pond after it is pre-treated by cascade aeration as described in Section 1.4.5.

The existing serpentine pond will serve as the treatment system for both the underground discharge and yard water. A backup chemical feed system will be incorporated into the Project design as a contingency in the event that the monitoring of wastewater proves it to be acidic. The wastewater will be constantly monitored as per the sampling locations depicted on Figure 1.4, i.e., the same monitoring system as was used during the tunnel dewatering program. Site runoff will include both storm water and dust suppression flows, i.e., on stockpiles. Both will be directed to the serpentine pond for sediment drop out. Once the fines have settled out, the wastewater will flow over a weir, through the drainage channel and into the onsite settling pond, i.e., the DEVCO settling pond as shown on Figure 2.2.

The truck wash system that will be installed will contribute little to the quantities of runoff as it will be a self-contained recirculated system.

2.2.3.7 Water Supply

There will be three separate requirements for water at the site, i.e., shower and toilet water, drinking water and process and fire suppression water.

Currently, the site utilizes a small water softening system treating groundwater from the site for showering and toilet use. Projected staffing of a maximum of 15 people per shift is not a significant increase from current needs; a similar system will be used. A new 1,200 litre holding tank will be installed. This will be located near the administration/bathhouse complex.

For the small quantity of drinking water required during the execution of the Project, purchased bottled water will be supplied. As a result, neither a potable water treatment plant, nor connection to the municipal water system from Donkin, is required.

The process water and the water for both dust suppression and the truck cleaning systems will be pumped from the DEVCO settling pond by a process water system. Process water will be supplied to the site entrance, to the rain birds for stock pile dust control, to the truck wash and to the conveyor transfer points.

2.2.3.8 Sewage

Sewage flows from the administration, wash house and workshop and warehouse facility will be collected in a holding tank and regularly emptied by truck as is currently the practice. The tank will be in-ground and situated for easy truck access.

2.2.3.9 Power

A system impact study undertaken by NSPI in May 2007 concluded that the existing 69kV power line that currently runs from Glace Bay is capable of supplying the site with 7.5 MW; this is adequate for the execution of this Project. The power supply system, however, would need to be upgraded for the development of the longwall mine should the latter proceed.

As stated in Section 2.2.3.2, the outdoor equipment and structures necessary to supply the power will be contained within a fenced compound that will be constructed to comply with regulatory and utility standards.

2.2.3.10 Lighting

Although a 24 hour operation is planned, night shift activities will be limited to those associated with maintenance operations. Outdoor general lighting will therefore be restricted to what is necessary to ensure safety. Stockpile lighting, for example, will be limited to structure lighting on the drift conveyor.

2.2.4 Trucking on Public Roadways

A key dimension of the Project is the requirement to haul coal to various destinations on public roads. This includes the delivery of coal to the Point Aconi and Lingan NSPI generating stations and to the International Coal Pier for onward shipment. Consultation with the community, the CLC, councilors and other stakeholders is an important part of the process that has been undertaken; this community engagement strategy is described in Chapter 5. The proposed routing plan is shown in Figure 2.5.

The proposed haul route, regardless of destination, involves roads under the jurisdiction of the Nova Scotia Department of Transport and Infrastructure Renewal ("NSTIR") and CBRM. The NSTIR has a formal process of approving projects relative to their impact on public roads. This involves the completion of a Traffic Impact Study ("TIS"). CBRM does not have the same structure with respect to approvals, but CBRM has been involved in discussions both with the Proponent and with NSTIR with respect to this Project. A scoping meeting was held between XCDM, NSTIR and CBRM on August 6, 2008; this laid out the scope for the TIS. Details of the work involved in the TIS is provided in Section 3.3.3.3, the results are discussed in Section 4.5.6 and the TIS scoping document is included in Appendix B.

Vehicular traffic will be a part of this Project during both construction and operations phases; this includes employee/contractor travel and the trucking of equipment and coal. The latter is of particular interest to the local communities. The proposed trucking route includes exit from the Project site by the proposed new access to the Long Beach Road and the Donkin Highway, followed by travel along Highway 255, i.e., the Donkin Morien Highway to Brookside Street, Dominion Street and Wilson Road to the intersection with Route 4. Route 4, which is designed to accommodate heavy truck traffic, is a designated Schedule C road. In 2004, NSTIR and CBRM commissioned a detailed operational and safety review of Route 4 (CBCL Limited, 2004); implementation of the recommendations arising from that study are being implemented.

2.2.4.1 Construction Phase

Construction activities will extend until January 2010. The rehabilitation of the tunnels will typically involve three shifts per day, five days per week; other work will be completed using one shift working five days per week. It is estimated that at the peak period during construction, there will be a maximum of 45 workers on site. Since most shift workers will not be travelling to and from the site during normal peak hour traffic periods and since there will likely be some ride sharing and random arrival rates, it is estimated that there will be 30 private vehicles arriving during the morning peak hour and leaving during the evening peak hour.

During the peak of surface construction, it is estimated that there will be an average of 30 trucks per day, five days a week, making site deliveries. This is expected to result in an average of three trucks entering and three trucks exiting the site during a peak hour.

The construction of the access road will probably cause peak construction volumes during a similar time period; it is anticipated, for example, that access road construction will require 1,500 truck loads of material over a three month period, or about 27 loads per day based on working five days per week. This is expected to result in an average of three trucks entering and three trucks exiting the site during a peak hour.

In total, it is estimated that the maximum peak hour trips will include 36 vehicles entering, i.e., 30 passenger vehicles and six trucks.

2.2.4.2 Operations Phase

When the exploratory works begin in early 2010, it is estimated that there will be a maximum of 32 workers on site, including 15 shift workers. Since most shift workers will not be travelling to and from the site during normal peak hour traffic periods and since there will likely be some ride sharing and random arrival, it is estimated that there will be 15 vehicles arriving during the morning peak hour and 15 leaving during the evening peak hour.

The Project is expected to produce an average of 2000 tonnes of coal per day. Based on an average of 42 tonnes of coal on a B-Train truck, this would result in the movement of 48 loaded and 48 unloaded trucks per day; this translates to four loaded and four unloaded trucks per hour. This phase will also generate 5 to 10 delivery truck trips per week to the site. While most of the latter will be smaller trucks, it is expected that there will be one or two semi-trailer trucks per week delivering cables, bolts and piping.

It is estimated that during this phase of the Project, maximum peak hour trips will include 20 vehicles entering, i.e., 15 passenger and five trucks, and five trucks exiting during morning peak hour. All truck trips will use the trucking route as illustrated on Figure 2.5. As most employee trips will likely originate from the more highly populated areas of CBRM, it is expected that most worker trips will use the Donkin Highway through Donkin; as many as two-thirds of these movements may come from the CBRM area to the west of Wilson Road.

2.3 Sustainable Development Framework

As referenced in Section 1.2.1, the Proponent's design philosophy is underpinned by their total commitment to their Sustainable Development Framework with respect to the management of all aspects and impacts of its operations globally. More specifically, this system will be applied with respect to the execution of the Project and will assist in:

- meeting HSEC legal obligations;
- creating and maintaining a safe workplace;
- implementing responsible environmental management;
- engagement with the communities in which the Project operates; and
- meeting the requirements of the Proponent’s Sustainable Development Policies, Business Principles, and Standards.

2.3.1 Health and Safety

Key achievements from a health and safety perspective based on work on the site to date include:

- no lost time injuries;
- only a single recordable incident since work began on site more than two years ago;
- ongoing development of a very committed HSEC culture;
- development and implementation of a robust site induction system covering visitors and contractors;
- development and implementation of a Code of Practice training system for tunnel rehabilitation;
- development and implementation of a Code of Practice training system for in seam drilling;
- development of a Broad Brush Risk Assessment (“BBRA”) for the Donkin site; and
- development and implementation of a site Joint Occupational Health and Safety Committee (“JOHSC”) in excess of legislative requirements.

2.3.1.1 Project Protocols

As part of the company’s Sustainable Development Framework, the Proponent is committed to developing site specific procedures and standards that will be comparable to or exceed the requirements of the Nova Scotia *Environment Act* or the Nova Scotia *Occupational Health and Safety Act.* Any incident would be addressed through procedures specified in Project specific Contingency and Emergency Response Plans.

These plans will be developed both in the context of the operating principles of the company at large and in association with the pertinent regulatory and response agencies, including those who would be categorized as first responders in CBRM. This process, in conjunction with the implementation of a behavioural safety program, will assist the Proponent to effectively manage all levels of risk to minimize injury and illness and to ensure that the Project maintains its high standards with respect to health, safety, environment and community management.

2.3.1.2 Catastrophic and Major Hazards

As part of the company's HSEC Management System, the Proponent has developed a core risk register to document and monitor potential catastrophic hazards across its global business. The core catastrophic hazards have been identified as:

- strata fall or collapse;
- explosions;
- fires;
- mobile equipment & pedestrian interaction;
- failure of surface containment structure;
- inrush; and
- inappropriate emergency response.

The Proponent is required to undertake a risk assessment at each phase of the Project to identify, assess, manage and monitor any potential for accidents against its internal standards and core catastrophic hazards, i.e., BBRAs. These have been completed for site work to date and will be revised to encompass activities associated with the Project. The BBRAs form the overarching document by which risk will be identified and managed.

In the unlikely event of an accident or malfunction, the incident will be addressed in the first instance by the emergency response procedures that will have been established and through the implementation of the protocols set out in Contingency and Emergency Response plans, including an emergency preparedness plan with escape and refuge strategies.

2.3.2 Environmental Management System

Given the diversity of habitats on the Donkin Peninsula (as described in Chapter 4), the Project will require both the deployment of a number of mitigation measures and the establishment of an environmental management system ("EMS") to ensure the protection of the Donkin peninsula and the continued enjoyment of the headland by the community. The Proponent's approach to environmental management is further outlined in Chapter 8; it incorporates the inherent strengths of their corporate program and accommodates or exceeds the requirements of provincial legislation.

The principal components of the EMS will include:

- an Environmental Management Plan ("EMP") that documents all measures that will be taken to protect the environment and to ensure safety including commitments made in the environmental assessment, the conditions of release and subsequent approvals;
- Environmental Protection Plans ("EPP") that detail the specifications that contractors will adhere to onsite; and
- a contingency and safety plan that lays out measures that will ensure safety onsite.

The EPPs will be distinct to particular activities within the site and guide the day-to-day operations of Xstrata employees and contractors in their work as part of the Project. The EPPs fall under the umbrella of the EMP. These specific procedures will address a variety of activities on the site including, but not limited to:

- mitigative measures, such as dust control, sediment and erosion control;

- monitoring programs for dust, surface water, groundwater, etc.;
- construction and site management activities, such as the handling of the existing waste rock material and ongoing wastewater management; and
- corrective action procedures outlining mechanisms to address a potential effect should monitoring or complaints identify a concern.

2.3.3 Monitoring

Ongoing monitoring of the potential interaction of the Project with the environment is a key aspect of each phase of the Project. Ongoing monitoring includes, but is not limited to, physical aspects of the environment, such as dust, surface water and groundwater. These monitoring plans will be integrated into the management of site operations. Similarly, via specific Target Action Response Plans ("TARPs"), there will be a methodology of response to various outcomes of the monitoring. The TARP prepared for the maintenance pumping of the tunnels is provided in Appendix C as an example.

2.3.4 Training

The EMS will also encompass the need for and approach to the training of employees, contractors and visitors, such as the induction program which is required by the Proponent prior to entrance to the site. Training for all aspects of HSEC will be provided and will include specific procedures as outlined in the EPPs as appropriate for the target audience.

2.3.5 Public Information / Community Engagement

An important part of the work done to date has been consultation and engagement with the local community. Moving into the execution of this Project, this aspect of the HSEC management plan becomes even more important. To execute this role, the Proponent will assign a specific Environment Coordinator and Community Coordinator for the Project.

2.4 Project Activities

This sub-section briefly describes the scope of each of the distinct activities associated with execution of the Project in terms of site preparation and construction, operation and maintenance and decommissioning and reclamation to facilitate the analysis in Chapter 7.

2.4.1 Site Preparation and Construction

2.4.1.1 Sustainable Development Framework

As referenced above, the Proponent has developed, as an integral part of its operating principles, a sophisticated sustainable development framework. To prepare for the surface and underground site works associated with this Project, the Proponent will ensure that this framework is used to develop protocols to facilitate the execution of the proposed works in an environmentally responsible and safe manner.

Both baseline environmental field work and environmental monitoring have been undertaken, and the Proponent recognizes the need to establish a program that will monitor key environmental parameters on a regular basis with respect not only to this Project, but in preparation of the environmental database required to support the environmental assessment of the longwall mine and associated infrastructure. This monitoring program will include, but may not be limited to, the following:

- the monitoring of discharge water through the serpentine pond to the DEVCO settling pond, i.e., comparable to what was undertaken for the dewatering of the tunnels;
- hydrogeological monitoring with respect to connectivity between the DEVCO settling pond and Baileys wetland;
- noise monitoring; and
- monitoring of air quality, particularly particulates.

These monitoring activities will provide the foundation that will be an integral part of the environmental management of the site.

The preparation of an EMP including these monitoring protocols will be prepared as part of sustainable development framework prior to the commencement of site work. Other dimensions include:

- Development of site specific documentation in terms of health, safety, environment and community, including TARPs;
- Education and training programs for staff and contractor on sustainable development framework principles and protocols; and
- Ongoing public communication and liaison via the Donkin Link Newsletter, regular CLC meetings and the continuation of community issue tracking and response procedures.

2.4.1.2 Tunnel Rehabilitation

Work is required to drill and bolt the structures within the two existing tunnels to ensure that they are secure and safe. The necessary underground installation work, including the installation of the conveyors and other equipment, will not be started until the rehabilitation of the tunnels has been completed.

2.4.1.3 Surface preparation

On the surface, a certain amount of site grading is required to support the installation of the required site facilities, including the coal pad. This work will include the installation of all necessary sedimentation and erosion control measures, including the drainage infrastructure; this work will be done in accordance with NSE's Erosion and Sedimentation Control Handbook for Construction Sites. Ongoing monitoring will occur under the sustainable development framework.

The existing waste rock piles will be graded to accommodate the access road; excess waste rock material will remain within the active footprint of the site, e.g., surface of coal pad.

The serpentine pond will be upgraded by the addition of a clay liner to minimize potential infiltration of wastewater into the groundwater. No other changes to the water discharge system are proposed based on the success of the dewatering of the tunnels and continued maintenance pumping.

Site works will be limited to a defined footprint as depicted on Figures 2.2 and 2.3, an area previously disturbed by the earlier DEVCO workings. The active surface area, as detailed, will be fenced. No areas outside the fence will be disturbed by Project activities.

2.4.1.4 Buildings and Equipment

As has been detailed, there is a need both to upgrade and to construct certain buildings and infrastructure to accommodate the proposed activities for surface coal storage and handling and associated site management. This includes, but is not limited to:

- improvements to the internal access roads and product loading loop;
- improvements to the warehouse and administrative buildings, other miscellaneous buildings and work areas;
- construction of the necessary electrical distribution system;
- installation of equipment for the ventilation of the underground mains;
- installation of conveyors; and
- construction of a coal storage pad with rainbirds.

2.4.1.5 Roadway and Electrical requirements

The construction of the new access road from Long Beach Road will be completed in 2009 before the start of Project related works. Any excess earth generated during the roadway construction will be stored on-site and used for grading on the site including the site preparation of the coal pad. It is, however, expected that there will be minimal excess material generated.

As the existing power line is 69 kV and is sufficient for the needs of the Project, there is no need to upgrade the electrical supply from the existing power line to the site. A new sub-station and secondary distribution system within the site do need to be constructed. The existing power line corridor generally follows the access road alignment from Long Beach Road.

2.4.2 Operation and Maintenance

2.4.2.1 Sustainable Development Framework

All activities necessary to the execution of the Project, i.e., operation and maintenance activities, will be completed in accordance with the Proponent's sustainable development framework. Environmental monitoring will continue and will be augmented as deemed necessary including monitoring within the underground mains, e.g., the monitoring of air quality. Other dimensions of the sustainable development framework that will apply over the life of the Project include training, the development and adherence to site specific documentation in terms of health, safety, environment and community, and ongoing engagement with the community.

2.4.2.2 Exploration

The exploration tonnage will be produced with one continuous mining section, which operates as two production shifts and one maintenance shift per day, i.e., 24 hour operation, five days per week. The exploration section consists of one continuous miner, one roof bolter, two shuttle cars and two scoops.

The assumed section productivity is 40 m of advance per production shift. Section advancement work takes place during the maintenance shift. During some of the maintenance shifts, there may be cases where one or two cuts of coal can be taken.

The section infrastructure will have to be advanced approximately every other day since it is a three-entry system. Sufficient idle days are allowed for belt extensions on advance, as well as initial section setup.

The ventilation of the underground mains and mine dewatering will be ongoing as needed throughout the exploratory works.

2.4.2.3 Coal Storage and Handling

The general process flow can be summarized as follows:

- ROM coal will be received on the surface from the drift conveyor (500 tph design rate);
- Product passes under a tramp iron magnet onto a small stockpile;
- A front end loader manages the pile, feeding coal into a portable crusher/stacker unit and onto a raw coal stockpile;
- Front end loaders will reclaim the product and load it into transport trucks; and
- Loaded trucks will haul the product direct to various locations, including the Lingan and Point Aconi power stations and the International Coal Pier, on public roadways.

Figure 2.6 shows the flow of coal and handling on the surface.

Figure 2.6: Coal Handling (not to scale)

In terms of operation and maintenance, there will be a need to control the moisture content of the coal to reduce the potential for dust. This will be accomplished by rainbirds. This water system will be used during those times when the potential for the transport of dust from the site is high, i.e., during periods of dry and windy weather. Water will be sprayed onto the ROM storage piles and throughout the site, as necessary, to suppress the release of dust. The water for dust suppression will be supplied from the DEVCO settling pond; no other dust suppression substances will be applied.

Drainage from the active yard will be treated in the wastewater treatment system. The surface water management system will ensure that clean surface water surrounding the site does not interact with the active site and, therefore, require treatment (see Section 2.6.2 for additional detail).

2.4.2.4 Wastewater Treatment

Water that collects in the underground mains will be pumped to the surface for treatment through the wastewater treatment system. Water from the active yard area will be similarly handled. The operation of this system will include the monitoring of the system for flow, the handling of sediment and the regular maintenance of the system. The quality of the water will be monitored at defined locations prior to its discharge from the DEVCO settling pond.

It is anticipated that the flow rate will be similar to the dewatering operations during the height of the exploration operations. The actual flows and water characteristics, however, will be continuously monitored to confirm this assumption.

2.4.2.5 Utilities Support

The regular operation and maintenance of the sanitary sewage and process water systems detailed above will be undertaken as part of the Project. Potable water will be provided in bottles to those onsite.

2.4.2.6 Trucking

Within the site, coal will be loaded onto trucks which would access the Long Beach Road by the new site access road. Maintenance of all roads within the site boundary includes watering to control dust, as required, grading where necessary, salt distribution and snow ploughing as weather dictates.

All trucks will be washed before leaving the site to limit tracking of sediment on to public roadways. The coal on all trucks will be tarped to reduce coal dust or spillage. Speed limits and traffic signals will be defined in the Proponent's contract with the trucking contractor; there will be serious penalties associated with any infringements.

Coal will be transported to various locations on Schedule C rated routes, i.e., B-train trucks with 42 t capacity year round. It is proposed to use the largest trucks allowed under the approval conditions, namely 42 t B-trains, to minimize the number of journeys required.

Based on the transportation of up to 2000 tpd and the average load of a B-train truck of 42 t, up to 50 truck return trips per day can be expected. Trucking will take place for 12 hours a day for five days per week. Trucking hours will be adjusted to limit trucking activities along the haul route during the hours of school bus operation in the mornings and afternoons. An average of eight trucks per hour are expected taking into account return trips, the average coal transport volume, and the hours of trucking taking school bus times into consideration.

2.4.3 Decommissioning and Reclamation

The Project is a part of a larger plan to develop the Donkin Resource Block with longwall mining techniques. As such, a decommissioning and reclamation phase is not planned as part of the Project scope and will be addressed in the subsequent environmental assessment for the longwall mine project.

In the event that the Proponent determines that the longwall development of the Donkin Resource Block is not viable within their business model based on the data collected by this Project, the Proponent will work with NSDNR under their Special License to determine appropriate actions to decommission the site until such time that the property and rights are sold. All works to decommission the site will be completed in accordance with pertinent regulations and industry standards, as well as the Proponent's sustainable development framework.

2.4.4 Accidents and Malfunctions

During the construction phase of the Project, including preparation of surface works such as the access road, releases or spills of hazardous materials may occur. Spills, e.g., oils, hydraulic fluids and petroleum product, related to the use of heavy equipment during construction have the potential to impact drainage ditches, vegetation, wildlife and surface waters at, and in the vicinity of, the site and associated works. The Sustainable Development Framework that will be implemented has a requirement to investigate, respond to and take appropriate corrective and preventative action following any such incident. The essential components are training and ensuring the awareness of all employees and contractors to the appropriate procedures, standards, roles and responsibilities.

During the operational phase, accidents and malfunctions may occur in any one of the following locales:

- inside the industrial complex or associated buildings, including the underground mine;
- outside the buildings, but within the active yard;
- along the trucking route; or
- within the areas surrounding the working site, i.e., natural environment, related to failings of environmental protection mechanisms, such as the wastewater treatment system.

As detailed in Section 2.3.1, contingency and emergency response plans will be developed and implemented for all phases and activities associated with the Project.

2.5 Project Schedule

Figure 2.7 provides the schedule for the Project. As detailed, initial preparatory activities such as the development of the HSEC Management Plan, have been initiated. If the requisite approvals are obtained, 2009 will see preparatory works undertaken both on the surface and underground and the procurement and installation of equipment. Operations, i.e., the execution of exploratory coal, would be initiated in 2010 and proceed throughout that year. Depending on the results, coal may continue to be extracted through 2011.

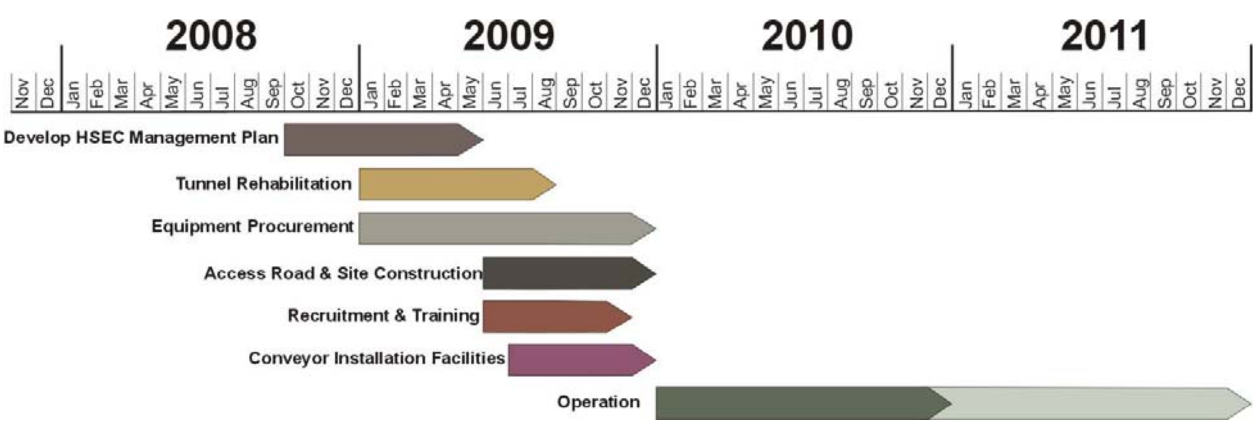


Figure 2.7: Project Schedule

2.6 Anticipated Emissions and Waste Streams

Eight categories of emissions and waste streams associated with the Project have been identified. These are: dust, site runoff, underground water discharge, sanitary sewage, solid waste, hazardous materials, noise and light. No production of waste rock from coal extracted for the exploratory works is anticipated based on the proposed scope of the work, i.e., ROM coal transported from the site for sampling and evaluation.

2.6.1 Dust

The effective mitigation of airborne dust is essential. Due to the location of the Project, the site does experience high velocity winds. The nearest residences, however, are approximately 1.5 km distant. Nevertheless, if not addressed, coal dust could potentially be an issue. To minimize the potential for dust leaving the site from the storage and handling of coal, a watering system will be installed. The dust suppression systems for the sized, raw coal stockpile will be a series of rainbirds. Winter operation will require that the piping to these devices be heat traced.

In terms of the trucking of coal, several mitigative measures will be in place to control dust along the trucking route. These include the washing of trucks before they exit the site to reduce the tracking of sediment on the roadways and the installation of tarpaulins on all trucks to reduce coal dust becoming entrained in the air. The access road and parking area will be watered as necessary if dust is an issue.

2.6.2 Site Run-off

Currently, the site is drained by the existing drainage channel that runs along the east and south sides of the disturbed area and empties into the DEVCO settling pond. A new diversion channel will be constructed surrounding the proposed active yard to divert clean water around the site. This water will be discharged into the existing drainage channel at a point to the west of the existing waste rock piles.

Run-off generated during rain events will be collected from the disturbed areas via the yard drainage ditch and directed to the existing serpentine pond to settle the sediment. The site water management system will collect water from all disturbed areas including the coal pad, the crusher/stacker, the ROM stockpiles, the coal handling front end loaders, as well as the surrounding active yard. Water will not be discharged from the site without adequate treatment and monitoring.

2.6.3 Underground Tunnel Water

Water from the exploratory mains consists of water that enters the underground mains and is collected for removal during normal operations. This water will be pumped from the underground workings and directed to the water treatment system. The successful dewatering of the tunnels pumped water at a rate in the order of 60 litres per second with a total of approximately 470 million litres of water removed. It is anticipated that the water pumped from the underground works during normal operations will be comparable. The flows and the chemistry of this water will be monitored, and adjustments will be made to the treatment program as required. The Proponent has been operating and will continue to operate on strict management control protocols referred to TARPs to ensure that all water discharges comply with regulatory requirements.

2.6.4 Sanitary Sewage

Sewage flows from the wash house will be collected in a tank and regularly emptied by truck as is currently the practice. The tank will be in-ground and situated for easy truck access. Sewage will be pumped by a licensed contractor and will be disposed of in accordance with legislation.

2.6.5 Solid Wastes

All wastes generated will be re-used or recycled on site, or handled at an approved off-site landfill facility. Recycling and the reduction of solid waste at all locations are audited on a yearly basis by the Proponent.

The operation of the wastewater treatment system will result in the production of sediments which will consist primarily of coal particles that will be recycled into the coal stream. Any solids resulting from the clearing of the serpentine pond will be disposed of at an off-site licensed landfill.

2.6.6 Hazardous Materials

As an industrial site, the exposure of the Donkin site to toxic and/or hazardous material is no different to any comparable site of its size. Equipment fuel and maintenance lubricants will be located on site. Material brought onto site will be approved by rigorous internal protocols based on the Workplace Hazardous Materials Information System (“WHMIS”). A register for approved chemicals on site will be developed and maintained.

2.6.7 Noise

Noise will be generated at the site during all phases of the Project due to the works as described. Baseline monitoring has been completed, and noise levels at the monitoring positions are currently dominated by the ambient sounds associated with the wind and waves; within 500 m of the active yard these ambient environmental factors tend to mask the noise generated by site activity. The latter currently includes noise associated with the use of heavy equipment and the power generators.

During the construction of the surface facilities, including the construction of a new site access road, there will be periodic increases in noise levels at the site. Site works, for example will include grading and excavation, the installation of utilities, construction of the site buildings and other facilities. Such activities typically involve the use of heavy equipment including tractors and loaders. Trucks will also be used to deliver equipment and building materials to the site and to haul away waste materials. Smaller equipment, including pneumatic tools, saws and hammers will be used extensively during construction. This equipment can generate both temporary steady and episodic noise that may be heard both on and off the Project site.

Selection of the equipment to be used on the site including the ventilation fans, the orientation of the site, and hours of Project operation will influence noise levels at the site. Off site, road conditions, speed and truck maintenance will influence noise levels associated with the transportation of coal. The operation of the trucks, including stringent requirements with respect to speed and maintenance, will be included in the performance based tender that will be issued by the Proponent; adherence to the stipulated requirements will be enforced and will serve to limit the noise that might be attributed to trucking.

2.6.8 Light

Limited outdoor general lighting will be provided as night coal handling is not required. Any stockpile lighting will be limited to structure lighting on the drift conveyor. Security lighting will be in place as needed, e.g., parking lot.

3.1 The Environmental Assessment Process

This environmental assessment methodology has been developed to meet the assessment regulations of the Nova Scotia *Environment Act* and reflects the technical and professional competency of the study team and their ability to address specific issues in a rigorous and pragmatic manner. In general, the approach has been designed to produce an environmental assessment document that:

- focuses on issues of greatest concern whether these have been identified by the study team, by the public or by the regulators;
- clearly addresses regulatory requirements; and
- integrates engineering design and mitigative measures into a Sustainable Development Framework that will enable, as the engineering proceeds, the preparation of a comprehensive EMS for the Project as it has been defined in the previous chapter.

Figure 3.1 depicts the key steps in the assessment process.

The preparation of the project description and the environmental and socio- economic baseline are the two fundamental building blocks necessary for the environmental analysis. The former is derived from the work undertaken by the Proponent and their engineering team. The latter is derived from the review and compilation of pertinent secondary data sources and the execution of selected field programs. The integrity of these building blocks is critical to the credibility of the subsequent analysis; the preparation of the two, however, is often iterative. This allows the environmental assessment to be used as a planning tool and to influence project design.

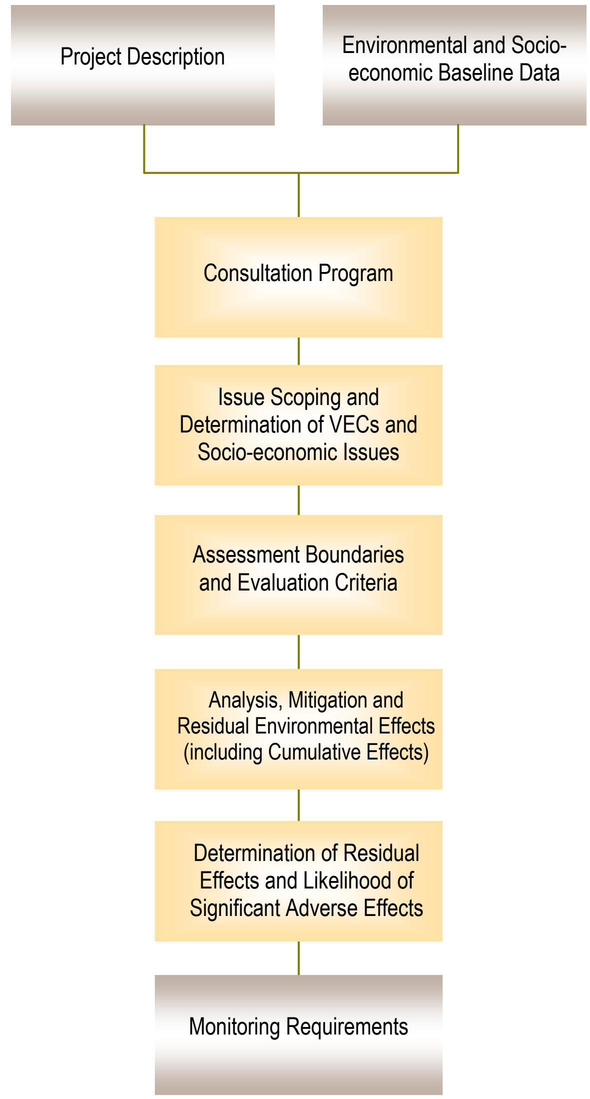


Figure 3.1: Environmental Assessment Methodology

To compile the environmental and socio-economic baseline, the study team drew on its collective knowledge and experience and considered input and opinions expressed by the community, the relevant regulations and guidelines and pertinent research including field work undertaken. This work has generated a substantial data base and enabled the identification of those matters that warrant further evaluation. The assessment examines the potential effects of the Project, i.e., the execution of further exploration activities over a defined period, as well as malfunctions and accidents, with regard to each Valued Ecosystem Component ("VEC") or socio-economic issue. VECs represent "key" or "indicator" species, communities, or ecosystems, as well as specific media, e.g., water or air that may be impacted by the project. Social, cultural or economic factors, or issues, may also be affected by the proposed works and are identified as such.

The final selection of VECs and socio-economic issues provide the focus of this assessment and reflect an informed understanding of the consequences of the proposed works in the physical, ecological and socio-economic context of the surrounding environment. These were determined through reference to pertinent literature, through consultation, as a result of work done on other industrial projects and through the execution of the field programs. The consultations undertaken have been extensive and have included meetings with the CLC, local residents, stakeholders, and the general public, as well as environmental regulatory staff at the municipal, provincial and federal levels. Chapter 5 provides an account of the consultation undertaken.

3.2 Research and Field Work Undertaken

An environmental assessment is a process that provides regulatory agencies with a better understanding of a project's possible environmental impacts and identifies ways to mitigate against those impacts. The environmental assessment process is executed early in project planning which enables environmental factors to be identified that may influence development decisions and detailed engineering. It is in part a planning tool, the underlying intent of which is to ensure that all works associated with the project's construction, operation and decommissioning are executed in a manner that results in minimal harm to the physical, ecological and socio-economic environments.

Work with respect to Xstrata's interests on the Donkin peninsula were instigated in 2006 and research, field programs and consultation have been ongoing since that time. The programs and the ongoing surface water monitoring at the DEVCO settling pond and Baileys wetland were designed at the outset to address requirements associated with the dewatering of the two subsea tunnels. Subsequent field programs were executed primarily to establish environmental baseline data. The environmental baseline data presented in Chapter 4 draws heavily from this original work, but has been augmented by work undertaken to address:

- Comments made by the regulatory agencies in response to the draft environmental assessment document submitted to NSE in November 2007; and
- requirements specific to this Project.

In combination, the resultant environmental and socio-economic database provides an enhanced profile of conditions on the Donkin peninsula and facilitates the identification of the VECs and socio-economic issues subject to evaluation.

The investigations and/or surveys that have been undertaken include:

- definition of ecological habitats and vegetation patterns;
- definition of freshwater aquatic habitat;
- analysis of habitats for species of concern;
- ground-truthing to verify breeding and migratory bird data compiled by local naturalists over many years;
- execution of a bat field program;

- execution of an odonata (dragonfly) field program;
- execution of an archaeological survey;
- execution of a hydrological field program;
- establishment of ambient noise levels;
- establishment of ambient air quality;
- execution of a Mi'Kmaq Ecological Knowledge ("MEK") study; and
- execution of a traffic impact study.

The programs undertaken are described below.

3.2.1 Secondary Data Research

The initial step in the environmental assessment process for this Project was to review and evaluate both the secondary database information that had been compiled since 2006 and the results of the field programs that had been undertaken in 2007. This database, augmented by the findings of additional programs executed in 2008, provides the basis for the bio-physical and socio-economic conditions related to the Project. Maps were prepared based on information gathered from the resultant databases and were used in scoping the field programs.

In broad terms, this phase of the work included:

- review of selected documents associated with previous works undertaken at the site which would contribute information relevant to the environmental assessment[4];
- acquisition of biophysical data sets from various government sources, including NSDNR;
- the acquisition and examination of aerial photographs from different eras to review changes in habitat, including wetlands, over time;
- review of local and regional mapping of the bedrock and surficial geology;
- review of key texts, e.g., the Natural History of Nova Scotia (Davis and Browne, 1996);
- consultation with individuals and groups who have specific knowledge of the Donkin peninsula;
- consideration of the federal *SARA*, the provincial *Endangered Species Act* and examination of the lists compiled by the Committee on the Status of Endangered Wildlife in Canada ("COSEWIC"), the Atlantic Canada Conservation Data Centre ("Atlantic CDC") and NSDNR; and
- compilation of demographic and related data from Statistics Canada to facilitate the preparation of the socio-economic profile.

One of the main focuses of the secondary database search was for species of concern. *SARA,* in conjunction with the provincial *Endangered Species Act,* provides the regulatory framework pertinent to the protection of valued rare and endangered species and the basis for the species at risk review. Two other conservation database lists, the NSDNR General Status rankings and the Atlantic CDC rankings, were used and cross referenced with the *SARA*, COSEWIC and *Endangered Species Act* list; both lists serve as early warning lists for the legislated lists. All lists were cross-referenced for the identification of species at risk or of concern on the Donkin peninsula. A summary of the ranking system used for each of the four databases used is presented in Table 3.1.

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[4] All documents accessed in the course of the preparation of the environmental assessment are referenced in the bibliography.

SARA and the *Endangered Species Act* provide legislative designations for species whereas the NSDNR - General Status Ranks and the Atlantic CDC provide technical tracking lists for conservation. The NSDNR-General Status Ranks are, by design, high level in nature. The results of the General Status Assessment provide more in-depth scientific assessment approaches and a "first-step tool" to help identify priorities, i.e., establish a list of priority species, for more detailed status evaluations, inventory, research and management. The Atlantic CDC is a member of NatureServe, an international non-profit organization that provides science and technical support to various Conservation Data Centres ("CDC"). The Atlantic CDC provides objective data and expertise about species and ecological conservation concerns in Atlantic Canada.

A list of the potential species of concern that may reside, or migrate through, the Donkin peninsula, or may have habitat preferences similar to that present on the peninsula was compiled from the legislated designated lists, the Atlantic CDC and the NSDNR General Status Ranks.

Table 3-1: Definitions of Rarity Rankings

COSEWIC Ranks	
Extinct	A species that no longer exists.
Extirpated	A species that no longer exists in Canada, but exists elsewhere in the world
Endangered	A species facing imminent extirpation or extinction.
Threatened	A species likely to become endangered if limiting factors are not reversed.
Special Concern	A species that may become threatened or endangered because of a combination of biological characteristics and identified threats.
Data Deficient	Available information is insufficient to assess the species' risk of extinction, or is insufficient to determine it's eligibility to be assessed
Not at Risk	A species that is not at risk of extinction.
SARA Ranks	
Endangered	A species facing imminent extirpation or extinction
Threatened	A species likely to become endangered if limiting factors are not reversed
Special Concern	A species of concern because of characteristics that make it particularly sensitive to human activities or natural events
SARA Schedule	
Schedule 1	Official list of wildlife species at risk
Schedule 2	Species under consideration for inclusion in schedule 1 (COSEWIC Endangered & Threatened)
Schedule 3	Species under consideration for inclusion in schedule 1 (COSEWIC Special Concern)
NS *Endangered Species Act*	
Endangered	A species that faces imminent extinction or extirpation and is listed as an endangered species pursuant to Section 12
Threatened	A species that is likely to become endangered if the factors affecting its vulnerability are not reversed and is listed as a threatened species pursuant to section 12
Vulnerable	A species of special concern due to characteristics that make it particularly sensitive to human activities or natural events and that is listed as a vulnerable species pursuant to section 12

NSDNR General Status Ranks	
Undetermined	Species for which insufficient data, information or knowledge is available or reliable to evaluate their status.
Red	Known to be or is thought to be at risk.
Yellow	Sensitive. Species that are not believed to be at risk of immediate extirpation or extinction but which may require special attention or protection to prevent them from becoming at risk.
Green	Secure. Species that are not believed to be at risk or sensitive. This category includes some species that have declined in numbers but remain relatively widespread or abundant.
Atlantic CDC Ranks Definitions	
S1	Extremely rare throughout its range in the province (typically five or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation.
S2	Rare throughout its range in the province (six to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.
S3	Uncommon throughout its range in the province, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences).
S4	Usually widespread, fairly common throughout its range in the province, and apparently secure with many occurrences, but the species is of long-term concern, e.g., watch list (100+ occurrences).
SU	Unrankable: Possibly in peril throughout its range in the province, but status uncertain: need more information. Used for new species not previously identified.
SX	Extinct/Extirpated: Believed to be extirpated within the province.
S#S#	Numeric range rank: A range between two consecutive numeric ranks. Denotes uncertainty about the exact rarity of the species, e.g., S1S2.
?	Inexact or uncertain: For numeric ranks, denotes uncertainty, e.g., SE? Denotes uncertainty of exotic status.

The methodology outlined in NSE's *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document*, November 2005, was followed to determine potential species of concern for the Project site. This protocol provides a framework through which listed species can be ruled in or out of an environmental assessment based, in the first instance, on geographical occurrence, and secondly, on the presence or absence of appropriate habitat within the Project area. The observed distance of each species from the study area (as noted in the Atlantic CDC guidance list) was also taken into consideration. Additional sources used to determine the regional distribution and habitat preferences for birds included the *Atlas of Breeding Birds of the Maritime Provinces* (Erskine, 1992) and *Eastern Birds* (Peterson, 1980) and for plants, key references included *Roland's Flora of Nova Scotia* (Zinck, 1998) and *Nemcomb's Wildflower Guide* (Nemcomb, 1977).

The result of the searches of the above reference lists of potential Species at Risk or of Conservation Concern that might be found in the study area based on the Atlantic CDC, 100 km radius search is included in Appendix D. The results of this analysis provided the framework for developing baseline maps of the Project site and scoping of the field programs to identify and evaluate the VECs.

3.3 Field Programs

The field programs conducted as part of this environmental assessment are presented under three headings: the physical environment, the ecological environment and the socio-economic environment. The methodologies associated with the field programs are described below; the results are presented in Chapter 4.

3.3.1 Physical Environment

The following programs are detailed in the sections below: hydrological and hydrogeological, water and sediment quality, ambient air quality and ambient noise levels.

3.3.1.1 HYDROGEOLOGICAL PROGRAM

Figure 3.2 depicts the topography and hydrology of the Donkin peninsula: surface water to the north, east and south of the Project footprint drains towards the coast of the peninsula; surface waters from the centre of the peninsula drain westward. The potential area of impact from the proposed works is therefore to the west of the active Project yard. No drainage from Project related activities will occur to the east, and no hydrological field investigations have been undertaken in the eastern portion of the peninsula. Baseline conditions in the shallow groundwater flow systems to the west of the project footprint that may be impacted by proposed Project activities have been investigated. This involves the two major wetland areas to the west of the Project yard, i.e., those associated with the DEVCO settling pond and Baileys wetland. The field programs were designed:

- to address the interaction of surface waters with these wetland features, including local pathways of groundwater discharge to the wetlands and the potential for connection between the two systems; and
- to determine the effects of the mine water discharge to the DEVCO settling pond during the dewatering of the tunnels, subsequent subsurface maintenance and planned exploration works in the mine.

i) *Groundwater Flow Data*

Groundwater flow data has been collected in the DEVCO settling pond and Baileys wetland from the following installations:

- Six wetland stand-pipes on the perimeter of the DEVCO settling pond and Baileys wetland referenced as DSP-1, DSP-2, DSP-3, BW-1, BW-2 and BW-3;
- Three streambed minipiezometers immediately down gradient of the berm separating the DEVCO Settling pond and Baileys Wetland referenced as DSP-4, DSP-5a and DSP-5b;
- Two bedrock monitoring well nests, consisting of monitoring wells screened in the shallow and deeper bedrock units, located on the ridge separating the two bodies of water referenced as D1 and D2;
- Four pneumatic piezometers located in the ridge separating the two bodies of water; and
- A stilling well / staff gauge in each of the two bodies of water referenced as SW-BW and SW-DSP.

Monitoring Well DSP-1

The locations of the above installations are depicted, with the exception of the four pneumatic piezometers, on Figure 3.3. Details of the groundwater monitoring installations and borehole logs are provided in Appendix E. The results are presented in Sections 4.3.3, 4.3.4 and 4.3.5. Monitoring wells had been installed as part of an earlier Phase II Environmental Assessment (Dillon, 2005) and the results of that program are also acknowledged in the analysis in Section 4.3.4.

The wetland standpipes were fully screened to allow delineation of the water table over seasonal high and low water table conditions. The standpipe locations were selected to capture water table variability across the wetland sites and to assess potential changes in hydrogeological conditions. The wetland standpipes were installed in July 2006. The ground surface elevation in wetland environments typically changes with soil moisture content and water table elevation because peat soils are highly deformable. A 1.5 m section of rebar anchor was driven into the soil adjacent to each of the standpipes to provide a standard datum for water level measurement. The top of each rebar anchor was surveyed to obtain measurements of elevation relative to mean sea level.

The streambed minipiezometers were screened over a discrete 0.3 m interval installed at or below the interface of wetland sediments with the underlying till. The three well locations were placed to assess vertical gradients immediately down gradient of the berm separating the DEVCO settling pond and Baileys wetland. The wells were inserted into the boreholes, allowing the formation to collapse around the well screen to form a natural filter pack. The streambed minipiezometers were installed in August, 2006. The well pipe-tops were surveyed to provide a standard datum for water level measurement.

Two bedrock monitoring well nests (D1 and D2), consisting of shallow and deep screen placements, were drilled into the sandstone and siltstone formation in the area between the DEVCO settling pond and Baileys wetland. Shallow wells were screened from 1 to 4 m below the till-bedrock interface, and deeper wells were screened from 30 to 33 m below the till-bedrock interface. The boreholes were advanced by auguring through the till unit and NQ coring through the bedrock. Bedrock wells were installed by Jacques-Whitford Associates Ltd. in September 2006. The well pipe-tops were surveyed to provide a standard datum for water level measurement.

Four pneumatic piezometers were installed through the berm separating the DEVCO settling pond and Baileys wetland. Boreholes were augured into the dam at depths of 4.8 to 5.8 m below grade (mbg). Each piezometer, installed by Jacques Whitford Associates Ltd. in September, 2006, consisted of a diaphragm installed at the base of the borehole with two small diameter pneumatic lines leading from the diaphragm. To obtain water level readings, the diaphragm was filled with nitrogen gas and allowed to equilibrate with the piezometric head at the position of the diaphragm. Equivalent piezometric head readings were obtained from a pressure gauge attached to the pneumatic lines.

The wells were developed by pumping each well dry a minimum of three times using dedicated Waterra tubing and footvalves. The wells were developed to reduce the amount of fine-grained material around the screen to improve responses in the well to water level changes, and to allow collection of representative groundwater samples with minimal sediment content.

Water level measurements were obtained from these installations on four occasions:

- July, 2006;
- August, 2006;
- August, 2007; and
- September, 2008.

Static water levels in the wetland standpipes were measured relative to the top of the rebar anchors, as the rebar is assumed to be immobile and unaffected by shrinkage and swelling of the peat and marsh sediments. Water level data was used to:

- Determine the annual water table elevation in the ponds and near-shore peat/wetland sediments;
- Calculate vertical gradients down gradient of the DEVCO settling pond berm;
- Compare the piezometric head in the dam with the water table elevation;
- Compare the piezometric head in the bedrock with the water table elevation;
- Calculate vertical gradients between the shallow and deep bedrock units; and
- Provide baseline data for comparison of the water table elevation with flow/discharge data.

Additional water level data was collected in the fall of 2008 using data loggers. Water levels were measured every hour over a two week period in the DEVCO settling pond, Baileys wetland and bedrock well nest D1. Detailed water level data was intended to show real-time water level fluctuations in response to precipitation events and the maintenance pumping of the mine tunnels. The measured results, i.e., the presence, magnitude and time lag of response in the bedrock wells relative to surface water levels, enabled the assessment of the possible hydraulic connection between the two wetland bodies via flow paths in the bedrock.

Hydraulic conductivity tests of the bedrock wells were conducted to help characterize the flow characteristics in the shallow and deeper formations. Rising head tests were accomplished by removing a slug of water from the well with a bailer. Detailed water level data was recorded using a data logger in the base of each well and recording water level changes every second. Recovery data were analyzed in AQTSolve software, using the Hvorslev and Bouwer-Rice methods of calculation.

ii) Groundwater Chemistry

Groundwater chemistry data were collected to:

- Provide baseline data for the wetland areas prior to any major activity occurring on the mine site;
- Assess the current groundwater quality in the context of past mining activities; and
- Assess the connection between surface water and groundwater, and the potential for transport of contaminants between these two flow systems.

Groundwater chemistry data were collected in July 2006, August 2006 and September 2008. Groundwater samples were collected from the wetland standpipes only when a significant head of standing water was not present outside of the pipe. During the wetter parts of the year, standing water is present outside of the pipes and flows freely through the screen which is slotted above the ground surface.

Field readings were recorded for groundwater pH, temperature, conductivity and dissolved oxygen content at each location sampled. Samples were collected from each well for general chemistry, metals and BTEX-TPH analysis. The samples obtained in July 2006 and September 2008 were also submitted for PAH analysis. Samples were stored in an insulated cooler before being delivered to Maxxam Analytics in Sydney, Nova Scotia, for analysis. Groundwater samples were collected at:

- The six wetland standpipes in July 2006 and August 2006;
- The three streambed minipiezometers in August 2006 and September 2008; and
- The two bedrock monitoring well nests in September 2008.

The presence of standing water prevented the collection of samples from the wetland stand-pipes in September 2008, as the design of the pneumatic piezometers did not allow for collection of water samples in such conditions. Pneumatic piezometers were installed in favour of traditional screened wells to avoid compromising the structural integrity and function of the berm.

Groundwater metal samples were field filtered and acidified. Field filtration was considered to be the only way to obtain accurate and precise measurement of metal concentrations. Metal concentrations were obtained primarily to assess contaminant mobilization and transport within the wetland system.

3.3.1.2 Surface Hydrology and Water Chemistry

The baseline surface water flows from the Project site were determined by the execution of a monitoring program, the objectives of which were to:

- determine the direction and quantity of surface water flows;
- provide a database of physical, chemical and biological parameters that could be used to predict and monitor the significance of the effects of Project activities on receiving water quality;
- develop mitigation measures as required with respect to surface activities; and
- develop an understanding of surface water characteristics in the vicinity of the Project site to allow the establishment of area-specific water quality objectives.

Data relating to surface water is included in Appendix F.

i) Surface Hydrology

The two main surface water channels on or in proximity to the Project site are an unnamed brook running towards the site from the south and the DEVCO pond discharge channel to the west of the project site (DSP Outlet A). Three flow gauges (SW-2, MP-2 and MP-4), one rain gauge and one level meter (MP-5) were installed to monitor both baseline hydrologic conditions and surface water flows during tunnel dewatering operations. Figure 3.3 shows these sampling locations.

The flow sampling locations include the serpentine pond effluent pipe (MP-2) and the DEVCO settling pond discharge pipe (MP-4). The level meter is located on the dam structure in the DEVCO settling pond (MP-5) and the rain gauge is located in the middle of the main disturbed mine site as depicted on Figure 3.3. Readings are datalogged for flow, rainfall and water levels; the data is downloaded monthly and transferred to a computer for analysis.

Data has been collected at the site since August 2006 and has been used to calibrate a hydrologic/hydraulic computer model of the site. This information provides the ability to determine the design and development of the water management requirements for the site during both the execution of this Project and any subsequent work at the site.

ii) Water and Sediment Chemistry

Surface water samples were collected and analysed to provide a baseline indication of contaminant concentrations along the flow path from the Project site to the outlets of the DEVCO settling pond and Baileys wetland. In the context of the hydrogeological investigation of the wetland areas, this data was used to assess the role of groundwater-surface water interaction in contaminant transport and attenuation. Surface water chemistry data also provided baseline data for long-term monitoring as part of Project activities. Surface water samples were collected in 2006, August 2006 and September 2008.

Drainage Course between Waste Rock Piles

The surface water samples were analyzed for general chemistry, metals, TSS and BTEX-TPH at the locations indicated on Figure 3.3. The samples obtained in July 2006 and September 2008 were also submitted for PAH analysis. Field readings were recorded for surface water pH, temperature, conductivity and dissolved oxygen content at each sampling location. Sampling location SW-6 at Baileys wetland (Outlet A) was added to the baseline program during the August 2006 sampling interval. Sampling locations SW-7, at the DEVCO settling pond berm, and SW-8, below the berm in the Baileys wetland, were added during the September 2008 sampling program.

The surface water metal samples collected in July 2006 and August 2006 were field-filtered and acidified to provide a direct comparison to dissolved groundwater metal concentrations. As indicated above, field filtration was considered to be the only way to obtain an accurate and precise measurement of metal concentrations. Metal concentrations were obtained primarily to assess contaminant mobilization and transport within the wetland system. Traditional methods for the collection and laboratory digestion of samples for total (unfiltered) metals were considered inadequate for this study. This method, although considered appropriate and optimal for the circumstances, did not allow comparison with Canadian Council of Ministers of the Environment (CCME) criteria. Surface water samples SW-1 through SW-6 collected in September 2008 were taken as unfiltered samples to allow for comparison to CCME guidelines. Samples collected at SW-7 and SW-8 were field filtered and acidified to allow for an assessment of groundwater transport across the dam and to avoid any interference from precipitated metals observed as a crust on the water surface at or near the sampling locations.

Sediment samples were collected at each surface water sampling location in July 2006 and submitted for metals, BTEX-TPH and PAH analysis. Five sub-samples were collected at each location and blended to create a composite sample. The sampling tools were washed, then rinsed with hexane and distilled water between sample stations. These samples were taken to provide an indication of potential impacts on the system by past mining activities, to assess the role of precipitation and adsorption in the removal of metals along the surface water flow path, and to assess potential remobilization to the shallow groundwater flow system.

3.3.1.3 Treated Wastewater Monitoring

Although the Project as defined relates to the proposed works required for the Underground Exploratory Project, this environmental assessment also draws upon the monitoring done to characterize the tunnel and the receiving waters. During the tunnel dewatering operations there was considerable monitoring undertaken with respect to determine both the quality of the tunnel water and also the effectiveness of the treatment process that had been designed to treat the tunnel water prior to its release into the marine waters of Schooner Pond Cove. The potential impact of this water was also reviewed in the context of the results of an effluent dispersion study. Each program is described below.

i) Dewatering Monitoring

At the outset, the only data available to determine the water quality of the tunnel water consisted of six samples collected in 1988 during the original tunnel boring operations. Although insufficient, the depths and configuration of the tunnels prevented additional samples from being collected, and the available data had to serve as the basis for the design of the water treatment process design. The monitoring program that was developed and implemented addressed these parameters.

The dewatering of the tunnels was completed in August 2007 and presently only the water infiltrating into the tunnels is pumped to the water treatment system. The treatment system developed during the initial dewatering activities is illustrated in Figure 1.4; the water passes through a cascade aeration system, a primary settling pond, a reed bed drainage channel and the DEVCO settling pond prior to its discharge to Schooner Pond Cove. Samples have been collected twice weekly by CBCL Limited since the start-up of the dewatering process in November 2006; third party monitoring was undertaken at the outset of the program by AMEC Consulting to ensure the establishment of effective protocols and to verify initial results. The sampling locations are shown on Figure 3.3; they are:

- MP-1 – the initial sampling of the water from the tunnel waters prior to its discharge to the serpentine sedimentation pond;
- MP-2 – sampling of the effluent discharged from the serpentine sedimentation pond;
- MP-3 – sampling of the effluent discharged from the drainage channel; and
- MP-4 – sampling of the effluent discharged from the DEVCO settling pond prior to discharge into Schooner Pond Cove.

As the Proponent is not permitted to discharge any deleterious substance to waters frequented by fish pursuant to section 36(3) of the *Fisheries Act,* two 96-hr LC_{50} acute toxicity tests were performed on the tunnel waters, i.e., at MP-1, and one 96-hr LC_{50} acute test on the discharge waters at MP-4. The bioassay used for all three toxicity tests were Rainbow Trout fingerlings. The results of this work are provided in Section 4.3.5.5.

ii) Dispersion Modelling

In addition to the water quality monitoring program, an effluent dispersion study was prepared to determine the potential impacts of the tunnel water on the receiving waters of Schooner Pond Cove. The development of the model was dependant on:

- Review of available data; and
- Site specific oceanographic measurements.

The parameters of concern at Schooner Pond Cove included iron and zinc. The concentrations of iron and zinc used in the dispersion modelling were based on the results of the water quality sampling program for the period November 7, 2006 to March 12, 2007, i.e., the model input assumed no wastewater treatment. A constant flow rate of 60 L.sec (900 USgpm) was used as it represented the maximum water pumping rate from the tunnels during dewatering. The results of the model were determined as parts per thousand of effluent in the water column. The results of the modelling are provided in Section 4.3.5.4.

To determine the site specific oceanographic conditions required for the model, a marine field monitoring program was undertaken between September 6, 2006 and October 11, 2006. The program consisted of deploying two Acoustic Doppler Current Profilers ("ADCPs") off the Donkin peninsula to collect data on the seawater salinity and current conditions surrounding the peninsula. In addition, temperature profiles were compiled at nine locations around the peninsula in 10 m depths to assess ambient seawater properties. The data from the ADCPs was then used to develop a two-dimensional model of the marine environment and current regime surrounding the Donkin peninsula. The Danish Hydraulic Institute's MIKE3 model was used for this analysis. The results are referenced in Section 4.3.5.4.

3.3.1.4 Ambient Air Quality

The objective of the baseline field study was to measure existing levels of particulate matter in the ambient air near the Project site. The baseline survey was designed to measure respirable fractions of particulate matter, including less than 10 µm (PM_{10}) and the smaller fractions of less than 2.5µm ($PM_{2.5}$) using automatic recording real-time aerosol analyzers. The data is representative of a 24-hour period showing natural fluctuation in readings due to the time of day and changes in weather parameters.

Baseline particulate matter readings were collected on August 17th and 18th, 2008. Two monitoring sites were selected near the mine site, on the Donkin peninsula; these are depicted on Figure 3.4. Site 1 was located at the former Bailey Homestead, approximately 500 m west of the mine site, adjacent to Schooner Pond Cove. Site 2 was located approximately 500 m south of the Project site on the upper terrain of a small hill. Site 1 was selected because of its close proximity to the local coastline environment, and because it was representative of natural background conditions. Site 2 was selected due to its siting on higher ground and its close proximity to the Project operations' area. Due to the higher elevation at Site 2, a portable weather station was also installed to record wind speed, its direction, temperature and relative humidity for a 24-hour period.

Continuous particulate matter measurements (PM_{10} and $PM_{2.5}$) were taken at both sites using DustTrak Aerosol Monitors, Model 8520. Each site was setup with two (2) DustTraks, one measuring PM_{10} concentrations and the other configured to monitor $PM_{2.5}$ levels. Aerosol monitors were placed on tripods, approximately 1.5 m above ground and away from any surface obstructions or buildings. The instruments were setup for a 24-hour period and collected at the end of the sample period. Data from each of the four units were downloaded to a computer. The logged data were reduced to one-hour average concentrations for review and presentation.

During the 24-hour period, the aerosol monitors were frequently checked and sometimes recalibrated in order to re-zero the instrument. The monitors required occasional correction whenever ambient temperatures changed by more than 5°C. The monitor used to measure $PM_{2.5}$
levels at Site 1 stopped functioning early during the 24-hour period. The remaining working aerosol monitor at Site 1 was deployed to collect both $PM1_{10}$ and $PM_{2.5}$ data for the time remaining in the monitoring period.

Weather parameters were measured at Site 2 using a portable wireless weather station, Vantage Pro 2 model. The weather station included an integrated sensor suite which houses and manages the external sensor array and the consol which provides user interface, data display and calculations. The external sensor array including the anemometer was mounted on a 3 m pole. This station is capable of monitoring a wide array of weather parameters. For the purpose of this study, wind direction, speed, temperature, relative humidity and rainfall were monitored. The natural influence of offshore weather conditions on dust/aerosol levels at the site is important in order to determine the impact local weather patterns will have on baseline concentrations and future air monitoring during operations. Weather data for the 24-hour monitoring period were collected and downloaded (five-minute averages) to a computer. The logged data were reduced to one-hour average values for use in the analysis of baseline levels and fluctuation of readings.

The results of this program are provided in Section 4.3.6.

3.3.1.5 Determination of Ambient Noise Levels

The objectives of the baseline noise study were:

i) to measure ambient noise levels; and
ii) to identify recurring sources of noise in the vicinity of the proposed Project that may influence the measured levels.

The first field program was undertaken on June 2nd and 3rd, 2008 and involved the automatic recording of sound levels at two on the Donkin peninsula over a 24 hour period. The recording locations, as depicted on Figure 3.4, are as follows:

- Location 1 - at the former Bailey Homestead; and
- Location 2 - south of the proposed mine site towards Morien Bay.

The weather during the sampling period was mainly clear as reported in the hourly data attained from EC.

All measurements were taken using an Extech Sound Level Meter. The sound level was measured as L_{eq}, which is the logarithmic average over a measurement time. L_{eq} measurements at each location were logged once per minute over a 24-hour period. The measurement unit selected for the evaluation was dBA, or "A" weighted decibels. A fast response time was selected to capture both noise peaks and noises that occur very quickly.

Each noise meter was set up approximately 1.5 m above the ground and away from reflective objects. As stated above, the instruments were activated for a 24-hour period and collected at the end of the sample period. The raw noise data from each of the four units was downloaded to a computer. The logged data was then reduced to one hour L_{eq} values for comparison with the Nova Scotia Guidelines for Environmental Noise Measurement and Assessment. (NSDE, 2005). The results of the monitoring program are provided in Section 4.3.7.

3.3.2 Ecological Environment

The following programs are detailed in the sections below:

- habitat and vegetation investigations;
- wetland investigation;
- breeding, wintering and migratory bird activity;
- bat field activity;
- odonata field program; and
- freshwater and marine ecological programs.

3.3.2.1 HABITAT AND VEGETATION INVESTIGATIONS

The methodology used to identify and assess the various habitat types and associated vegetation patterns found on the Donkin Peninsula followed the protocol outlined in the NSE *Guide to Addressing Wildlife Species and Habitat in an Environmental Assessment Registration Document, 2005*. Activities included the identification of habitat, reviewing and preparing a "short-list" of priority species for the study area, and site investigation of the different habitat types.

Ground-truthing a wetland area on the Donkin peninsula

Aerial photography and other biophysical and topographical databases, including the NSDNR Wetland and Significant Habitat databases, were used to compile a preliminary habitat map for the headland, including the sensitive wetland areas of the former DEVCO settling pond and Baileys wetland. Based on this desk-top habitat mapping, a short list of "priority species" known to be, or which may have the potential to be, associated with

A mix of marsh and ericaceous plant species align the shores of Baileys Wetland identified habitat types was generated from the extensive long list of species of concern, based on a 100-km radius search of databases. Phenology windows were identified for the priority plant species and the best survey times were identified.

General habitat and associated vegetation surveys involved a pedestrian Relevé sampling procedure (MNDNR, 2007). The nature and species composition of the vegetation and general abundances within plant communities were assessed using relative abundance measures (Braun-Blanquet, 1932, Brower & Zar, 1977) at representative locations within each habitat identified. Sensitive habitats, or those likely to support rare or unusual species, were noted and geo-referenced with a hand-held GPS unit. Particular emphasis was given to the aquatic and semi-aquatic vegetation around Baileys wetland and the DEVCO settling pond. Specifically, the vegetation survey involved a search for rare species and species of conservation concern identified as potentially present in the area according to lists maintained by the NSDNR, NSE and the Atlantic CDC. Specimens of species not readily identified were taken back to St. Francis Xavier University for identification and/or forwarded to the Nova Scotia Museum of Natural History. All taxonomy followed Zinck (1998). Based on the habitat and vegetation field assessments, the preliminary habitat mapping was updated and any prior species were documented according to NSDNR procedures.

The first botanical field investigation undertaken in the early summer of 2006 was conducted by Dr. Barry Taylor (St. Francis Xavier University) and Clinton Pinks (CBCL Limited). A number of additional botanical investigations were conducted between July 2006 and August 2007 to confirm the location and habitat of several plant species of interest. Several species were confirmed under laboratory conditions, and other species were sent to Marian Monroe of the Nova Scotia Museum of Natural History for confirmation.

3.3.2.2 Wetlands Investigation

The primary wetland areas on the peninsula, i.e., Baileys wetland and the DEVCO settling pond, were mapped as part of the habitat assessment program (See Section 3.3.2.1 Habitat and Vegetation Investigations), and plant surveys were conducted as part of the vegetation assessment. The investigation undertaken at these sites also took into consideration surface and groundwater conditions as an integral part of the hydrological investigations. Wetland boundaries acquired from the provincial wetlands database were ground-truthed.

Neither the Baileys wetland nor the DEVCO settling pond will be physically disturbed by Project activities. Variations in the wetland boundaries noted during the field investigations are based on recording hydrophytic vegetation and wetland hydrology indicators in the manner described by the American *Corps of Engineers Wetlands Delineation Manual* (1987). Plant associations were confirmed and characterized based on *The Canadian Wetlands Classification System* (1997). Baileys wetland and the DEVCO settling pond are described in detail in Chapter 4 including their development and classification, functional processes and vegetation composition.

3.3.2.3 Breeding, Wintering and Migratory Bird Activity

The determination of the importance of the Donkin peninsula for avian species is based on the following:

- review of secondary databases, previous ornithological work conducted at the site and reference to informed personnel in the Canadian Wildlife Service;
- the results of the extensive field work on bird activity, with respect to both breeding and migratory patterns, conducted by Cathy and Allan Murrant, two highly respected local naturalists[5]; and
- the review of the databases, including field visits, by a renowned ornithologist[6] to verify the validity of the approach and the findings.

The extensive and rich ornithological database that has been made available to the study team is further discussed in Section 4.4.4. This database is continually being expanded. In 2007, for example, the Murrants released findings of a three month field survey documenting the migratory use of the Donkin peninsula by the Whimbrel[7]; communication with the Murrants in September 2008 confirmed that Whimbrels had been seen on the headland in 2008.

3.3.2.4 Bat Field Program

The intent of the bat field program undertaken in 2007 was to:

i) provide information on the ecology of the bats present on the Donkin peninsula;
ii) determine if there were bat maternity colonies on the peninsula; and
iii) assess the distribution of bats by monitoring echolocation activity.

The work in the field involved both the capture and identification of bats and the monitoring of bat activity. The results of the field program are provided in Section 4.4.6.

i) Capture and Identification of Bats

To determine if maternity colonies were present on the peninsula, bats were captured using harp traps (Austbat Research Equipment, Lower Plenty, Victoria, Australia) which were placed on forested trails on 8 August 2007. The trap locations are identified on Figure 3.4[8]. The species, sex, weight, relative age (adult or juvenile) and reproductive status were recorded for all captures. Female bats were identified as reproductive by the presence of bare patches around nipples and/or the expression of milk (Racey 1988).

Based on questions posed to employees on the Donkin site, no bats are known to roost in buildings on the peninsula.

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[5] Port Caledonia residents, fishers and naturalists, Cathy and Allan Murrant have been birding in eastern NS for over 20 years. The self-taught enthusiasts learned mostly from books, endless field observation and maintenance of a photographic and written record of their sightings. The Murrant's have contributed to several birding publications including the *Sibley Field Guide to Birds of Eastern North America*. In 1995, Cathy published a book, *Birding Cape Breton's Historic East* which is available for purchase on their website, Cape Breton Birds (http://www.capebretonbirds.ca/index.html); they maintain a photographic record of all of the birds they have sighted over the years at this website. Cathy has in the past also operated a small business offering tours of her favorite birding areas, including the Donkin Peninsula.

[6] Dr. Ian McLaren, ornithologist and professor emeritus at Dalhousie University, Halifax, Nova Scotia. Dr. McLaren is a recognized expert having studied and published his findings on Nova Scotian birds for over 30 years. Dr. McLaren met on several occasions with the Murrant's to review their data and to conduct a field visit.

[7] The field techniques deployed as part of this program accorded with the CWS's requirements and the results of the program have been entered into the Maritime Shorebird Survey.

[8] Trap locations were: Location #1: 744862 E 5118922 N and Location #2: 744098 E 5118537 N; UTM Zone 20 NAD83 format.

ii) Monitoring of Bat Activity

Three Anabat II detection systems were used to sample the echolocation calls of bats to monitor activity on the peninsula. Each system consisted of an ultrasonic Anabat II detector interfaced to a CF Storage ZCAIM (Titley Electronics Ltd., NSW Australia). The systems were calibrated to reduce variability in their sensitivity using the methods suggested by Larson & Hayes (2000) and were deployed at ground level. The seasonal timing of the sampling period corresponded to the late lactation and post-lactation periods of the summer reproduction season[9].

The identification of many bat species is possible because of the distinctive nature of their echolocation calls (Fenton and Bell 1981, O'Farrell et al. 1999). Species were qualitatively identified from echolocation sequences by comparison with known echolocation sequences recorded in this and other geographic regions. In the case of species in the genus Myotis (northern long-eared and little brown bat), sequences to the species level were not identified as their calls are too similar to be separated. Identifications were facilitated using frequency-time graphs in ANALOOK software (C. Corben, www.hoarybat.com). A bat call sequence, defined as a continuous series of greater than two calls (Johnson et al. 2004), was used as the unit of activity.

3.3.2.5 Odonata Field Program

Dr. Paul Brunelle undertook three trips through the summer and early fall of 2008 to execute odonate surveys on the Donkin peninsula. The methodology deployed followed the protocols of the Atlantic Dragonfly Inventory Protocols (ADIP) which have evolved over the last 20 years and which reflect current practice in the study of ondates. After discussions with CBCL Limited staff with respect to the site, aerial photographs were reviewed and target survey locations identified. Each location was given an ADIP identification code (see Figure 3.4). Survey work was done only downstream of the site footprint, essentially west of the Quonset hut and serpentine settling pond. The Project as defined will not encroach on to the headland, or to the east of the area as referenced. Five aquatic habitats were samples. All but one, i.e., Baileys wetland, are anthropogenic, or highly impacted, aquatic areas, and all, excepting Baileys wetland, are in series.

All fieldwork was undertaken by Dr. Paul Brunelle in association with a colleague or a member of the CBCL Limited environmental team. The field work was undertaken in July, August and September of 2008 during the peak periods of ondata activity, i.e., 10:00-17:00, depending on weather. As the intent was to identify adults and tenerals, i.e., recently emerged adults, field days were chosen when the weather was expected to be sunny and hot, with no more than moderate winds. During a few site visits, the wind rose to strong, with a consequent reduction in the diversity of species observed; overcast conditions, particularly early in the day, occasionally reduced results. The third trip was cut short as a result of poor weather. Table 3.2 records the sites visited, the times of those visits and the weather conditions.

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[9] Monitoring began from 21:00 until 06:00 on the evening of August 8, 2007 at Baileys wetland, i.e., monitoring location #1: 743684 E 5118629 N-UTM Zone 20 NAD83 format; from August 8 to 16, 2007 at the west end of the DEVCO settling pond, i.e., monitoring location #2: 743979E 5118676 N, and from August 9 to 16, 2007 at the forested road, i.e., monitoring location #3: 744474 E 5118278 N. The monitoring locations are identified on Figure 3.4.

Table 3-2: Odonata Survey Locations, Times and Conditions

Location	*ADIP Ref.*	*Coordinates*	*Dates/Time*	*Weather Conditions*
Serpentine Settling Pond	NS 1079	15W02 (43e03), 11J04 46°10’ 38.80”, 59°49’ 23.70” [46.1774N, 59.8233W]	July 7, 2008 9:10-9:30	Sunny 80%, wind light
			July 8, 2008 15:40-16:05	Sunny 100%, wind light
			August 15, 2008 12:00-12:55	Sunny 90%, wind light to moderate
			August 26, 2008 16:35-17:20	Light overcast variable, wind none to light
Stream from Serpentine Settling Pond	NS1080	15W02 (43e03), 11J04 46°10’ 38.80”, 59°49’ 23.70” [46.1774N, 59.8233W]	July 7, 2008 9:30-10:00	Sunny 80%, wind light
			July 8, 2008 15:50-15:55	Sunny 100%, wind light
			August 15, 2008 12:25-12:40	Sunny 90%, wind light to moderate
			August 26, 2008 17:05-17:15	Light overcast variable, wind none to light
DEVCO Settling Pond	NS1083	15W02 (43e03), 11J04 46°10’ 40.80”, 59°50’ 20.20” [46.178N, 59.8389W]	July 7, 2008 11:45-12:15	Sunny 90%, wind light to moderate
			August 15, 2008 14:25-15:25	Sunny 90%, wind none to light
			August 26, 2008 17:35-18:05	Cloudy 60%, wind none to light
Stream from DEVCO Settling Pond	NS1082	15W02 (43e03), 11J04 46°10’ 40.80”, 59°50’ 23.70” [46.178N, 59.8399W]	July 7, 2008 11:30-11:45	Sunny 80%, wind light
			August 15, 2008 14:02-14:25	Cloudy 90%, wind light
Baileys Wetland	NS1081	15W02 (43e03), 11J04 46°10’ 39.79”, 59°50’ 31.19” [46.1797N, 59.842W]	July 7, 2008 10:15-11:15	Sunny 80%, wind light
			July 8, 2008 15:10-15:35	Sunny 100%, wind light
			August 15, 2008 13:00-14:00	Sunny 80%, wind light to moderate
			August 26, 2008 18:10-18:48	Medium overcast wind none to light
Donkin Mine Access Road	NS1102	15W02 (43e03), 11J04 46°10’ 46.93”, 59°50’ 4.37” [46.1797N, 59.8345W]	August 17, 2008 17:30-17:45	Sunny 50%, wind none to light

Adult specimens were collected by net and retained in field envelopes until preserved. Specimens were taken pro forma in many cases, and in all cases where field determination of particular species required to be verified. The specimens were force-dried in acetone (adults and tenerals) and air dried (exuviae); all are stored in clear Mylar envelopes labeled with all identification and accession information. Each specimen was given a six-digit ADIP accession number and catalogued in the ADIP database. The specimens will be deposited with the Nova Scotia Museum of Natural History.

The results of this field program are presented in Section 4.4.7 and in Appendix G.

3.3.2.6 Freshwater and Marine Ecological Programs

i) Freshwater Program

The initial freshwater field reconnaissance was conducted on July 17 to 18 and August 30 to 31, 2006. The underlying objective was to garner information on fish habitat in the freshwater ponds. It was limited to those water bodies near the Schooner Pond Beach Road; it included Baileys Wetland and its tributaries, and the DEVCO settling pond and its inflows. Two minnow traps were set in each of Baileys wetland and the DEVCO settling pond to provide an initial indication of the species present, in addition to the stocked trout. The minnow traps were placed at depths of 0.3 m and 1.0 m below the water's surface. The results are provided in Section 4.4.8 and the trap locations are illustrated in Figure 3.4.

Further field work was conducted in mid July 2008. The objective of this latter trip was to gather additional data on the habitat characteristics, water quality and benthic assemblages characteristic of Baileys wetland and its outlet and inlets. At this time, the following freshwater benthic samples were taken:

- One sample near the outlet of Baileys wetland (FW-1);
- One in the headwater stream of Baileys wetland (FW-2); and
- One sample from the north eastern channel of Baileys wetland (FW-3).

These sample site locations are illustrated in Figure 3.4. The benthic samples were taken using a Surber sampler. Three 500 ml sample bottles were collected per site, preserved in 70% Isopropyl alcohol and shipped to Envirosphere Consultants Limited in Windsor, Nova Scotia, for analysis. The samples were sieved on a 0.5 mm sieve and organisms were removed by sorting at 6.4x magnification on a stereomicroscope. The sorting efficiency for laboratory personnel was checked periodically by resorting samples to ensure levels of 85% or better. Wet weight biomass (g/sample) was estimated by weighing animals to the nearest milligram after blotting to remove surface water. Organisms were identified to the appropriate taxonomic level, using conventional literature for the groups involved. Species abundance, number of species, % Ephemeroptera + Plecoptera + Trichoptera ("EPT") taxa richness and wet weight biomass were estimated.

Fish habitat assessments were also conducted at each of the identified sites, i.e., sites FW-1, FW-2, and FW-3, in July 2008. The site characteristics assessed included:

- physical water quality
  - pH;
  - dissolved oxygen (DO);
  - electrical conductivity; and
  - water temperature (°C);
- stream velocity;
- bank vegetation;
- substrate composition;
- embeddedness;

- percentage of instream vegetation, woody debris and overhanging vegetation; and
- the depth and width of the stream.

Water samples were taken at each site for total nitrogen, total phosphorus and total suspended solids ("TSS"); the samples were sent to MAXXAM Analytics in Sydney, Nova Scotia, for analysis. The headwater stream of Baileys wetland (FW-2) was electrofished to determine the presence or absence of fish.

The results of the freshwater ecological program are presented in Section 4.4.8.2.

ii) Marine Program

The marine waters around the Donkin peninsula provide valued lobster habitat. On October 16 and 17, 2006, a team of three divers completed the shallow portions of a marine survey within Schooner Pond Cove. Accessing the inner area of the cove, however, proved difficult because of what fishermen refer to as a mussel shoal on the eastern side of the cove; the shoal is also shallow (approximately 0.5 m). As a result, the surf prevented the divers from taking adequate video footage. The sediment was generally too rocky to sample with a grab sampler.

3.3.3 Socio-Economic Programs

The following programs are detailed in the sections below: the archaeological investigations, the Mi'Kmaq ecological knowledge study and the traffic impact study.

3.3.3.1 ARCHAEOLOGICAL INVESTIGATION(S)

Davis Archaeological Consultants Limited was contracted to conduct an archaeological resource impact assessment on the Donkin peninsula. The work was conducted by two qualified archaeologists and included both a historical background study and a field study.

The historical research was conducted in June, 2006 at the Nova Scotia Archives and Records Management in Halifax. The purpose was to assess the level of archaeological potential within the area, to determine past land use and to relate any archaeological resources encountered to their historic and pre-contact context. Historical maps, texts, land grants and deeds, and newspapers were consulted. A local citizen and the last resident to live on the peninsula, Ms. Martha Bailey, was also interviewed regarding her knowledge of the history of the area.

A subsequent field survey was conducted between the July 17 and 19, 2006, by Dr. Stephen Davis and April MacIntyre under a Category C Heritage Research Permit (A2006NS57). The results of this work are further detailed in Sections 4.5.6; the permits are provided in Appendix H.

3.3.3.2 MI'KMAQ ECOLOGICAL KNOWLEDGE STUDY

To identify Mi'Kmaq traditional land use activity, the Proponent contracted Membertou Geomatics Consultants (MGC) to undertake a MEK Study. The study area for the purposes of this work included the lands and waters within a 10 km radius around the Project site, i.e., the proposed location of the surface mine facilities on the Donkin peninsula. The methodologies deployed in the execution of this work included an archival and literature search, interviews and field sampling. Each is described briefly below.

i) Literature and Archival Research
The study team accessed pertinent documents including census records, colonial government records and various texts to attain reference to past or present Mi'Kmaq occupation of the study area. A complete listing of the documents referenced is provided in the section entitled "Sources Cited" in the final report (see Appendix I).

ii) Interviews
The study team developed a list of Mi'Kmaq individuals deemed to be holders of Mi'Kmaq Ecological Knowledge. Although many interviews were undertaken with residents of Eskasoni, most were conducted at Membertou, the Mi'Kmaq community closest to the study area. All interviews were conducted following interview protocol established by the MGC. Respondents were shown maps of the study area and asked questions pertaining to Mi'Kmaq use of the area including questions pertaining to where activities occurred, where such activities occurred and what type of resource was sought, when permission was granted, the interviews were recorded. This enabled a certain level of cross checking of the accuracy of the data compiled.

iii) Field Sampling
Three separate site visits were made to the Project area by the study coordinator and a Mi'Kmaq Ecological Knowledge holder from Membertou. This facilitated both an appreciation of where development would possibly occur and provided the opportunity to identify specific plant species of particular value to the Mi'Kmaq that might be located within the study area.

The findings of this work are discussed in Sections 4.5.5 and the entire Mi'Kmaq Ecological Knowledge Study is provided in Appendix I.

3.3.3.3 Traffic Impact Study
Atlantic Road and Traffic Management were engaged to conduct a TIS to examine possible haul routes for the trucks that will be used to transport up to 2,000 tonnes of coal per day five days a week for a period not exceeding 24 months as part of the Project. The haul/access route under consideration is depicted in Figure 2.5. The methodology deployed can be summarized as follows:

- Project initiation included:
  - Meeting with Xstrata Coal, NSTIR and CBRM officials to discuss the Scope for TIS (Wednesday, August 6, 2008).
  - Historical traffic count data for the proposed route sections, i.e., Average Annual Daily Traffic (AADT) data for the past 30 years, were used to establish the annual volume growth rate for background traffic and the most recent hourly machine count data were used to establish peak hour volumes and to estimate design hourly volumes for the various road sections; and
  - Compilation of available collision data for 2001 to 2006 for appropriate sections of the proposed route from the NSTIR collision database.

- Examination of areas of concern identified by NSTIR included:
  - pavement strength needed for Schedule C all-year maximum weight road
  - bridge load capacity

- road cross-section
- intersection and road geometry
- vertical alignment; check signs.

➢ Examination of areas of concern identified by CBRM officials included:
- residential areas in Donkin
- residential areas on Dominion Street / Wilson Road
- pavement strength on sections of Glace Bay streets
- Reserve Street from Wilson Road westerly to the beginning of the 80 km/ h zone
- cross-walk signing (upgrade to RA-5)

➢ Trip generation estimates for the Project were prepared for weekday daily volumes, as well as for weekday AM and PM peak hourly volumes based on data provided by the Proponent.

➢ Study Area intersections were examined with regards to the following:
- Stopping sight distances were measured for existing intersections
- Need for left turn and right turn lanes were examined
- Geometry of intersections with regards to heavy vehicle turning requirements were examined
- Need for traffic signals was examined
- Level of service analyses was completed for design hour volumes and projected horizon year volumes using Synchro 6.0

The results of this study are summarized in Section 4.5.6; the TIS Scoping Document, approved by NSTIR on September 9, 2008, is provided in Appendix B.

Chapter 4 Environmental Baseline

4.1 Context

This section describes the environmental characteristics of the study area through the findings of the various field programs and other background research and consultation; information is provided on the physical, ecological and socio-economic environments.

4.2 Regional and Local Setting

The location of the Project site on the Donkin peninsula, as depicted on Figure 1.2, could be considered remote, yet it is within an hour's travelling time of Sydney. The peninsula, a rough, exposed headland jutting into the Atlantic Ocean, is approximately 9 km^2 in area. Davis and Browne (1996) describe the headland at Donkin as being part of the Sydney Coalfield (Unit 531), one of two units under the Stony and Wet Plain District (530) of the Carboniferous Lowlands Theme Region of Nova Scotia (500). The Sydney Coalfield Unit lies within an area of Pictou-Morien Group sandstones and siltstones rich in coal seams. The area is covered with sandy to stony till. Along the coast, coal seams are exposed by the eroding effect of the tides, and beaches in the area, including those at Donkin, are often strewn with plant fossils that are embedded in the eroding shales (Davis and Browne, 1996).

Although the peninsula has many natural attributes and the headland is valued as a local recreational destination and draws the interest of birders, it is not a tourist destination as are the Cape Breton Highlands. It is an attractive peninsula characterized by coniferous forest and wetlands surrounded by wind blown steep sea cliffs; it is also the past site of the preparatory works for a subsea coal mine. The Project is located within CBRM, a municipality that has experienced the closure of both the coal mines and the steel mill, but has demonstrated a resiliency and the ability to adjust and adapt to the resultant changing economic conditions. New investment is occurring in a number of industrial sectors, and there is cause for some optimism for the regional economy. The potential development of the Donkin Resource Block from the peninsula is one of the opportunities that is underpinning the region's aspirations for the future.

The landscape around the mine has been and is influenced by human activity. In the early 1980s, for example, a large settling pond was created to the south of the mine portals by damming a small stream; this changed the hydrology of the area. The work yard around the mine portals, and related areas adjacent the site, was subsequently regraded and partially revegetated by DEVCO. There is also evidence of several homesteads of the headland that predate DEVCO's activity, the last apparently removed about the time that the tunnels were being developed. The land beyond the old mine workings is largely undisturbed, but criss-crossed by old logging roads and ATV trails which provide access to the greater part of the peninsula.

4.3 Physical Environment

4.3.1 Climatology and Meteorology

This section provides a general description of the region's climate over a 30-year period (climate norms) and the meteorological conditions at the Donkin site, which is located approximately 12 km ENE of the Sydney Airport. The site is situated on the eastern coastline of Cape Breton within a cool, temperate climatic zone.

4.3.1.1 General Climatology

On a regional scale, Atlantic Canada lies within a zone of prevailing westerly winds that carry air from the interior of the North American continent. This zone experiences the passage of high and low pressure systems which are in turn influenced by ocean currents and continental topography. The low pressure systems moving through this area typically track across the continent, or up the seaboard, resulting in the onset of wind from an easterly direction, thickening cloud and a gradual drop in pressure. The frequent movement of such systems through Atlantic Canada brings significant precipitation, resulting in the Sydney area having one of the highest annual precipitation levels in the region. Along the coastline, cold north-easterly winds can be accompanied by fog in late spring and summer. During periods of low wind speed, sea and land-breezes occur along the coastline and up to several kilometres inland. Winters are usually cold with frequent snowfall and freezing precipitation. Spring is typically late (some time in May), cool and cloudy. Summers are short in duration, warm and are characterized by less precipitation than other seasons.

In recent years, extreme weather events have been occurring more frequently. The Province has been subjected to both drought and intense storms, including the landfall of Hurricane Juan in September 2003. Tropic weather events are expected to be both more intense and frequent as the effects of climate change influence ocean warming and coastal currents. Climate models predict an increase in extreme local events throughout this century.

Climate normals (30-year averages) for the 1971 to 2000 period from the principle weather station located at the Sydney Airport are tabulated in the sections that follow. Extreme weather data are also provided for the period of record.

4.3.1.2 Precipitation

Precipitation data recorded at the Sydney Airport is summarized in Table 4.1. The total annual precipitation (1,504.9 mm) is defined as the total rainfall plus water equivalent of snowfall and other forms of frozen precipitation. Rainfall is generally higher in the fall with snow and freezing precipitation frequent between November and April. Monthly precipitation ranges from 66.7 mm (February) to 143.8 mm (October).

Table 4-1: Precipitation Normals and Extremes: Sydney Airport

Month	*Mean Rainfall (mm)*	*Mean Snowfall (cm)*	*Total Precipitation (mm)*	*Extreme Daily Rainfall (mm)*	*Extreme Daily Snowfall (cm)*	*Extreme Daily Precipitation (mm)*
JAN	82.4	70.8	151.5	57.2	44.5	57.2
FEB	66.7	66.8	132.1	62.2	45.2	62.2
MAR	88.4	51.4	138.9	73.0	43.2	73.0
APR	103.7	26.1	130.4	73.4	29.2	73.4
MAY	100.1	2.7	102.9	93.5	24.9	93.5
JUN	92.6	0.0	92.6	84.0	1.0	84.0
JUL	86.8	0.0	86.8	68.2	0.0	68.2
AUG	93.1	0.0	93.1	128.8	0.0	128.8
SEP	113.4	0.0	113.4	90.9	0.0	90.9
OCT	143.8	2.0	146.0	96.2	15.7	96.4
NOV	134.4	15.7	149.7	97.3	27.4	97.3
DEC	107.6	62.8	167.5	94.0	58.7	95.0
YEAR	1212.9	298.3	1504.9	128.8	58.7	128.8

Source: Environnent Canada Climate Normals: 1971-2000.

4.3.1.3 Temperature

The Atlantic Provinces tend to experience a large annual temperature variation, but coastal areas have a reduced temperature range as a result of the ocean supplying heat in the winter and cooling in the summer. Daily mean temperatures range from -6.5°C in February to 17.7°C in summer. The annual daily mean is 5.5°C. Daily maximums, minimums and extreme temperatures at Sydney Airport are reported in Table 4.2.

Table 4-2: Temperature Normals and Extremes: Sydney Airport

Month	*Daily Maximum (°C)*	*Daily Minimum (°C)*	*Daily Mean (°C)*	*Extreme Maximum (°C)*	*Extreme Minimum (°C)*
JAN	-1.3	-10	-5.7	16.9	-26.2
FEB	-1.9	-11.1	-6.5	18.0	-27.3
MAR	1.5	-6.9	-2.7	17.8	-25.6
APR	6.1	-1.9	2.1	27.2	-14.6
MAY	12.9	2.6	7.8	31.1	-7.8
JUN	18.9	7.6	13.3	34.4	-3.9
JUL	23.0	12.3	17.7	33.9	2.2
AUG	22.7	12.6	17.7	35.9	2.8
SEP	18.3	8.5	13.4	32.3	-1.7
OCT	12.2	3.8	8.0	25.0	-5.6
NOV	6.8	-0.2	3.3	22.2	-12.0
DEC	1.6	-5.8	-2.1	16.7	-22.2
YEAR	10.1	1.0	5.5	35.9	-27.3

Source: Environment Canada Climate Normals: 1971-2000.

4.3.1.4 WIND

Table 4.3 provides a summary of wind data at Sydney Airport, and Figure 4.1 depicts the direction of the prevailing winds. The average annual wind speed is 18.6 km/hr for all directions. Maximum hourly speeds of 97 km/hr were measured in the months of March, October and December. Extreme gusts of 161 km/hr were recorded in December. Table 4.4 presents a frequency distribution of wind directions for the 1971 to 2000 period of record.

Table 4-3: 30-Year Normals Wind Data: Sydney Airport

Wind	*Average Per Month*												
	J	*F*	*M*	*A*	*M*	*J*	*J*	*A*	*S*	*O*	*N*	*D*	*Year*
Speed (km/h)	21.3	20.6	20.8	19.5	17.9	16.9	15.8	15.1	16.2	18.2	19.8	21.0	18.6
Prevailing Direction	W	W	SW	N	S	S	S	S	SW	SW	W	W	S
Extreme hourly Speed (km/h)	89	89	97	80	80	76	72	61	89	97	85	97	--
Direction	E	SE	E	SW	SE	NE	S	W	NW	SE	S	S	--
Extreme Gust Speed (km/h)	121	124	129	115	109	114	87	89	129	138	129	161	161
Direction	S	SW	SE	SE	E	N	S	S	NW	S	S	S	S

Source: Environnent Canada Climate Normals: 1971-2000.

Table 4-4: Summary of Wind Direction Frequency: Sydney Airport

Wind Direction	*Percent Frequency*
N	7.8
NNE	3.8
NE	2.9
ENE	2.5
E	3.5
ESE	2.4
SE	2.7
SSE	3.6
S	9.0
SSW	10.3
SW	11.2
WSW	9.4
W	12.4
WNW	6.1
NW	4.5
NNW	4.5
CALM	3.3

Source: Environment Canada Climate Normals: 1971-2000.

4.3.2 Topography and Physical Characteristics

The proposed surface infrastructure, i.e., roads and offices associated with the Project, are located on a low lying divide between lands that rise to the north to 20+ m before falling to the sea and land to the south that rises to over 40 m. To the west, the area drains naturally to the DEVCO settling pond and to Baileys wetland and to the east to an unnamed wetland behind Wreck Point (See Figure 3.2). Despite the land that has been cleared to accommodate earlier industrial activity and the relatively clear terrain around the cliffs, access through many parts of the peninsula is inhibited by dense vegetation and underlying, poorly drained surface conditions.

The Donkin Peninsula is defined by its landscape and ocean influences

Much of the present landscape is a result of past human activity. It includes: forested lands; areas of regrowth, i.e., formerly cleared lands; disturbed lands, such as the mine and the existing access road, the two waste rock disposal piles and a central drainage channel between the disposal piles; a wetland complex comprising the DEVCO settling pond and the adjacent Baileys wetland; the provincially designated Schooner Pond Beach; and the bluff headland around the perimeter of the peninsula, including the footpath.

4.3.3 Surface and Subsurface Geology

4.3.3.1 Regional Geology

The Sydney Coal Field has been described as a relatively simple basin, with the beds dipping towards the deeper and central parts of that basin some 20km north of the Donkin Resource Block. The gradients are greater at the coast, becoming flatter offshore.

The Morien bedrock that underlies the peninsula consists of alternating beds of sandstone, siltstone, mudstone and coal seams. As depicted on Figure 4.2, the primary geological formations influencing the area are the Sydney Mines Formation, the Waddens Cove Formation and the South Bar Formation. The geologic sequence on the Donkin peninsula was described conceptually by Forrester and Baechler (2007); it is, with increasing depth:

- Undifferentiated Complex (“UC”), i.e., mixed mudstone, siltstone, sandstone, limestone, and coal;
- Emery Coal Seam;
- UC;
- Portal Sandstone;
- UC;
- Gardiner Coal Seam; and
- UC.

4.3.3.2 Soils and Surficial Geology

In coastal areas throughout the coalfield, the soils are poorly drained; the sandstone bedrock is shallow if not protruding at the surface. The overlying glacial till is typically stony, sandy loam. Wetland soils observed during the installation of stand-pipes in 2006 generally consisted of an upper root mat and a thin horizon of poorly decomposed peat, or muck. Sandy, gravely silt, till or clay was encountered approximately 0.30 m below the surface. A summary of the subsurface conditions encountered at the identified monitoring locations is provided in Table 4.5.

The fragile and eroding coastline of Donkin

Table 4-5: Well Details and Subsurface Conditions

	DSP-1	***DSP-2***	***DSP-3***	***BW-1***	***BW-2***	***BW-3***
Date Completed	July 17, 2006	July 17, 2006	July 17, 2006	July 17, 2006	July 17, 2006	July 18, 2006
Internal Diameter (mm)	25	25	25	25	25	25
Depth (mbgs)	1.11	0.69	0.67	0.65	0.84	0.91
Static Water Level (mbgs)	0.27 (July 18, 2006)	-0.12 (July 18, 2006)	0.02 (July 19, 2006)	0.03 (July 19, 2006)	0.04 (July 18, 2006)	0.07 (July 18, 2006)
Subsurface Conditions	Peat depth > 1 m, moderately decomposed, hummocky, sphagnum mat	Peat depth < 0.3 m, moderately decomposed, underlain by grey clay and silt till	Peat depth < 0.3 m, poorly decomposed underlain by grey clay and silt till	Peat depth < 0.3 m, poorly decomposed, underlain by grey clay and silt till	Peat depth < 0.3 m, poorly decomposed, underlain by sand and silt till	Peat depth < 0.3 m, poorly decomposed, underlain by clay and silt till

Borehole logs for groundwater monitoring wells drilled at the site are provided in Appendix E. The monitoring wells were installed between the DEVCO Settling Pond and Bailey's Wetland, as shown on Figure 3.3. The surficial material consisted of compact sandy silt till, with a thickness of 4.5 to 6.3 m.

4.3.4 Site Hydrogeology

4.3.4.1 Regional Setting

Groundwater flow on the Donkin Peninsula is dominated by three primary hydrostratigraphic units ("HU") (Forrester and Baechler, 2007); these units are (with increasing depth):

- the surface soil HU / organic soil HU;
- the till HU; and
- the Morien bedrock HU, which drifts seaward at an angle of 5 to 10 degrees.

The coal seams are assumed to act as aquitards within the bedrock complex, restricting flow between other units and influencing regional groundwater flow patterns. The mine tunnels were excavated through the Portal Sandstone. Flow in this unit is assumed to be generally horizontal and seaward, with components of recharge in the on-shore zone and discharge in the off-shore reaches. Flow is dominated by major fracture sets, which have a strong influence on flow into the mine tunnels. Primary inflows are observed wherever major fracture sets and bedding planes intersect the tunnels. Flow into the tunnels is also facilitated by a blast-induced fracture zone around the tunnels, tunnel induced stress redistribution and drill-holes (Forrester and Baechler, 2007).

Flow within the bedrock in the coastal flow system can be further subdivided into three predominant zones (Forrester and Baechler, 2007):

- on-land/fresh water zone: the upper groundwater flow field which is recharged annually by precipitation;
- exposed sea bed zone: the sequence of weathered bedrock 2 to 4 km off shore, where dense sea water infiltrates into the bedrock aquifer complex; and
- covered sea bed zone: the deeper, off-shore zone where fine grained sediments form a confining layer over the bedrock aquifer complex. Density driven flow can cause mixing of seawater with recent, fresh recharge and/or fossil groundwater.

Figure 3.2 shows surface water flow divides in the study area. Shallow groundwater flow on the peninsula is dominated by two wetlands in the interior portion of the Donkin mine site and by discharge to the coastal zone on the periphery of the peninsula. Local flow paths through the existing waste rock piles comprise an additional component of shallow groundwater flow on the mine site. As part of the geotechnical investigation currently being undertaken with respect to the waste rock piles additional chemical data is being attained which will determine the potential, if any, for acid mine drainage when work is instigated on these piles.

A Phase II investigation focused on the active mine area, above the receiving wetland area (Dillon, 2005). Eight boreholes were drilled and completed with monitoring wells. Three additional boreholes and thirty-seven test pits were drilled as part of this investigation. Soil, groundwater, sediment, and surface water were sampled for general chemistry, metals, petroleum hydrocarbons, PAHs, PCBs, glycol, ARD, and explosive residue. The site was assigned an National Contaminated Site ("NCS") classification score of 58, indicating a moderate risk and a likely requirement for further action. Metals (including arsenic), BTEX compounds, low pH and sulfide sulfur were among the contaminants identified, with a recommendation for further delineation. Groundwater flow at the bedrock interface was determined to be to the west toward the DEVCO settling pond. The results of the study provided evidence of residual contamination of soil, groundwater, sediment and surface water stemming from the previous mine operation.

Gradients in the surface soil HU are generally downward, i.e., infiltrating rainwater passes through the shallow soil HU into the underlying till HU, or discharges to local surface water bodies. Flow in the till HU is also downward, recharging the underlying Morien bedrock HU. The DEVCO settling pond and Baileys wetland receive much of the shallow groundwater flow from the area of the mine yard. Local topographic and drainage conditions indicate that shallow groundwater flow systems to the north, east, and south of the active mine yard are isolated.

Baseline monitoring data were collected within the wetland flow system. Data were collected to establish baseline chemistry, existing contaminant levels and to assess the potential interaction of groundwater in the shallow bedrock associated with both the DEVCO settling pond and Baileys wetland. This program is on-going; preliminary data is presented below.

4.3.4.2 Groundwater Flow In Wetland Areas

There is a berm and control structure located at the western end of the DEVCO settling pond. This structure impedes the flow of water into the Baileys wetland and maintains the DEVCO settling pond at a higher elevation than Baileys wetland. The resulting difference in hydraulic head between two was expected to induce flow from the former to the latter via shallow groundwater flow. Leaks through the berm control structure were observed during the field visit in September 2008. Channels leading from the berm are observed directly below the control structure and from a spring 5 to 10 m south of the control structure. This second spring does not appear to receive flow from the control structure, but is probably maintained by leakage through the berm.

Area between the DEVCO settling pond and Baileys wetland

The DEVCO settling pond is connected to a fen at its eastern extent, adjacent to the mine site and waste rock piles. Previous alterations to surface drainage patterns in the area, including road construction, the installation of drainage ditches and the construction of the control structure between the DEVCO settling pond and Baileys wetland have impacted the original area of the fen, causing more channelized flow from the upland areas to the DEVCO settling pond, thereby hydrologically isolating the fen.

As indicated in Section 3.3.1.1, six wetland stand-pipes were installed in July 2006 in the vicinity of the DEVCO settling pond and Baileys wetland (see Figure 3.3). These installations were fully slotted to provide measurements of the water table as it fluctuates seasonally above and below the ground surface on the margin of each pond. As detailed on Table 4.5, the wells ranged from 0.65 to 1.11 m in depth, and, with the exception of that found at DSP-1, the peat thickness was less than 0.30 m. The screened intervals of the wells therefore spanned the peat and silt layer in roughly equal proportions. Groundwater elevation data are presented in Table 4.6.

Table 4-6: Groundwater Elevation Data

Location	Groundwater Elevation (m AMSL)			
	17-Jul-06	23-Aug-06	31-Aug-07	3-Sep-08
DSP - Water Table				
DSP-1	4.61	4.61	4.76	4.93
DSP-2	4.66	4.65	4.82	4.96
DSP-3	4.63	4.60	4.77	4.93
SW-DSP	n/m	n/m	n/m	4.96
BERM1	n/m	n/m	n/m	4.45
BERM2	n/m	n/m	n/m	4.20
BERM3	n/m	n/m	n/m	4.05
BERM5	n/m	n/m	n/m	3.39
BW - Water Table				
BW-1	2.17	2.15	2.28	2.32
BW-2	2.27	2.26	2.38	2.42
BW-3	2.30	2.30	2.41	2.43
SW-BW	n/m	n/m	n/m	2.49
Bedrock				
D1-S	n/m	n/m	4.00	4.13
D1-D	n/m	n/m	3.37	3.47
D2-S	n/m	n/m	6.02	6.42
D2-D	n/m	n/m	5.25	5.33

Note: n/m not measured

The water table elevation was between 4.6 and 4.9 m above mean sea level (“AMSL”) during each of the sampling intervals. In July and August 2006, the water table was close to the ground surface, whereas in 2007 and 2008, the ground surface was under water at the point of measurement. The water table elevation in Baileys wetland was between 2.2 and 2.5 m AMSL during each of the sampling intervals.

The difference in elevation between the two ponds suggests that there is groundwater flow across the berm. Stream bed minipiezometers installed below the berm in August 2006 showed the vertical gradient at two locations. Location DSP-4 was closer to the berm, and DSP-5 was closer to the open water of Baileys wetland. The vertical gradient at DSP-4 was -0.011 m/m in August 2008, indicating a component of downward flow between the wetland sediments and underlying till. The vertical gradient at DSP-5 was -0.017 m/m, also indicating downward flow. Downward gradients in the shallow wetland sediments below the berm imply that any upward gradients induced by the berm are either:

- Observed only at the immediate base of the berm (a very localized discharge zone); or
- Groundwater flow from the DEVCO settling pond to Baileys wetland occurs through the till unit and/or shallow bedrock.

Groundwater elevations in the berm were measured at four pneumatic piezometers (Berm-1, Berm-2, Berm-3, and Berm-5, Table 4-6) in September 2008. Elevations in the berm were below the pond level, attributed to the slope of the water table between the DEVCO settling pond and Baileys wetland. Water elevations in the berm decreased from north to south, reflecting increasing distance from the DEVCO settling pond and the resulting decrease in hydraulic influence by the DEVCO settling pond.

Bedrock monitoring well nests were installed at locations D1 and D2 in October 2006. These nests are located between the DEVCO settling pond and Baileys wetland. The topography of the land separating the two wetlands suggests that there is a shallow groundwater divide in this area, but flow in the bedrock may be influenced by more regional gradients across the peninsula, with the potential to connect the DEVCO settling pond and Baileys wetland. Groundwater elevations in the bedrock are shown in Table 4.6. The groundwater elevation in shallow bedrock well D1-S was 4.1 m AMSL in September 2008, which was below the water table elevation of the DEVCO settling pond, implying a downward gradient between the DEVCO settling pond and shallow bedrock unit. Elevation data from the till unit would be required to confirm a component of downward flow from the DEVCO settling pond to the shallow bedrock system. Flow passing through location D1 would result in discharge to Schooner Cove, or to Baileys wetland.

There was a downward gradient between the shallow and deep bedrock at locations D1 (0.023 m/m) and D2 (0.037 m/m) in August 2008. Downward flow at these locations is consistent with recharge to the bedrock over the central part of the peninsula, with deeper flow lines discharging to Schooner Cove.

Hourly water level data were collected over a two week period in September 2008, at locations D1-S, D1-D, SW-DSP, and SW-BW. The data are presented in Appendix E. Water level changes in the DEVCO settling pond corresponded directly to changes in the Baileys wetland, reflecting the direct hydraulic connection of the two systems (Figure E-1). Water level fluctuations in the shallow bedrock also corresponded directly to changes in Baileys wetland and the DEVCO settling pond (Figures E-2 and E-3). Water levels in the deeper bedrock were independent of fluctuations in the shallow flow system (Figure E-4). The hydraulic connection between the DEVCO settling pond, Baileys wetland, and shallow bedrock supports the possibility of a flow between the DEVCO settling pond and Baileys wetland via the shallow bedrock aquifer.

Slug testing provided a geometric mean hydraulic conductivity of 3.5×10^{-3} m/s for the shallow bedrock and 3.4×10^{-4} m/s for the deeper bedrock. The relatively high hydraulic conductivity of the shallow bedrock is consistent with the observed hydraulic connection to influences at the ground surface. The hydraulic conductivity of the deeper bedrock is also relatively high and could result in transport velocities in the order of several hundred metres per year.

4.3.4.3 Groundwater Chemistry in Wetland Areas

Samples were collected from wetland stand-pipes in July and August, 2006, from streambed minipiezometers in August 2006, and from streambed minipiezometers and bedrock monitoring wells in September 2008. The wetland standpipes could not be sampled for groundwater in September 2008 because the water table was above the ground surface. The bedrock monitoring wells were installed after the July and August 2006 sampling events, and the minipiezometers were installed after the July 2006 sampling event. Minipiezometer DSP-4 was not sampled in September 2008 because the well did not recover after purging (the screen of this installation is assumed to be clogged or damaged). Samples were analyzed for general chemistry, metals, BTEX-TPH and PAHs. Groundwater sampling data are presented in Tables E-2 through E-5, in Appendix E.

Measurements of water temperature ranged from 20.5 to 24.4°C during the July 2006 field visit and from 14.5 to 23.0°C during the August 2006 field visit; these results suggest that the surface water has a direct influence on the shallow groundwater regime on the perimeter of the wetlands. The groundwater pH was in the range 5.0 to 7.6 in the stand-pipes reflecting surface water inputs and influence by humic and fulvic acids. The mean pH was 4.6 at DSP-1 which is consistent with peatland environments. The groundwater pH at location DSP-5 was 6.9 in September 2008, which is consistent with the earlier sampling data.

The concentrations of aluminium, arsenic, cadmium, copper, iron, lead, selenium, and zinc were elevated in the wetland standpipes in July and August, 2006 (Table E-2). In some cases these concentrations exceeded the CCME guidelines for the protection of Freshwater Aquatic Life (CCME FWAL). The toluene concentration was also elevated in the stand-pipe samples from DSP-2, DSP-3, BW-1, and BW-3 in July and August, 2006. Elevated concentrations of toluene and metals in the shallow groundwater likely reflect infiltration of surface water laden with these contaminants. Current (baseline) surface water contaminant concentrations are elevated, as discussed in Section 4.3.5.

Lower concentrations of metals were observed in the fen (DSP-1) as compared to the marsh areas of the site (Table E-2 in Appendix E). The data suggest that most of the surface and shallow subsurface flows originating east of the wetland near the waste rock piles are directed to the north, south, or under the fen, or that geochemical controls induced by the peat sequester metals in this area. Water chemistry results obtained from locations DSP-2 and DSP-3 installed in the littoral marsh are comparable, both showing lower levels of pH and alkalinity and elevated concentrations of dissolved metals. Lower pH in these areas may promote the mobility of metals.

The channel that drains away from the DEVCO settling pond control structure (DSP Outlet B on Figure 3.3) into Baileys wetland is the most direct and likely pathway of contaminant transport between the two areas. Stand-pipe BW-1 is located in a part of Baileys wetland that is up-stream of the channel. Results from BW-1 exhibit lower pH, TDS and hardness (Table E-2) as compared to the results from BW-2 and BW-3, which is consistent with lesser (or no) influences by contaminants at this location. Elevated TDS, chloride and sodium concentrations also suggest sea water influence at stand-pipes BW-2 and BW-3.

Bedrock groundwater chemistry samples showed selected elevated metals concentrations (Table E-4) in September 2008, but petroleum hydrocarbon and PAH compounds were not detected (Table E-5). The groundwater pH was below the acceptable range at both shallow installations, which may indicate inputs by low pH waters from the overlying formation, which is connected directly to surface water. Cadmium concentrations were elevated at location D1-D and D2-S (Table E-4). Releases from the waste rock piles and geochemical controls could also play a role in the groundwater metal concentrations.

The iron concentration was 19 000 μg/L at monitoring well D1-S which exceeds expected background concentrations by several orders of magnitude. Iron concentrations in the wetland stand-pipes were in this range. The iron concentration in the deeper well was 4800 μg/L, which is also higher than expected. Further analysis is required to show if the source of iron in these wells is the local formation, the waste rock piles, or a connection to the DEVCO settling pond. The iron concentration was 910 µg/L at D2-S, at <100 µg/L at D2-D. The screen at D2-D may intersect a flow system originating from the east, thus representing conditions unrelated to mine activity.

4.3.4.4 Summary of Groundwater Investigation

The following can be concluded from the groundwater data currently compiled:

- The natural function of the fen has been affected by engineered structures – effects include increased channelization;
- The water table elevation was relatively consistent between sampling years, i.e., changing by up to 0.3 m between 2006, 2007 and 2008;
- The elevation of the DEVCO settling pond is 2.5 m higher than the elevation of Baileys wetland;
- This condition induces a hydraulic gradient across the berm;
- Springs at the base of the berm suggest that this gradient causes leakage through the berm;
- Upward gradients are limited to the area immediately below the dam, or to flow paths through the till unit;
- The groundwater elevation in the berm was lower than the elevation of the DEVCO settling pond, reflecting a sloped water table through the dam, between the DEVCO settling pond and the Baileys wetland;
- The groundwater potential of the shallow bedrock was below the water table, suggesting the possibility for downward flow from the DEVCO settling pond into the shallow bedrock;
- The vertical gradient in the shallow bedrock was downward;
- Hourly water level monitoring showed a direct hydraulic connection between the DEVCO settling pond, Baileys wetland and the shallow bedrock regime;
- The hydraulic conductivity of the bedrock was relatively high, consistent with a connection to overlying formations/features;
- Temperatures in the wetland stand-pipes were elevated, reflecting a direct connection to the surface water regime;
- The pH was relatively low in the wetland stand-pipes, reflecting influences by humic and fulvic acids in the wetland;
- Metals concentrations were elevated in the wetland stand-pipes;
- Metals concentrations in the fen (DSP-1) were lower than at other locations;
- The toluene concentration was elevated in the wetland stand-pipes;
- The water table was too high to allow sampling of the wetland stand-pipes in September 2008;
- Stand-pipe BW-1 does not share a direct surface water connection to the DEVCO settling pond, and the resulting water chemistry is more consistent with background conditions;
- Stand-pipes BW-2 and BW-3 are influenced by sea water; and
- The bedrock groundwater pH, iron, and cadmium concentrations suggest an influence by surface features.

4.3.5 Hydrology

The surface waters, including the wetlands on the Donkin peninsula, are depicted on Figure 3.2 and are described in detail in Section 4.4.1.2. The active site watershed is approximately 116 ha in size and drains to the DEVCO settling pond. The eastern portion consists of surface flow from east of the current mine yard, including the existing drainage channel, and drains to an existing culvert located between the two waste rock piles along the eastern edge. This water then drains into the western drainage portion and collects all surface water to the west of the active site including surface flows from the waste rock pile. This area drains into the DEVCO settling pond and discharges to Schooner Pond Cove through an overflow channel located on the northern edge of the DEVCO settling pond. This drainage system was constructed as part of the original site development.

The central drainage channel passing between the two waste rock piles is a perfect water filtration system for surface runoff

The entire mine yard drains towards the drainage ditch and an associated drainage channel that extends south from the middle of the active yard to the drainage ditch. Ditches are also located on either side of the site access road and travel to the west towards the overflow channel that discharges into Schooner Pond Cove.

4.3.5.1 Surface Water Chemistry

Based on the results of the ongoing water monitoring program related to the tunnel dewatering and through visual inspections, no environmental stress has been noted on the vegetation surrounding the waste rock piles. Monitoring will continue throughout the Project to note any acid rock drainage resulting from either the construction or ongoing site operations.

An overflow channel connects the DEVCO settling pond to Schooner Pond Cove

Baseline sample data was collected in the summer of 2006 prior to the start of the tunnel dewatering operations (Appendix F, Tables F-1, F-2 and graphs). Surface water concentrations of iron, manganese, aluminium, barium, cadmium and zinc were elevated in the vicinity of the waste rock pile (SW2 and SW3), but decreased along the flow path through the DEVCO settling pond. For example, in the samples collected on July 18 (2006), the concentration of iron decreased from 230,000 µg/L at location SW1 to 120 µg/L at SW5, i.e., where the water discharges to Schooner Pond Cove. A similar result was observed during the August (2006) field visit, with the concentration of iron decreasing from 13,000 µg/L to <100 µg/L. The decreasing trend in metal concentrations appears to be related to the concentration of TSS and illustrates the importance of the wetland vegetation and the DEVCO settling pond in promoting the removal of sediments prior to discharge to Schooner Pond Cove.

Surface water in the vicinity of the eastern margin of Baileys wetland showed evidence of iron precipitation. A crust of red iron oxide (potentially including other trace metals) was observed at several locations, indicating that there are inputs of iron either associated with the leakage from the DEVCO settling pond, or as a component of the groundwater discharging to the wetland. As indicated in Section 4.3.4.3, mildly reducing conditions may allow the shallow groundwater transport of ferrous iron from the DEVCO settling pond directly to Baileys wetland, or iron rich water from the shallow bedrock may discharge to Baileys wetland. Based on the low iron concentrations within the DEVCO settling pond at SW5 (120 and <100 µg/L), the source of the iron is most likely not directly from the surface water in the DEVCO settling pond. The locations of the iron staining within Baileys wetland will continue to be monitored throughout the execution of the Project.

Surface water samples were collected from the DEVCO Settling Pond and Bailey's wetland, on each side of the control structure. Dissolved metals concentrations for these samples are presented in Table F-1 in Appendix F. Dissolved metal concentrations were very similar, demonstrating the connection between the two wetland bodies. The dissolved metals in the surface water were different from those in the bedrock wells, suggesting that the source of the elevated metals in the bedrock is not directly related to the surface water at the DEVCO Settling Pond outlet. Bedrock metal concentrations measured in September 2008, were closer to the concentrations observed at DSP-3 and BW-1, measured in July and August, 2006. Although these two sampling events are not directly comparable, they provide a further indication of shallow bedrock groundwater flow paths connecting the DEVCO Settling Pond and Baileys Wetland.

Acid generation from the waste rock piles was cited as a concern in a Phase II environmental site assessment (Dillon, 2004); this remains an issue that requires further monitoring during the development of the Project site. Surface water chemistry data from samples taken from the six surface water (SW1 through SW5) locations along the drainage ditch to the DEVCO settling pond and beyond are provided in Tables F-1, F-2 and F-3 in Appendix F. These results suggest that the existing drainage channels between and to the west of the rock piles are able to buffer the effects of the waste rock through natural removal mechanisms, such as plant uptake, sedimentation/ precipitation and adsorption to sediment. Whether this will continue as the site is further developed is not known, but it is a situation that can be monitored and issues addressed as circumstances necessitate.

4.3.5.2 Sediment Chemistry

Baseline sediment samples were collected at the same six sample locations that the surface water samples were collected. Elevated concentrations of metals were detected in the sediment, with exceedances of the CCME Interim Sediment Quality Guidelines (ISQG) reported for arsenic, cadmium, and zinc (Table F-3, Appendix F). There was no apparent decreasing trend in the metal concentration along the discharge channel. The metal concentration would have resulted from the discharge of tunnel water during tunnel development which contained elevated iron and other metals that precipitated and settled out along the drainage ditch. This drainage ditch transferred all tunnel water without treatment to the DEVCO settling pond for the removal of sediment, including iron precipitate, during the original development.
Generally, the detection limits were above CCME criteria for petroleum hydrocarbons and PAHs due to the high moisture content of the sediment samples, i.e., insufficient sample volume. It is therefore not known whether the sediment quality meets CCME ISQG criteria, although exceedances for 2-

Methylnapthalene, Napthalene and Phenanthrene were reported for SW-2 (Table F-4, Appendix F). The sediment PAH results most likely result from past operations on the site such as leaks and spills from equipment operated during the original development of the tunnels.

4.3.5.3 Monitoring of Tunnel Water Quality

Tunnel dewatering operations began in November 2006. At the present time only water infiltrating into the tunnels is pumped into the water treatment system. Table 4.7 summarizes the concentrations of select water quality parameters for MP1, untreated tunnel water, and MP4, treated discharge from the DEVCO settling pond to Schooner Pond Cove during this period. It indicates that the maximum concentrations for each of the parameters, except cadmium, were less than the CCME Freshwater Aquatic Life ("FWAL") Guidelines prior to being discharged to Schooner Pond Cove. Graphs depicting the incidence of pH, iron, zinc and TSS over the monitoring period indicate the effectiveness of the water treatment system as the water travelled from sampling point MP1 through the system to MP4 (see Appendix F).

Table 4-7: Summary of Water Quality of the Donkin Mine Tunnel Dewatering Activities (2006-2008)

Water Quality Parameter	***Statistical Parameter***	***MP1 (ug/L)***	***MP4 (ug/L)***	***CCME Freshwater Aquatic Life***	
				FWAL	***MAL[1]***
pH	Max	8.2	8.0		
	Min	7.3	7.1		
	Average	7.9	7.6	6.5-9.0	7.9-8.7
Total Suspended Solids ("TSS")	Max	320	45	-	
	Min	2	<2		
	Average	40	4.5		
Arsenic	Max	10	1.8		
	Min	0.3	0.3		
	Average	2.4	0.9	5 ug/L	12.5 ug/L
Cadmium	Max	0.76	0.085		
	Min	0.0085	0.0085		
	Average	0.19	0.02	0.017 ug/L	0.12 ug/L
Copper	Max	10	4.8		
	Min	1	1		
	Average	3.9	1.4	2-4 ug/L	-
Iron	Max	9700	550		
	Min	220	50		
	Average	3165	237	300 ug/L	-
Lead	Max	5.4	0.5		
	Min	0.5	0.25		
	Average	1.9	0.5	1-7 ug/L	-
Nickel	Max	15	1.5		
	Min	1.5	1		
	Average	4.6	1.5	25-150 ug/L	-
Zinc	Max	690	93		

Water Quality Parameter	Statistical Parameter	MP1 (ug/L)	MP4 (ug/L)	CCME Freshwater Aquatic Life	
				FWAL	MAL[1]
	Min	45	1		
	Average	232	12	30 ug/L	-

1 Marine Aquatic Life

The data for the ongoing monitoring shows the same drop in metal concentrations through the flow path as the baseline samples, from the inlet to the serpentine pond to the discharge from the DEVCO settling pond. The ongoing monitoring program has shown that the existing wastewater treatment system is very effective in treating the tunnel water and protecting the surrounding water environment. This monitoring program will be kept in place throughout the execution of the Project.

There have been a number of peaks in the MP1 iron concentrations through the monitoring period. These spikes, samples with iron concentration greater than 6,000 µg/L, correspond to operational events within the tunnels, primarily during cleaning activities to remove sediment buildup on the bottom of the tunnels to make a safer environment for the underground miners. The data indicates that the wastewater treatment system was very effective in reducing the iron concentrations following these events.

4.3.5.4 Receiving Water Study

The level of treatment required for the tunnel waters was also determined with reference to attainable marine dilution. In the near-field, i.e., from the outfall to the final height of rise of the plume, effluent dilution depends primarily upon depth, ambient sea water density and currents. If the water column is well-mixed, the plume will reach the surface and dilution will be roughly proportional to outfall depth. In the far field, effluent dispersion depends primarily on ocean currents. As referenced in Section 3.3.1.3, a receiving water study was conducted to assess effluent dispersion patterns. The results, based on the measurements of temperature, salinity and density and the modelling undertaken, demonstrated that any discharge from a point on the shores around the Donkin peninsula in depths of less than 10 m would be completely mixed with the water column.

4.3.5.5 Environmental Effects Monitoring (Toxicity)

The potential effects of the tunnel water discharge on the local fishery was identified as an issue by both the Proponent and the local community. As mandated under the *Fisheries Act*, the Proponent is not permitted to discharge any substance to waters frequented by fish which is deleterious to fish. For this reason, two 96-hr LC_{50} acute toxicity tests were conducted on the Donkin Mine Tunnel Water (MP1) and one 96-hr LC_{50} acute toxicity test conducted on the discharge water (MP4). The bioassay used for all three toxicity tests were Rainbow Trout fingerlings. The results are summarized in Table 4.8.

Aeration in the sedimentation basin through cascading the mine water

Table 4-8: Summary of Toxicological Bioassay Results

Bioassay	*Test Parameter*	*Result*[1]	*Interpretation*
Rainbow trout 96-hr LC_{50} for MP1	% Mortality at 100% sample concentration	July, 2006: 0% Mortality	Not Acutely Lethal
Rainbow trout 96-hr LC_{50} for MP1	% Mortality at 100% sample concentration	February 2006: 0% Mortality	Not Acutely Lethal
Rainbow trout 96-hr LC_{50} for MP4	% Mortality at 100% sample concentration	February 2006: 0% Mortality	Not Acutely Lethal

Note 1: As reported by Harris Industrial Testing Service Limited

Based on the modelling undertaken (see Section 3.3.1.3) and the maximum discharge concentrations of parameters of concern in the tunnel waters, i.e., iron and zinc, concentrations in the marine environment would always be below CCME guidelines in the far field, i.e., 25 m away from the discharge site.

4.3.6 Air Quality

The Nova Scotia Ambient Air Objectives regulate total suspended particulate ("TSP") levels in the province for annual (70 µg/m^3) and 24-hour (120 µg/m^3) averaging periods. In recent years, the focus has shifted to the respirable fractions of particulate matter which pose the greater risk to human health. The NSE has adopted the use of federal guidelines when establishing criteria for particulate matter levels from industrial projects. The CCME provide a 24-hour Canada-Wide Standard ("CWS") of 30 µg/m^3 for $PM_{2.5}$. This standard is based on the evaluation of several years of data with allowance for a number of exceedances. The CCME does not provide a CWS for PM_{10} levels, and, until a federal standard is developed, provincial jurisdictions across the country have been adopting a 24-hour criterion of 50 µg/m^3.

4.3.6.1 Particulate Matter

PM_{10} and $PM_{2.5}$ were recorded at a 30-second sampling interval for two monitoring locations on Donkin peninsula (see Figure 3.4). One-hour average PM_{10} and $PM_{2.5}$ concentration levels are presented in Table 4.9 and Figure 4.3. A few "corrected" data points are provided in brackets (next to the actual reading), adjusted to reflect the level of correction required to re-zero the instrument.

Table 4-9: One-Hour Average Baseline Air Monitoring Results

	Site 2		*Site 1*	
TIME[(1)] *(hour)*	*PM_{10} (µg/m^3)*	*$PM_{2.5}$ (µg/m^3)*	*PM_{10} (µg/m^3)*	*$PM_{2.5}$ (µg/m^3)*
8:45	35.6	32.6		30.1
9:45	40.8	36.0		28.9
10:45	43.8	35.2		20.6
11:45	36.6	30.6		18.1
12:45	31.7	28.0		16.4
1:45	25.2 (26.0)[2]	26.7 (26.0)[5]		15.9
2:45	15.4 (18.4)[2]	20.5 (17.5)[5]		15.0
3:45	8.4	11.3	8.3	
4:45	6.4	9.1	5.8	

	Site 2		Site 1	
TIME[(1)] (hour)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)
5:45	5.0	7.1	3.7	
6:45	7.0	6.5	2.4	
7:45	10.0	8.4	1.4	
8:45	3.3	5.2	3.1	
9:45	3.5 (1.4)[3]	2.5		4.5
10:45	8.9 (2.9)[3]	1.2		4.3
11:45	4.6	2.7		5.9
12:45	3.7	3.8		6.4
1:45	5.3 (6.1)[4]	5.5		8.1 (4.1)[7]
2:45	2.2 (6.7)[4]	5.8		8.7 (4.7)[7]
3:45	5.7 (7.5)[4]	6.4	4.7	
4:45	10.1	8.0	4.9	
5:45	15.8	12.6	8.8	
6:45	23.3	16.7	12.2	
7:45	36.5	30.5	33.9 (29.4)[6]	
MAX	**43.8**	**36.0**	**33.9**	**30.1**
MIN	**2.2**	**1.2**	**1.4**	**4.3**
AVG				

Notes:
1. The time shown represents the end of the sampling period.
2. Instrument reading during zero check was -5 µg/m³.
3. Instrument reading during zero check was +9 µg/m³.
4. Instrument reading during zero check was -7µg/m³.
5. Instrument reading during zero check was +5 µg/m³.
6. Instrument reading during zero check was +6 µg/m³.
7. Instrument reading during zero check was +4 µg/m³.

4.3.6.2 Weather Conditions

Weather parameters including wind speed, direction, temperature and relative humidity were recorded at five-minute intervals at site 2. One-hour average readings are presented in Table 4.10. The weather during the 24-hour sampling period was mainly clear, but with some cloudy periods during the night time hours.

One-hour average temperatures ranged from a low of 13.8°C, recorded during the early morning hours, to a high of 22.9°C. One-hour average wind speeds ranged from 1.7 m/s (6 km/hr) to a high of 4.8 m/s (17 km/hr) Winds were primarily from the south and west directions during monitoring. Average relative humidity levels were generally above 80% during the night with levels dropping to the 60 and 70% range during daylight hours.

Table 4-10: One-Hour Average Weather Readings

Time (Hour)	*Temp (°C)*	*Humidity (%)*	*Wind Speed (M/S)*	*Wind Direction*
845	18.2	88.6	4.5	S
9:45	17.9	89.7	4.3	S
10:45	17.9	89.9	4.8	SSW
11:45	18.4	87.7	4.4	SSW
12:45	18.6	86.4	4.3	SW
1:45	17.9	86.9	3.5	SW
2:45	17.4	82.7	4.1	WSW
3:45	16.5	80.1	3.3	WSW
4:45	15.5	81.0	3.1	SW
5:45	14.7	82.4	3.0	SW
6:45	13.8	85.5	2.6	S
7:45	14.8	82.9	2.5	S
8:45	16.9	76.9	2.7	SW
9:45	18.6	69.5	3.2	WSW
10:45	19.8	63.9	3.4	WSW
11:45	21.2	61.1	2.8	SW
12:45	20.8	66.9	3.2	E
1:45	22.4	60.7	2.6	NW
2:45	22.6	57.8	2.9	NW
3:45	22.7	57.8	2.8	N
4:45	22.9	56.7	1.7	NE
5:45	21.4	66.3	4.2	SSE
6:45	19.0	78.8	4.3	SSE
7:45	17.2	86.1	4.5	S
MAX	**22.9**	**89.9**	**4.8**	
MIN	**13.8**	**56.7**	**1.7**	
AVG				

4.3.6.3 Conclusions

The particulate matter data collected over the 24-hour monitoring period can be summarized as follows:

- the particulate matter levels measured at both Site 1 and 2 are similar in concentration and level of fluctuation over the 24-hour period;
- concentration levels between PM_{10} and $PM_{2.5}$ at both sites do not differ significantly;
- aerosol monitors are sensitive to moisture levels within the ambient air environment with instruments measuring higher readings in the night when relative humidity levels were above 80%;
- the particulate matter levels recorded did not exceed any guidelines or criteria;
- particulate matter readings and fluctuations in data can be attributed primarily to moisture particles in the air and not dust generated from any source on or near the proposed mine site; and
- actual baseline levels of dust particles are likely in the order of the minimum recorded values, i.e., 1 to 3 $\mu g/m^3$).

4.3.7 Noise

The CBRM has a noise bylaw, known as the "Cape Breton Regional Municipality Noise By-Law", which outlines the times of day that noise from construction activity is permitted. Exempted activities outlined in Schedule C of that by-law include "Activities at Pits, Quarries or Mining Operations for which a permit has been issued by the NSDEL, which expressly regulates sound levels". The permissible noise levels for the Project site will most likely form part of the Environmental Approval governing the Project that will be issued by NSE.

The Project site is located in a rural environment, and the nearest occupied dwelling is approximately 1.5 km distant from the hub of the surface activities. In July 2008 ambient noise levels were measured for a 24 hour period at two locations on the peninsula, i.e., near the site of the former Bailey's homestead and at a location to the south of the mine site: these sites are depicted on Figure 3.4. Table 4.11 and Figure 4.4 depict the L_{eq} values measured at each of these sites for comparison with the Nova Scotia Guidelines for Environmental Noise Measurement and Assessment (NSDE, 2005).

Table 4-11: Noise Levels for Locations 1 and 2 on the Donkin Peninsula

Time (Hour)	*NSE Criteria (dBA)*	*Location 1 (Bailey's Homestead)*	*Location 2 (South of Mine Site)*
1:00	55	51	46
2:00	55	51	46
3:00	55	51	45
4:00	55	52	46
5:00	55	49	49
6:00	55	48	51
7:00	65	49	47
8:00	65	47	48
9:00	65	45	46
10:00	65	43	47
11:00	65	44	48
12:00	65	44	50
13:00	65	51	53
14:00	65	58	52
15:00	65	61	55
16:00	65	46	56
17:00	65	45	53
18:00	65	46	53
19:00	60	50	51
20:00	60	56	53
21:00	60	64	56
22:00	60	60	55
23:00	60	56	47
24:00	60	52	45

As the monitoring meters were unmanned, the peak values cannot be totally explained. At Location 1, the NSDE guidelines were exceeded during two periods, i.e., 21:00 and 23:00 hours, but this is the more exposed of the two sites, particularly to the influence and sound of the ocean. Other sources of noise at this location would include wildlife, the operating ventilation fan at the mine site and, at certain times of the day, traffic on the Schooner Pond Beach Road. There were no exceedances recorded at Location 2.

4.4 Ecological Environment

4.4.1 Terrestrial Habitats and Site Vegetation

Six general habitats were identified on the Donkin peninsula as a result of the habitat and vegetation investigations referenced in Section 3.3.2.1. Each habitat is both its own ecosystem as well as part of a greater ecosystem that supports local populations of mammals, avian species and numerous plant species. Each principal habitat is described below; Figure 4.5 depicts the results of the habitat analysis.

4.4.1.1 Coniferous Forest

The largest habitat type by area on the peninsula is dense forest dominated by white and black spruce *(Picea rubens* and *P. mariana)*, with lesser numbers of balsam-fir *(Abies balsamea*), eastern larch *(Larix laricina)*, red maple *(Acer rubrum)* and white birch *(Betula papyrifera).* The understorey vegetation within the forest varies markedly over short distances depending on the topography. The variety of microhabitats generates a diversity of vegetation and habitat for a wide range of bird species. The NSDNR forest inventory is depicted on Figure 4.5.

A dominant colony of *Typha latifolia* colonize the shoreline of the DEVCO settling pond

4.4.1.2 Ponds and Wetlands

This habitat includes:

- the large wetland complex that consists of the former DEVCO settling pond and Baileys wetland;
- a smaller unnamed wetland complex to the east of the mine surface works; and
- a number of other small wet forested areas as a result of poorly-drained soils and/or ATV rutting scattered throughout the peninsula, some of them only a few dozen square metres in area.

Artificial channels that lead into and drain the DEVCO settling pond have become colonized with predominately *Typha* and represent a third aquatic habitat.

The DEVCO settling pond

The distribution of these wet habitats, as well as the location of Baileys wetland, have been considered in the layout of the proposed surface works including alignment for the new access road from Long Beach Road. The location of this access road, for example, was aligned to avoid identified wet areas created largely by ATV tracks in the poorly-drained soils and watercourse crossings. In addition, the protection of Baileys wetland was paramount in the design of the tunnel dewatering system. The work undertaken with respect to the latter included geotechnical investigations and work to re-enforce and strengthen the safety factor associated with the existing berm between Baileys wetland and the DEVCO settling pond. As referenced in Section 4.3.4, monitoring suggests that there is both a hydrogeological connection between the DEVCO settling pond and Baileys wetland and some leakage through and/or around the berm and control structure.

Section 4.4.2 provides further information on Baileys wetland and the DEVCO settling pond, including their classification, functions and vegetation.

The eroding headlands of Donkin

4.4.1.3 Headland

Around the peninsula, there is a narrow band of treeless headland atop steep bluffs. This wind-swept zone is covered in a carpet of low-lying vegetation, traversed by a well-used walking/ATV trail. The vegetation here is simple: crowberry, cinquefoil and lowbush blueberry form an almost unbroken mat. Juniper bushes, marsh-fern, bayberry and common woodrush are found in the mat from place to place. A few roadside species such as hawkweeds and sow-thistles have invaded the disturbed ground created by the trail. This headland vegetation makes an abrupt transition into dense spruce forest within 50 m of the cliffs.

Spurred gentian (*Halenia deflexa*) was found on the barren headlands to the east end of the site at Wreck Point (see Figures 4.5 and 4.6). The headlands cliffs also provide important breeding habitat for a variety of sea birds, including the Razorbill, which has a NSDNR General Status Rank of Yellow (see Section 4.4.3 for further information).

A thick mat of Crowberry and Juniper help stabilize the fragile soils of the coastal headlands at Donkin.

The headlands have traditionally been used by local bird-watchers and ATV users.

4.4.1.4 Waterfront

Baileys wetland is separated from the sea by a barrier beach that may have been artificially enlarged to accommodate the construction of the Schooner Pond Beach Road which provides access to the headland and currently to the Project site. Vegetation in this area is a mixture of seaside species, freshwater species and weeds and wildflowers common to roadsides. The area, in general, is constantly altered by ongoing efforts to maintain, and or repair, the road from the consequences of storm surges. Further to the east towards the mine site, the roadside habitat broadens into a grassy sward between the road and rising cliffs above the seashore. Red fescue (*Festuca rubra*) is the dominant grass in this location and may have been a component of a hydro-seed mix that was applied. It is in this grassy meadow area near the coast that the Baileys Homestead stood (see Section 4.5.4 and Figure 4.7).

The protected Schooner Cove Beach at Donkin

4.4.1.5 Mine Yard

The land in the immediate vicinity of the mine portals and industrial buildings represents a distinct habitat created by years of disturbance by the earlier mine head works, followed by reclamation and abandonment. Most of this area is low, flat and wet. Two piles created from waste rock are located on the south side of the yard and intrude on the natural wetland surrounding the DEVCO settling pond (cattail marsh). Between the two piles a drainage corridor or channel is also dominated by cattails. These waste rock piles are composed of weathered rock and support essentially no vegetation.

The cleared lands of the mine yard provide habitat for exotics and early successional species

Around the mine portals, the ground has evidently been compacted, and much of the vegetation is dwarfed. The area was bounded on the north and west by alder thickets on the steep slopes, but these have been cut.

Alders are a key indicator species for previously disturbed or cleared lands

4.4.1.6 Heathland

South of the yard, there are a few hectares of open, stunted forest which is floristically distinct from the remainder of the forest on the peninsula. This area is characterized by a mixture of deciduous and coniferous species, all young and often growing in dense clumps. Red maple, white spruce and black spruce are the most common canopy species, along with scattered willows. Tree height is reduced to between 2 and 3 m, and stumps and charcoal are evidence of both historical forest harvesting and fire.

This site appears to have departed from the usual successional pathway, perhaps because of soil nutrient depletion following repeated disturbance.

Spruce fens are typical to the Donkin peninsula

4.4.2 Wetlands

4.4.2.1 WETLAND DEVELOPMENT AND CLASSIFICATION

An understanding of their development is useful in characterizing the wetlands on the Donkin peninsula. The latter is bowl shaped, with a low-lying central area. This surface physiognomy and the associated slopes control the morphology and distribution of the wetlands. As a result, surface water runoff is directed towards the central area of the peninsula away from the surrounding upland areas. There is a central water track traversing the site from east to west, eventually discharging to Schooners Pond Cove. The hydrology of the site is shown on Figure 3.2. Figure 4.5 shows the habitats on the peninsula including delineation of the NSDNR wetlands.

Based on the findings of the July 2006 site investigation and interpretation of historical aerial photography, the two major wetland types on the peninsula consist of fen and marsh wetlands. The approximate location and boundaries of the wetlands are shown on Figure 4.5. Whereas the fen is located in the central area of the peninsula, the marsh wetlands occur in association with the central drainage channel, the DEVCO settling pond and Baileys wetland. Both Baileys wetland and the DEVCO settling pond are comprised of shallow open water surrounded by a typha-dominated littoral marshland.

A review of historical aerial photographs indicates that the extent of the fen was considerably greater pre-development, i.e., before the works undertaken by DEVCO in the 1980s. The fen was located in the natural drainage basin that was confined to the north, east and south by topographic highs. It appears from the 1975 aerial photograph that a natural outlet existed at the western margin of that fen hydrologically connecting the fen to Baileys wetland, with riparian marshlands occurring along the natural drainage course. The fen did not appear to have a feeder stream, but did have a well defined surface water outflow to Schooner Pond Cove. These characteristics suggest a basin fen wetland. Basin fens are topographically confined to basins and do not have inlet streams (North American Wetlands Conservation Council, 1992).

The fen has been encroached upon by past DEVCO site activities, especially by the placement of waste rock fill. The resultant alterations to the surface water drainage patterns, including those caused by road construction, the installation of drainage ditches and the construction of the control structure between the DEVCO settling pond and Baileys wetland have also impacted the fen, causing a more channelized flow from upland areas to the settling pond, hydrologically isolating the fen, and possibly creating conditions more conducive to bog development. The drainage ditches associated with the Schooner Pond Beach Road discharge to the DEVCO settling pond.

The water control structure and associated berm between the Baileys wetland and the DEVCO settling pond was constructed to create the latter. The control structure created a large open water area along the natural drainage course which connected the basin fen to the downstream Baileys wetland. A riparian marsh environment has subsequently developed along the drainage course to the DEVCO settling pond, and a littoral marsh environment has developed along its margins. Although water flow is regulated by the control structure, the DEVCO settling pond exhibits open water wetland characteristics with more than 75% of its habitat characterized as that associated with shallow open water (North American Wetlands Conservation Council, 1992).

Baileys wetland is located in a supratidal zone to the south of Schooner Pond Cove and receives freshwater input primarily, but not only, from adjacent upland areas. Despite the control structure and the berm, Baileys wetland appears to receive limited quantities of both surface and subsurface water from the DEVCO settling pond. (Based on observed soil moisture content and vegetation patterns, for example, it appears that there is seepage track through the earthen berm from the DEVCO settling pond to Baileys wetland.) Flow in the channel to the west of the control structure, however, is sluggish and the vegetation is characteristic of a marsh.

A control structure, i.e., two metal culverts, 1 m in diameter, permit the flow of water from Baileys wetland into Schooner Pond Cove. Sea water can under certain tidal conditions also seep into the wetland at this location.

Baileys wetland can be described as wetland marsh habitat with characteristics of a tidal lagoon marsh, although the influence of tidal changes on the marsh habitat is not known. Elevated conductivity was observed in the wetland along the access road, but cattails and other plant communities, which are salt intolerant, were also observed. The characteristic features of tidal lagoon marshes include:

- Location in a supratidal zone on the sea coast;
- Situated in embayments or lagoons behind barrier beaches and bars; and
- Water is saline during high tide and fresh or brackish during low tide.

Based on aerial photographs, Baileys wetland does not appear to have undergone dramatic change over the past 30 years, although the presence of standing dead softwood in areas of open water does suggest that inundation of these areas and a rise in water level did occur.

4.4.2.2 Wetland Functions

The functions that can be attributed to the wetlands on the Donkin peninsula include flood modulation, pollution control, wildlife habitat, productivity, biodiversity and life support. The hydrological and hydrochemical functions of the wetland areas are described in more detail in Section 4.3.4.

The large retention capacity of the DEVCO settling pond and Baileys wetland slows the passage of water and promotes sediment removal, resulting in lower sediment export to Schooner Pond Cove. The large amount of free surface water enhances evaporation, which also modulates the basin runoff response. These systems may have had an important role in attenuating historical contamination associated with site activities, e.g., from the waste rock disposal pile. A variety of chemical and biochemical processes, such as microbial degradation, assimilation, precipitation, and adsorption to sediment operate within the wetland environment; all of which may serve to generate an improved water quality to downstream receptors such as Schooner Pond Cove.

4.4.2.3 Wetlands Complex Vegetation Assessment

Baileys wetland is a small lake draining to the sea; it is surrounded by a fringing marsh which grades into fen and wet forest. There are substantial peat deposits around the lake margin, and in some places floating peat mats support herbaceous plants. Vegetation around the lakeshore is lush, marsh-like in appearance and consists of common species of *Typha*, *Juncus*, and *Carex*. *Potentilla palustris*, a typical lakeshore species in Cape Breton, is one of the dominant species present.

The former DEVCO settling pond was formed by damming and enlarging a natural wetland. Since abandonment, most of the settling pond has been colonized by broad-leaved cattail (*Typha latifolia*) which covers several hectares at the upstream end of the pond as a mono-cultural stand. Cattails also fill the drainage channel leading from the mine workings to the settling pond. At the downstream end of the settling pond, above the dam, an open-water pond persists. *P. palustris* again grows in an unbroken band around the water's edge; sweet gale (*Myrica gale*) replaces it farther up the bank. The shallows, to at least 0.5 m depth, support dense beds of submersed and floating-leaved plants, almost all of them pondweeds: *Potamogeton perfoliatus*, *P. oakesianus*, *P. confervoides* and *P. pusillus*. The common pondweed *Potamogeton epihydrus* is likely in the pond because it was observed elsewhere on site, and it frequently grows with *P. oakesianus*. The only other submersed plant is a common bladderwort, *Utricularia vulgaris*. Small stands of bulrush (*Scirpus validus*) are scattered throughout the shallows.

Elsewhere along the coast, wet clearings in the spruce forest are dominated by downy alder and meadow-sweet (*Spirea alba)*. These sites are characterized by brambles such as Blanchard's dewberry (*Rubus recurvicaulis*) and dwarf raspberry (*Rubus pubescens*), marsh-fern (*Thelypteris palustris)*, bracken (*Pteridium aquilinum*), bunchberry (*Cornus Canadensis*), wild lily-of-the-valley (*Maianthemum canadense*), blue flag, marsh St. John's-wort (*Triadenum virginicum*), water-whorehound (*Lycopus americanus*) and lion's-paw (*Prenanthes trifoliata* or *P. altissima*). Soft rush and bulrushes (*Scirpus atrovirens* and *Scirpus cyperinus*) were occasional in wetter spots, while other places were dense with lowbush blueberries (*Vaccinium angustifolium*). Wire grass (*Danthonia spicata*) was common at these sites. The orchids were represented by northern club-spur (*Platanthera clavellata*), and a second species that was not in flower at the time of the survey; probably hooded ladies'-tresses (*Spiranthes romanzoffiana*).

In other wet-forested areas, inland from the coast, other hydrophytic vegetation assemblages were identified. In addition to the ubiquitous cattails, soft rush, and bulrushes mentioned above, these places also support another spikerush (*Eleocharis ovata*), bur-reed (*Sparganium emersum*), loosestrife (*Lysimachia terrestris*), a beak-rush (*Rhynchospora alba*), and the sedges *Carex gynandra* and *C. scoparia/crawfordii*. These are all exceedingly common species in this type of wet habitat. The submersed species *Potamogeton epihydrus* and *Callitriche palustris* were frequently encountered in standing water in wetlands, and even in the puddles along the trails.

4.4.3 Species at Risk and of Conservation Concern

Under *SARA* an environmental assessment must always consider project impacts on listed wildlife species, their critical habitat or the residences of individuals of that species. An environmental effect is defined as any effect on species of concern and their habitat resulting from project activities. Figure 4.5 shows the various habitats associated with and surrounding the Project area. The potential for effects resulting from the execution of the Project on these areas, on listed wildlife species, their critical habitat, or the residences of individuals of that species, provides the ecological focus of this environmental assessment.

The screening of the Atlantic CDC list acquired for areas within 100 km of the Donkin peninsula yielded a "long" list of 147 species that had been noted within this boundary (Appendix D). Consideration of the habitats in and adjacent to this Project site enabled this list to be reduced to 44 species, i.e., those species that might have a habitat requirement consistent with those on the Donkin peninsula. This "short" list of priority species, or species of concern, is presented in Table 4.12; the field teams were vigilant in striving to identify these species on the headland. Figures 4.5 and 4.6 illustrate key locations on the peninsula for Species of Concern as well as important habitats in the broader study area.

Table 4-12: Species at Risk and of Conservation Concern

Common Name	***Scientific Name***	***COSEWIC Status***	***SARA Status & Schedule***	***NSESA Status***	***NSDNR Status***	***Atlantic CDC***
BIRDS						
Common Loon	*Gavia immer*	Not at Risk	-	-	Yellow	S4B,S4N
Brant	*Branta bernicla*	-	-	-	Yellow	S2M
Harlequin Duck, eastern population	*Histrionicus histrionicus*	Special Concern	Special Concern, Schedule 1	Endangered	Red	S2N
Northern Goshawk	*Accipiter gentilis*	Not at Risk	-	-	Yellow	S3B
Piping Plover	*Charadrius melodus*	Endangered	Endangered, Schedule 1	Endangered	Red	S1B
Peregrine Falcon	*Falco pergrinus*	Special Concern	Threatened, Schedule 1	Threatened	Red	S1B
Red Knot	*Calidris canutus rufa*	Endangered	-	Endangered	Yellow	S3M
Common Tern	*Sterna hirundo*	Not at Risk	-	-	Yellow	S3B
Arctic Tern	*Sterna paradisaea*	-	-	-	Yellow	S3B
Razorbill	*Alca torda*	-	-	-	Yellow	S1B
Atlantic Puffin	*Fratercula arctica*	-	-	-	Yellow	S1B
Short-eared Owl	*Asio flammeus*	Special Concern	Special Concern, Schedule 3	-	Yellow	S1S2B

Common Name	*Scientific Name*	*COSEWIC Status*	*SARA Status & Schedule*	*NSESA Status*	*NSDNR Status*	*Atlantic CDC*
Common Nighthawk	*Chordeiles minor*	Threatened	-	Threatened	Yellow	S4B
Chimney Swift	*Chaetura pelagica*	Threatened	-	Endangered	Yellow	S4B
Olive-sided Flycatcher	*Contopus borealis*	Threatened	-	-	Yellow	S4B
Purple Martin	*Progne subis*	-	-	-	Red	S1S2B
Barn Swallow	*Hirundo rustica*	-	-	-	Yellow	S4B
Gray Jay	*Perisoreus canadensis*	-	-	-	Yellow	S4
Boreal Chickadee	*Parus hudsonicus*	-	-	-	Yellow	S3S4
Eastern Bluebird	*Sialia sialis*	Not at Risk	-	-	Yellow	S2S3B
Bicknell's Thrush	*Catharus bicknelli*	Special Concern	Special Concern, Schedule 3	Vulnerable	Yellow	S1S2B
Prothonotary Warbler	*Protonotaria citrea*	Endangered	Endangered, Schedule 1	-	Accidental	SAN
Hooded Warbler	*Wilsonia citrina*	Threatened	Threatened, Schedule 1	-	Accidental	SAN
Yellow-breasted Chat *virens* subspecies	*Icteria virens virens*	Special Concern	Special Concern, Schedule 1	-	Accidental	SAN
Vesper Sparrow	*Pooecetes gramineus*	-	-	-	Yellow	S2S3B
Savannah (Ipswich) Sparrow	*Passerculus sandwichensis princeps*	Special Concern	Special Concern, Schedule 1	-	Yellow	S1S2B
Bobolink	*Dolichonyx oryzivorus*	-	-	-	Yellow	S3B
PLANTS						
Coast-Blight Goosefoot	*Chenopodium rubrum*	-	-	-	Red	S1?
Spurred Gentian	*Halenia defexa*	-	-	-	Yellow	S2S3
Richardson Rush[10]	*Juncus alpinoarticulatus*	-	-	-	Undetermined	S1S2
Long-leaved Stitchwort	*Stellaria longifolia*	-	-	-	Yellow	S3

[10] Richardsons Rush was not present in the ACCDC report; during plant surveys, a specimen that was suspected to be this species was encountered. This specimen was subsequently identified by the NS Museum as the exceedingly common *Juncus articulatus.*

Common Name	Scientific Name	COSEWIC Status	SARA Status & Schedule	NSESA Status	NSDNR Status	Atlantic CDC
Purple Crowberry	*Empetrum rubrum*	-	-	-	-	S2S3
Downy Willow-Herb	*Epilobium strictum*	-	-	-	Yellow	S3
Slender Blue Flag	*Iris prismatica*	-	-	-	Red	S1
Bulbous Rush	*Juncus bulbosus*	-	-	-	Undetermined	S1
New Jersey Rush	*Juncus caesariensis*	Special Concern	Special Concern, Schedule 1	Vulnerable	Yellow	S2
Moor Rush	*Juncus stygius*	-	-	-	Yellow	S1
Northern Blueberry	*Vaccinium boreale*	-	-	-	Red	S2
MAMMALS						
Northern Long-eared Bat	*Myotis septentrionalis*	-	-	-	Yellow	S2
Little Brown Bat	*Myotis lucifugus*	-	-	-	Yellow	S4
FISH						
Striped Bass	*Morone saxatalis*	Threatened	-	-	Red	S1
Atlantic Salmon	*Salmo salar*	Endangered	Endangered, Schedule 1	-	Red	S2
Brook Trout	*Salvelinus fontinalis*	-	-	-	Yellow	S4
ODONATA						
Muskeg Emerald	*Somatochlora septentrionalis*	-	-	-	Yellow	S1

The following sections provide observations on the Species at Risk or of Conservation Concern identified in Table 4.12; these are based on the research undertaken, the field programs executed and the knowledge of the study team involved.

4.4.4 Birds

The Donkin peninsula is known to provide nesting, feeding and migratory habitat for approximately 300 bird species. In Canada, under the federal *Migratory Bird Convention Act*, migratory birds, their young, eggs and nests are protected and must be considered in an environmental assessment. This is in addition to the stipulations of *SARA* referenced above. Together this legislation provides the mandate to recognize and address the importance of the peninsula to birds.

Dr. Ian MacLaren of Dalhousie University has been working, and will continue to work, with local naturalists, Cathy and Allan Murrant and the Project team, to categorize the bird species known to occur as breeding, migratory or residents of the headland.

The cumulative list of birds recorded on the Donkin peninsula (see Table A-1 in Appendix J), is extensive, marking the area as one of the most bird-rich areas in Nova Scotia, and comparable to other well known sites including Sable Island, Brier, Seal and Cape Sable Islands in the south of the province, and areas around Canso in Guysborough County. These sites have received much attention from birders and ornithologists, but their long lists of birds seen are the cause, not the result, of this attention. The reasons are partly evident in a geographical context. Sable Island and the southwestern islands are situated as landfalls for birds migrating routinely or "lost" over the unwelcoming sea. The prominent peninsulas on the northeast mainland and in Cape Breton are similarly attractive to migrating birds and are also last havens for landbirds displaced eastward from their usual paths.

Wind patterns are a well-established influence on the incidence and abundance of migrant and "vagrant" birds, i.e., those greatly displaced from their usual ranges, along the Atlantic coast. Many birds are assisted in their northward spring migrations by the frequent southwesterly airflows. In autumn, this southwesterly airflow induces downwind "reverse" migration by some birds. Many migrants are also carried out to sea off Nova Scotia following rapid offshore movements of cold fronts (Richardson 1971, 1972). The marked continental convergence of mean southwesterly and westerly airflows on the province is partly responsible for the unusual diversity and abundance of vagrant birds on its offshore islands (McLaren 1981). Cold fronts moving off the southeastern US sometimes displace huge fallouts of late and "southern" landbirds to our coastal areas (McLaren et al., 2000).

The Donkin peninsula experiences these migration patterns and events. Hundreds, perhaps thousands, of regular daytime migrants have at times been observed moving across the peninsula, e.g., Blue Jay, Robin, sparrows and blackbirds, along, e.g., Whimbrel, and off, e.g., Northern Gannet, alcids, its eastern edge. Night time migrants, e.g., thrushes, warblers, appear in large numbers foraging along the various ecotones (boundary habitats) of the peninsula, for example, along the forested edges of the peripheral barrens, the waste rock piles and exploration areas, and in alder thickets along the Schooner Pond Beach Road. Another great attraction is in the presence of Baileys wetland and the DEVCO settling pond that attract and hold migrant waterbirds and shorebirds. A majority of the routine migrant and many of the vagrant birds recorded in the province have been found on the Donkin peninsula (see Table A-2 in Appendix J). Records and photographs of the birds seen in the area are frequently featured on the website of local resident naturalists, Alan and Cathy Murrant (http://www.capebretonbirds.ca/).

An important factor in attracting large numbers of passing and settling birds may be the peninsula's prominence along this easternmost projection of the province. With relief over 40 m above sea level, the peninsula rises above the nearby South Head and Scaterie Island. This may be especially important when low fog covers the coastal region.

The peninsula is not only attractive to migrants (a "migrant trap" in birder parlance), but its habitats are sufficiently diverse to host a broad array of breeding species (Table A-3 in Appendix J). The weather patterns that influence migration probably also amplify the abundance and diversity of breeding birds on the peninsula, particularly the landbird majority (92/114, 81%). There are indications (McLaren, in prep.) that the yearly abundances of some common species on the formal Nova Scotia Breeding Bird Surveys (Sauer, 2007) are influenced by the relative frequencies of easterly and westerly winds during May and early June. Birds swept eastward out to sea and re-orienting westward may settle near the coast where they first find suitable habitats.

The list of wintering birds detected in Cape Breton (Table A-4 in Appendix J) is considerably more restricted, with a smaller proportion of landbirds (62/99, 63%). This is not surprising, since the open sea sustains wintering seabirds, along with some wetland birds and shorebirds, whereas insectivorous birds must leave for warmer climes.

As described in the following section, the diversity of the habitats on the peninsula is the other major influence on the diversity of the bird species. While general habitat analysis and forest-type mapping are helpful, some fine-scale vegetation features need to be noted in the context of breeding birds.

4.4.4.1 Bird Species at Risk or of Conservation Concern

Based on the work undertaken, only a handful of bird species have been sighted on or near the peninsula, or in nearby waters, that are protected by *SARA*. A greater number are ranked by NSDNR pursuant to Nova Scotia *Endangered Species Act*. A few rare or very rare bird species, categorized as Yellow status by NSDNR, are known to nest on the peninsula. These include the razorbill, the common nighthawk, the olive-sided flycatcher and the bobolink. The following text provides observations on each of the latter species and those species protected by *SARA* and the *Endangered Species Act*.

Harlequin Duck (*Histrionicus histrionicus*): The Harlequin Duck is categorized as of 'Special Concern' to *SARA*; 'Endangered' by the Nova Scotia *Endangered Species Act* and is Red-coded in the NSDNR list. It is estimated that less than 250 Harlequin Ducks winter on the coast of Nova Scotia. The species had been depleted in the past by hunting, but hunting for this species was closed in 1990. Its numbers have been increasing according to the Nova Scotia Christmas Bird Count ("CBC") since 1961. It is, however, a very rare winter visitor to the coast of the Donkin peninsula.

Piping Plover (*Charadrius melodius*): This species is currently listed as 'Endangered' under both *SARA* and the Nova Scotia *Endangered Species Act* and is Red-coded by NSDNR. Only about 40 breeding pairs of Piping Plovers remain in Nova Scotia. These birds are known to breed on 17 sand beaches around the Province, but despite concerted conservation efforts here and elsewhere in North America, their numbers remain low. The main reasons include the deterioration in marginal nesting habitat due to natural events, e.g., storms, vegetation succession, etc., human alteration of beach habitat, human disturbance during nesting and predation by birds and mammals on eggs and young. This species does not use habitat on the Donkin peninsula, but is known to inhabit the shoreline of Big Glace Bay Lake and Glace Bay Beach (Power, 2007).

Peregrine Falcon (*Falco* spp.): The Peregrine Falcon remains 'Threatened' under *SARA* and the Nova Scotia *Endangered Species Act* and Red-coded by NSDNR, but species numbers have increased, particularly since the 1980s according to the Nova Scotia CBC. Indeed, its recovery is often cited as a conservation success; it remains rated as vulnerable because of its restricted breeding area on exposed cliffs. It is a rare-to-uncommon visitor on the Donkin peninsula, though the sea cliffs could offer nesting sites.

Common Nighthawk (*Chordeiles minor*): This species is listed as 'Threatened' by COSEWIC and the Nova Scotia *Endangered Species Act*, but is not legislated by either *SARA* or provincial legislation. It is believed to nest in the clearings around the Project area footprint; these clearings can be viewed as contributing to its habitat needs.

Olive-sided Flycatcher (*Contopus boreali*): This species is listed as 'Threatened' by COSEWIC, but is not legislated by either *SARA* or by provincial legislation. It is often found nesting in partially cut or burned areas, habitats which are not prominent on the peninsula. It has, however, been sighted on the peninsula as a migrant.

Yellow-breasted chat (*Icteria virens virens*), Hooded and Prothonotary Warbler (*Wilsonia citrina & Protonotaria citrea*): Three species, the Yellow-breasted Chat, the Hooded and the Prothonotary Warbler, are on the *SARA* list (as "Special Concern", "Threatened" and "Endangered" respectively) because they are vulnerable in the margins of their Canadian breeding range in southern Ontario; they are vagrants in Nova Scotia and, accordingly, "accidental" on the NSDNR list. According to McLaren and Murrant the study area is insignificant to their welfare, and therefore the Project poses no harm to them.

Bobolink (*Dolichonyx oryzivorus*): This species has declined sharply in numbers in Nova Scotia and throughout its eastern range in part because of more intense haying practice. It has been known to nest in the rough grassland surrounding the former Bailey property. Its future, however, is not dependent on this very marginal site, nor will the Project be affecting this habitat.

Red Knot (*Calidris canutus rufa)*: The Red Knot was listed as 'Endangered' by both COSEWIC and the Nova Scotia *Endangered Species Act*, due to an observed 70% decrease in populations. This species is not legislated by *SARA*. The species breeds in the arctic; the Donkin peninsula provides no attractive habitat in terms of breeding or stopover.

Short-eared Owl (*Asio flammeus*): The Short-eared owl is listed by COSEWIC as a species of 'Special Concern' and is under consideration for legislation under *SARA*. This is due primarily to loss and degradation of its wintering and breeding grounds. This species has confirmed breeding sites in the vicinity of Glace Bay (Erskine, 1992), but breeding habitat values on the Donkin headland are considered minimal. The species is known to the area as a migrant (Murrant, Pers. Comm.).

Chimney Swift (*Chaetura pelagica)*: The Chimney swift is designated as 'Threatened' by COSEWIC and 'Endangered' by the Nova Scotia *Endangered Species Act*, having shown marked decreases across its range. This species is known as a migrant to the Donkin headland, but is at the limit of its breeding range in Nova Scotia. There are no confirmed breeding sites in the area, and the generally windswept and stunted forest of the peninsula provides little in the way of suitable breeding habitat.

Bicknells Thrush (*Catharus bicknelli*)

Bicknells Thrush is listed as a species of 'Special Concern' by COSEWIC, as 'Vulnerable' by the Nova Scotia *Endangered Species Act* and is under consideration for inclusion in *SARA*. This is due in part to the low reproductive potential of the species, as well as habitat alteration throughout its breeding range in Nova Scotia. Although the habitat on the peninsula appears promising for this species, it is known only as a rare migrant.

The Bicknells Thrush is known to nest in the Cape Breton Highlands and in Guysborough County. Searches for nesting Bicknell's Thrush on the peninsula were made using taped songs for 10 minutes at each of 10 plausible sites in July, 2002 (McCorquodale, 2002). Although no responses were heard, the Peninsula has much unsampled dense spruce habitat (including marginal *krummholtz*) that could conceivably attract the species (Rimmer et al., 2001).

Savannah (Ipswich) Sparrow (*Passerculus sandwichensis princeps*)

The *SARA* 'Special Concern' listed Savannah sparrow is known to the Donkin headland as a migrant; it is known to breed on Sable Island.

A number of NSDNR Yellow-status species identified in Table 4.12 nest regularly on the peninsula, and thus deserve special consideration. The Northern Goshawk (*Accipiter gentilis*) is relatively uncommon, as it is throughout Nova Scotia. Its status on the Breeding Bird Survey ("BBS") and the CBC have not changed; it is listed as being generally sensitive when nesting. The numbers of Barn Swallow (*Hirundo rustica*) have been decreasing significantly in the Province and throughout eastern North America; their numbers may be responding to the use of pesticides and to a decline in suitable farm outbuildings for nesting. The construction of buildings associated with the mine, therefore, may inadvertently be beneficial to its welfare. The Razorbill (*Alca torda*) is at the southern limit of their range in Nova Scotia, and with only a few scattered pairs, the Razorbill is the most vulnerable seabird nesting on the peninsula. The Nova Scotia CBC reveals no population trend, but presumably its few breeding sites are rated as vulnerable, and, as such, its toehold on the peninsula is important.

Among the balance of the Yellow status species, the Gray Jay (*Perisoreus canadensis*) and Boreal Chickadee (*Parus hudsonicus*) may be of the greatest interest. These birds nest commonly or fairly commonly respectively on the peninsula. They are listed by NSDNR because of significant declines on the BBS or CBC or both, and the Boreal Chickadee has declined markedly throughout its range in eastern North America. As boreal birds they inhabit old coniferous woods and may both be affected by forestry practices and, perhaps, by global climate change. Their apparently healthy nesting status on the peninsula may be a concrete result of a lack of recent forestry management on the peninsula. The Semipalmated Sandpiper (*Calidris pusilla*) is also fairly commonly sighted on the Schooner Pond Beach where it feeds during its fall migration.

The following Yellow-coded species are merely uncommon, rare or very rare as migrants, vagrants, or occasionally wintering species; the peninsula offers neither suitable breeding habitat, nor particularly attractive stopover habitat. These species include the Brant (*Branta bernicla*), Common Loon (*Gavia immer)*, Red Knot (*Calidris canutus*), tern species (Arctic Tern-*Sterna paradisaea &* Common Tern-*Sterna hirundo*), the Short-eared Owl (*Asio flammeus*), Chimney Swift (*Chaetura pelagica*), Purple

Martin (*Progne subis*), Eastern Bluebird (*Sialia sialis*), Vesper Sparrow (*Pooecetes gramineus*), and the Savannah (Ipswich) Sparrow (*Passerculus sandwichensis* sub-species *princeps* breeding only on Sable Island). Among those that are represented on the Nova Scotia BBS or CBC, only one has shown significant decline. The Common Loon may be rated as vulnerable to disturbance and pollution on its breeding lakes in Nova Scotia, but it has shown no changes on the Nova Scotia BBS and has increased substantially on the Nova Scotia CBC. The other species are either too uncommon to be represented in the long-term BBS or CBC, or have shown no significant change.

4.4.4.2 Observations from Field Work and Habitat Identification

For birds, the peninsula can be broken up based on plant associations and landscape. Dr. Ian MacLaren, through his field work and in conjunction with the Murrants' work, has identified several associations between birds using the Peninsula and different plant communities and landscape form. These are discussed below.

i) Coniferous and Mixed Forest

ATV tracks and walking trails through the wet coniferous forest often create large semi-permanent puddles able to sustain hydrophytic vegetation.

As stated in Section 4.4.1, much of the peninsula is covered with mature coniferous forest. Although the balance of tree species varies widely, dominant coniferous tree species include White and Black Spruce (*Picea glauca* and *P. mariana*), especially along the north side of the peninsula. Black Spruce is found on the lower, often wet, areas, and is common immediately east of the mine site. The pioneer Balsam Fir (*Abes balsamea*) is locally common on high ground in the southwest of the Peninsula, and scattered elsewhere. It has long been known that diversity of nesting bird species in forests depends more on plant structural diversity (number and density of layers) than on plant species-diversity (Macarthur, 1961). Species composition of forest trees does, however, affect the composition of bird species, although less so among stands of different spruce species within regions (Lee and Rotenberry, 2005). For example, the local predominance of White and Black Spruce probably has little effect on the nesting habitat choice of such abundant species as Swainson's Thrush, Yellow-rumped and Magnolia Warblers, although others like Blackburnian and Black-throated Green Warblers have some preference for Red Spruce because of its needle structure (Parrish 1995) and bigger crown (Dr. Cynthia Staicer, pers. comm.). The higher admixtures of intolerant hardwoods near the western boundary will support a wider variety of nesting species not found in the purer softwood stands. Some habitat variables will affect both the structure and tree-species composition of such stands. For example, some sparrow species will nest near edges of spruce stands, but be scarce in or absent from the interior.

ii) Ponds and Wetlands

The existence of Baileys wetland and the DEVCO settling pond add greatly to the diversity of both nesting and migrant birds. Migrant and nesting freshwater waterfowl, migrant herons, migrant and nesting rails, some migrant shorebirds, and nesting Red-winged Blackbirds depend on these wetlands. Surface-feeding and diving waterfowl and grebes use the open waters. Of particular importance to nesting species are the stands of cat-tails (*Typha* spp.) both on the fringes of the two ponds and extending along the inlet of the DEVCO settling pond. At the eastern end of the DEVCO settling pond and possibly in the wetland to the east of the mine site, sparse stances of Black Spruce attract particular nesting species including the Yellow-bellied Flycatcher, Palm Warbler and Lincoln's Sparrow.

iii) Possible Importance of Poplars

Poplar species are particularly favoured by a number of bird species, e.g., woodpeckers, which in turn supply used nesting holes for other species. Northern Saw-whet Owls are particularly attracted to the holes made by Northern Flickers in such stands. Thus the apparent abundance of Trembling Aspen (*Populus tremuloides*) on the eastern margins of Baileys wetland may be of importance.

iv) Alder Thickets

Alder thickets, particularly along the existing access road and the tracks south of the mine site, are important in offering thick, insect-rich deciduous cover for migrants in the period from late summer through autumn. Many of the unusual landbirds recorded on the peninsula have been found in this area.

v) Coastal Headlands

The peninsula is margined on its northern, eastern and southern flanks by barrens. Blueberries (*Vaccinium* spp.) and Black Crowberry (*Empetrum nigrum*) are important food for Whimbrel using these barrens during their southbound migration in late summer and early fall. Surveys of passing flocks of Whimbrel have estimated that a minimum of 149 flocks of more than 3,000 birds passed through the general area in the period July-September 2007, many of them along the Donkin peninsula (see http://www.capebretonbirds.ca/rarebird.html).

Wind-swept coastal barrens and rocky cliffs are ideal headland habitat for the Great Cormorant

Scrubby spruce (dense *krummholtz* in places) along the inner margins of the headlands supply nesting habitat for Fox Sparrows, at the southern limit of their range along Nova Scotia's coast.

vi) Outer Cliffs and Rocky Shores of the Headlands

The outer cliffs and rocky shores of the Peninsula offer nesting habitat for a number of seabirds. These have been censused in connection with the ongoing Maritimes Bird Atlas project (see Table A-4 in Appendix J); nest sites are depicted on Figures 4.5 and 4.6. The kilometer stretch west from Northern Head is clearly the most important section for the birds.

Both cormorant species are common and nest widely in Nova Scotia, and breeding Great Cormorants have spread to the southern end of the province in recent decades. The substantial colonies on the peninsula are located on the steep cliffs along the south side. The Black-legged Kittiwake was first found nesting in Nova Scotia on an island off Gabarus, CBRM, in 1951 (Tufts, 1986). It has since spread to other sites and as far south as Pearl Island off Mahone Bay. On the peninsula, the Kittiwakes form the largest and most compact seabird colony on the cliffs of the outer stretch of the south coast. Razorbills are at the southern limits of their range in the Maritimes; the largest colony is located on the Bird Islands 45 km to the northeast of the peninsula, and there are other small colonies as far south as Pearl Island off Mahone Bay. With only a few scattered pairs, the Razorbill is the most vulnerable seabird nesting on the peninsula. Black Guillemots are widespread along rocky coasts throughout the province. They do not form true colonies, but opportunistically occupy crevices in cliffs, talus slopes and rock piles. There are two loose concentrations of Black Guillemots on the Peninsula, perhaps the most densely settled being located close to Wreck Point.

The heathland habitat is comprised of stunted trees, alder and ericaceous species.

vii) Cleared Areas of the Heathlands
These cleared areas, perhaps partially burned in the past, are regenerating slowly and thus supply important habitat for grassland and shrubland birds during their migration. Most migrant sparrows are found in these areas.

viii)Rough Grasslands Associated with the Bailey and MacDonald Properties
The grassy slopes at the eastern end of the Schooner Cove Beach provide habitat for high populations of nesting Savannah Sparrow, and the Bobolink is known to have nested there in some years. The small cleared area around the MacDonald Farm site may also attract nesting birds. Abandoned farm sites, because the surrounding lands are not cut for hay like many coastal fields, are valuable as nesting habitat.

ix) Waste Rock Disposal Piles
Although not commonly prized as bird habitats within otherwise largely natural areas, the Donkin waste rock sites offer unique habitats for migrant sparrows; most vagrant sparrows have been found there. These sites may have been seeded in a modest reclamation effort, but some forbs and grasses, which supply food for the birds, may also have been introduced by defecation by migrant birds, and in that sense they are a natural feature. The gravely northern landfill area is the only recorded nesting site for Killdeers on the peninsula.

4.4.5 Flora

4.4.5.1 Plant Species at Risk and of Conservation Concern

The Atlantic CDC screening identified 11 species of plants possibly existing on the peninsula based on geographic proximity and habitat conditions. Botanical field investigations were conducted in the early summer of 2006 by Dr. Barry Taylor (St. Francis Xavier University) and Clinton Pinks (CBCL Limited). A number of additional botanical investigations were sequentially conducted between July 2006 and August 2007 to confirm the location and habitat of several of the plant species of concern. Several species were confirmed under laboratory conditions, and other species were sent to Marian Monroe of the Nova Scotia Museum of Natural History for confirmation. An additional 12th species, Richardson's Rush, not presented on the original Atlantic CDC List, was added to the short list for field verification.

Coast-Blight Goosefoot (*Chenopodium rubrum*): is ranked as Red by NSDNR. A specimen of what was thought to be this species, was sent to the Nova Scotia Museum where it was re-identified as Halberd-leaf Saltbush (*Atriplex patula),* which is ranked as Green under the NSDNR General Status Ranks. A few specimens of *A. patula* were also found growing along the inland side of the former DEVCO Pond in the area of the upland berm.

The tiny Spurred Gentian *(Halenia deflexa)* finishes flowering in early September

Spurred Gentian (*Halenia deflexa*): This species was confirmed on the headlands near Wreck Point on August 3, 2007 when it was in flower. It is categorized as a Yellow species by DNR. It was found growing on the headland within 5 m of the edge. Approximately 40 specimens, ranging in height from 50 to 130 mm, were observed in a grassland environment which included such other species as rattlesnake plantain, goldenrod, bay berry, bog fern, strawberry, blueberry, bunchberry and assorted grasses. The gentian was not found in areas where crowberry and juniper were the dominant groundcover species. This species was first observed by Murrant in 1993, which suggests that the habitat has not changed significantly over the intervening years. Figure 4.3 illustrates the location where the Spurred Gentian was found on the Headland; the coordinates for the species are: Easting: 745856 Northing: 5118553; (UTM NAD83 Zone 20).

Richardson Rush (***Juncus alpinoarticulatus***): This species is ranked as Undetermined by DNR; A suspected specimen of *J. alpinoarticulatus* was taken, and subsequently re-identified by the Nova Scotia Museum as *J. articulatus*, a DNR Green species.

Long-leaved stitchwort (*Stellaria longifolia*): Suspected specimens of this species found growing in the drainage ditch along the old access road were later re-identified as *S. graminea*, Grass-leaved stitchwort, a common weedy species suited to the drainage ditches. *S. longifolia,* ranked as a Yellow species by DNR, prefers minerotrophic, coniferous, swamp-like conditions, unlike the alder-grove environment where the specimen was taken.

Purple Crowberry *(Empetrum rubrum)*: This 'Yellow' species has a habitat requirement of headlands, bogs and barrens, all of which are present on site. This species is not known to the Donkin headland, with *E. nigrum* being the dominant species of crowberry on the headland as determined through the field surveys undertaken. As the coastal barrens will not be impacted by the Project, there is no possibility of disturbing any potential habitat for this species.

Downy Willow-Herb *(Epilobium strictum)*: This 'Yellow' species has a habitat requirement of bogs and meadows, and is found in places throughout Cape Breton. Although favourable habitat exists on the peninsula, it will not be disturbed by the Project; moreover the species was not found at any of the wetland locations surveyed.

Slender Blue Flag *(Iris prismatica)*: This 'Red' species is typically found at wet coastal sites in a variety of locations throughout Nova Scotia. Reportedly, this species was once quite common near Louisbourg, which has a similar habitat value to the Donkin peninsula; it was flagged as high potential for existing on site. Surveys yielded no incidence of this species, with the very common Blue flag (*Iris versicolor*) being the only member of this genus encountered. Avoidance of the coastal barrens and wetlands to the east of the footprint will ensure no disturbance to potential habitat.

Bulbous Rush *(Juncus bulbosus)*: This species is typically encountered at the margins of freshwater bodies. Surveys of the various freshwater wetlands, i.e., Baileys wetland and the DEVCO settling pond, yielded no incidence of this species. Six other species of *Juncus* (*J. acuminatus, J. articulatus, J. bufonius, J. effuses, J. filiformis & J. tenuis*), none of which are legislated, were encountered at various locations.

New Jersey Rush *(Juncus caesariensis)*: This species is known to inhabit bogs and fens, mostly in Richmond County, and is listed nationally by both COSEWIC and *SARA* as a species of 'Special Concern', and as 'Vulnerable' by the Nova Scotia *Endangered Species Act*. No specimens of this species were encountered during the surveys undertaken.

Moor Rush *(Juncus stygius)*: This species is known to inhabit sphagnous bogs and bog pools and is listed as 'Yellow' by NSDNR. No specimens of this species were encountered during surveys.

Northern Blueberry *(Vaccinium boreale)*: This 'Yellow' species is typically found on exposed headlands and coastal barrens, such as those encountered on site. The surveys conducted did not identify any specimens of *V. boreale*, only the exceedingly common *V. angustifolium,* the lowbush blueberry.

4.4.5.2 Observations from the Field Programs Executed

The diversity of the flora on the Donkin peninsula is relatively high. The area accommodates six distinct habitats where over 150 species of plants were found during the field investigations undertaken by Dr. B. Taylor (Appendix K). The influence of coastal exposure is evident along the headlands and by the barrier beach at Schooner Pond Cove; inland, small changes in elevation, and therefore soil moisture level, appear to be the dominant influence on vegetation. Super-imposed on this matrix is the disturbance that was caused by the original works undertaken by DEVCO, and perhaps by historical homesteaders, as well as the introduction of species in hydro-seed mixes used to reclaim the site after DEVCO discontinued project development.

The vegetation around Baileys wetland is influenced by its close proximity to the ocean

Vegetation communities are also diverse and rich. Bailey's wetland, for example, is surrounded by lush vegetation. The dominant species at the water's edge is *Potentilla palustris*, a typical lakeshore species in Cape Breton. A broken band of *P. palustris* apparently occupies the shallows all around the lake, extending outward into deeper water as islets and drowned plants. Inland from the *P. palustris* is a zone of saturated soil with occasional pools. Near the north (road side) of the lake, this area is covered in a lush savannah of red top grass (*Agrostis gigantea*), among which are embedded clumps of downy alder (*Alnus viridis*) and a great variety of facultative and facultative minus plants. Prominent among these are bog laurel (*Kalmia polifolia*), leatherleaf (*Chamaedaphne calyculata*), rushes, marsh-fern, bedstraw *(Gallium tinctorium* and possibly *G. labradoricum*), loosestrife (*Lysimachia terrestris)*, bur-reed (*Sparganium emersum*), mare's-tail (*Hippuris vulgaris*), monkey-flower (*Mimulus ringens*), boneset (*Eupatorium perfoliatum*), Joe-pye-weed (*E. maculatum*) and *Carex projecta*. In other areas, where the forest quickly approaches the water's edge, downy alder and *P. palustris* essentially define the transition zone. Baileys Wetland is a murky, brown-water body and apparently does not have a submersed plant community. During one of the site visits, later in the growing season, common pondweed *Potamogeton epihydrus* was observed stranded in a drying pool near the lake's edge.

The engineered channel draining the DEVCO settling pond from DSP Outlet A (see Figure 3.3) to Schooner Cove provides a running-water habitat of shallow pools and gentle riffles. Along with broad-leaved cat-tails and *Potamogeton perfoliatus*, the stream supports rushes (*Juncus articulatus*), blue flag (*Iris versicolor*), coltsfoot (*Tussilago farfara*), a spikerush (*Eleocharis palustris*), least duckweed (*Lemna minor*) and water plantain (*Alisma triviale*). *Polygonum cilinode*, a trailing vine, grows among grasses on the bank. Streams and brooks running through the woods were for the most part too cool and shaded to permit rooted plants, with the exception of a submersed bur-reed, probably *Sparganium angustifolium*.

A small coastal bog near the meteorological tower supports a variety of wetland plants among downy alder, bog laurel, balsam fir saplings, and bayberry (*Myrica pensylvanica*) bushes. Soft rush, cotton-grass (*Eriophorum polystachion*), bog aster (*Aster radula*) and a number of common sedges (*Carex folliculata, C. paupercaulis* and *C. nigra*) were scattered among a thick bed of moss. This site and others on the head land support the characteristic bog orchid, grass-pink (*Calopogon tuberosus*). At the edge of this site, a pool, filled with deeply stained water, supports broad-leaved cattails and dense growth of bladderwort (*Utricularia vulgaris)*, along with *Sphagnum* moss. True bog, marshland and maritime influences are apparent in this species assemblage.

With the exception of the Spurred Gentian, found on the headland, no other species of concern were encountered during the field investigations that were undertaken.

4.4.6 Fauna

Nova Scotia provides habitat to 86 species of mammals (Scott and Hebda, 2004), and most are relatively widespread in their distribution across the province. The range and numbers of mammalian fauna on the peninsula is limited due in part to a large portion of the area having been disturbed. Deer, coyotes, beavers, squirrel, hares and voles have all been seen, but the peninsula has no particular attributes of importance to these species, and all are common in the Province. No mammals, other than bats, are identified on Table 4.13. As such, the focus of the mammalian field work undertaken was bats.

4.4.6.1 Species of Conservation Concern

The following species of bat are categorized as Yellow by NSDNR:

Little Brown Bat (*Myotis lucifugus*): Its preferred habitat consists of caves, mine tunnels, hollow trees, buildings and dead trees close to lakes and ponds. This species is considered to be the most abundant bat species in Nova Scotia; numbers, however, have been declining due to increasing habitat disturbance. The habitat preference of this species is marginally similar to the habitat characteristics on the peninsula.

Northern-Long Eared Bat (*Myotis septentrionalis*): During the summer, the northern long-eared bat uses buildings, towers, hollow trees, beneath the loose bark of trees, in crevices of cliffs and beneath bridges as day roosts, but commonly uses caves as night roosts. During the winter, these colonial bats move into caves and abandoned mines where they either hang individually or in small clusters. They prefer caves and mines that are relatively cool and moist and where the air is still.

4.4.6.2 Results of Field Program

There are occurrence records for seven species of bats in Nova Scotia which include hoary bats (*Lasiurus cinereus*), silver-haired bats (*Lasionycteris noctivagans*), eastern red bats (*Lasiurus borealis*), big brown bats (*Eptesicus fuscus*), eastern pipistrelles (*Perimyotis subflavus*), northern long-eared (*Myotis septentrionalis*) and little brown bats (*Myotis lucifugus*) (van Zyll de Jong, 1985, Broders et al., 2003a). Nova Scotia is at, or above, the northern extent of the current known range for each of these species, with the exceptions of the northern long-eared and the little brown bat (van Zyll de Jong 1985). These two species are likely ubiquitous in Nova Scotia as their distributions extend into Newfoundland (Grindal, 1998, Broders et al., 2003b), while eastern pipistrelles appear to be only locally abundant in southwest Nova Scotia (Broders et al., 2003a, Farrow, 2007).

Only the northern long-eared and little brown bat are common summer residents in Nova Scotia (Broders et al., 2003a). Both bat species follow the typical temperate bat life-history consisting of a period of activity (reproduction) in the summer and a hibernation period in the winter. The females of both species bear the cost of reproduction in the summer from pregnancy and by providing sole parental care to juveniles (Barclay, 1991, Hamilton and Barclay, 1994, Mclean and Speakman, 1999, Broders et al., 2006). The northern long-eared bat roosts and forages in the interior of forests (Broders et al. 2003a, Jung et al. 2004, Henderson, 2007). Females predominantly roost in deciduous tree species in maternity colonies (Foster and Kurta, 1999, Menzel et al., 2002, Broders and Forbes, 2004, Henderson, 2007) although they have also been found in coniferous tree species in Nova Scotia and New Brunswick (Broders and Forbes, 2004, Garroway and Broders, in press). Males typically roost solitarily in either deciduous or coniferous trees (Lacki and Schwierjohann, 2001, Jung et al., 2004, Ford et al., 2006). The little brown bat, in contrast, is a generalist species, associated with forests, as well as human-dominated environments (Barclay 1982, Jung et al. 1999). This species has been found to forage over water and in forests (Anthony and Kunz 1977, Fenton and Barclay 1980) and both males and females, i.e., maternity colonies, have been shown to roost in buildings and trees (van Zyll de Jong 1985, Crampton and Barclay 1998, Broders and Forbes 2004).

A total of 25 bats were captured, five at trap site 1 and 20 at trap site 2 (see Figure 3.4); these included 19 little brown bats and six northern long-eared bats (Table 4.13). Lactating or post-lactating females and juveniles of both species were captured. All 19 little brown bats and one female northern long-eared bat were captured at trap site 2; the remaining five northern long-eared bats were captured at trap site 1. At monitoring location #1 (Schooner Pond; acoustically sampled for one night) a total of 18 call sequences were recorded which were all attributable to Myotis bats (Table 4.13). Monitoring location #2 (former DEVCO settling pond) was acoustically sampled for nine nights, and 437 Myotis species call sequences were recorded (Table 4.14). Monitoring location #3 (area cleared for access road) was acoustically sampled for eight nights and a total of 965 call sequences were recorded which were also all attributable to Myotis bats (Table 4.14).

Table 4-13: Total Bats Captured by Species, Sex and Relative Age at Two Locations on the Donkin Peninsula, 2007

	Little Brown Bat (Myotis lucifugus)	*Northern Long Eared Bat (Myotis septemtrionalis)*
Males		
Adults	2	3
Juveniles	2	2
Females		
Adults	12	1
Juveniles	3	0
TOTAL	19	6

Table 4-14: Number of Echolocation Call Sequences per Site

Site	*# Call Sequences Recorded*	*# Sampling Nights*
1 (Schooner Pond)	18*	1
2 (Devco Pond)	437*	9
3 (Forested road)	965*	8

* All identified as Myotis spp.

Although it was not possible to distinguish the calls of Myotis species, the majority of the Myotis sequences recorded at both locations likely represent the little brown bat for two reasons. First, the northern long-eared has low intensity calls, and is thus not recorded as well as the little brown bat (Miller and Treat 1993, Broders et al., 2004). Secondly, the northern long-eared is a recognized forest interior species (Sasse and Pekins, 1996, Broders et al., 2006, Henderson, 2007) and is less likely to use open areas where the acoustic sampling was done for foraging and commuting.

The trapping survey on the Donkin peninsula confirmed the presence of two Myotis species bats, i.e., the little brown bat and the northern long-eared bat. All of the echolocation sequences recorded on the Donkin peninsula were attributable to these Myotis species. The confirmation of these two species was expected as these are the only bat species with significant populations in Nova Scotia (Broders et al., 2003b). The capture of lactating and/or post-lactating females and juvenile bats provides evidence of maternity colonies on the peninsula. Spatially, the high number of recorded call sequences on the clearing for the proposed road likely reflects proximity to a local maternity roost.

All 19 little brown bats were captured at a single location, i.e., trap site 2. This is a generalist species known to forage in a variety of habitats, including open areas, along forest edges and over water (Anthony and Kunz, 1977, Fenton and Barclay, 1980, van Zyll de Jong, 1985). Trap site 2 was located near the DEVCO settling pond and Baileys wetland which together would provide an ample foraging area for the species. Little brown bats are also generalists in terms of roosting as they roost in buildings as well as cavities or cracks in trees (van Zyll de Jong, 1985, Crampton and Barclay, 1998, Broders and Forbes, 2004). Communication with mine staff on site indicated that bats had not been observed in any nearby buildings; it is therefore likely that the maternity colonies are roosting in trees in the vicinity of trap site 2.

Although captured in fewer numbers, the capture of lactating/post lactating females and juvenile northern long-eared bats also indicates the presence of one or more maternity colonies. This species inhabits forests and primarily roosts in cavities or cracks in trees (Sasse and Pekins, 1996, Broders and Forbes, 2004, Garroway and Broders, in press). Although the species most often roosts in deciduous tree species (Sasse and Pekins, 1996, Menzel et al., 2002, Carter and Feldhamer, 2005), across its range it is known to use coniferous trees depending on what it available in a given landscape (Carter and Feldhamer, 2005, Ford et al., 2006); selection is based on the micro-climate characteristics provided by individual trees. The species is also associated with foraging in forests as it have been found to forage under the forest canopy (LaVal et al., 1977, Broders et al. 2006) in association with vernal pools and forest streams (Brooks and Ford, 2005, Henderson, 2007) rather than in open areas. Therefore, the forest cover and forested wetlands on the Donkin peninsula provide the foraging conditions required by northern long-eared bats.

4.4.7 Odonata

Of the 98 species of odonata that have been encountered on Cape Breton Island, 23 (24%), were identified on the peninsula during the field programs executed in the summer of 2008. A healthy dragonfly diversity and population is an indicator of viable water habitats. As odonata are high on the aquatic food chain, they reflect any uptake of toxins throughout the flora and fauna of the habitat. They also act to reduce populations of pest invertebrates such as biting flies.

4.4.7.1 Odonata Species of Conservation Concern

The following species has been listed by NSDNR as yellow indicating sensitivity to human activities and natural occurrences:

- Muskeg Emerald (*Somatochlora septentrionalis*).

This species is known to reside on Cape Breton Island, and to prefer shallow sphagnum ponds and bogs.

4.4.7.2 Results of Field Programs

As referenced in Section 3.3.2.5 and shown on Figure 3.4, five aquatic habitats were sampled on the peninsula. These are:

- Serpentine Settling Pond (NS1079);
- DEVCO Settling Pond (NS1083);
- Stream from the Serpentine Settling Pond (NS1080);
- Stream from the DEVCO Settling Pond (NS1083); and

Aeshna canadensis Walker 1908, Canada Darner, Androchrome Female, at the Donkin Pond Stream

- Baileys wetland (NS1081).

Although the Schooner Pond Beach Road that runs parallel to Schooner Pond Cove does not provide residence for odonata, there are daily foraging flights over it and the species observed were abundant. Table 4.15 identifies 23 species of odonata recorded by location; the full odonata report is provided in Appendix G.

Table 4-15: Odonata Species Recorded

Location	*ADIP Ref.*	*# Species Recorded*	*Species Recorded*
Serpentine Settling Pond	NS1079	10	***Lestes forcipatus*** Sweetflag Spreadwing ***Enallagma civile*** Familiar Bluet ***Ischnura verticalis*** Eastern Forktail ***Aeshna canadensis*** Canada Darner ***Aeshna u. umbrosa*** Shadow Darner ***Anax junius*** Common Green Darner ***Pantala flavescens*** Wandering Glider ***Pantala hymenaea*** Spot-winged Glider ***Plathemis lydia*** Common Whitetail ***Sympetrum internum*** Cherry-faced Meadowhawk
Drainage channel from the Serpentine Settling Pond	NS1080	8	***Ischnura verticalis*** Eastern Forktail ***Aeshna canadensis*** Canada Darner ***Aeshna u. umbrosa*** Shadow Darner ***Anax junius*** Common Green ***Cordulegaster diastatops*** Delta-spotted Spiketail ***Leucorrhinia hudsonica*** Hudsonian Whiteface ***Libellula quadrimaculata*** Four-spotted Skimmer ***Sympetrum internum*** Cherry-faced Meadowhawk
DEVCO Settling Pond	NS1083	12	***Lestes disjunctus*** Common Spreadwing ***Enallagma civile*** Familiar Bluet ***Enallagma hageni*** Hagen's Bluet ***Ischnura verticalis*** Eastern Forktail ***Aeshna i. interrupta*** Variable Darner ***Aeshna u. umbrosa*** Shadow Darner ***Anax junius*** Common Green Darner ***Leucorrhinia hudsonica*** Hudsonian Whiteface ***Leucorrhinia intacta*** Dot-tailed Whiteface ***Libellula quadrimaculata*** Four-spotted Skimmer ***Sympetrum internum*** Cherry-faced Meadowhawk ***Sympetrum vicinum*** Autumn Meadowhawk
Discharge channel from the DEVCO Settling Pond	NS1082	9	***Lestes disjunctus*** Common Spreadwing ***Chromagrion conditum*** Aurora Damsel ***Ischnura posita*** Fragile Forktail ***Ischnura verticalis*** Eastern Forktail ***Aeshna canadensis*** Canada Darner ***Anax junius*** Common Green Darner ***Libellula quadrimaculata*** Four-spotted Skimmer ***Sympetrum internum*** Cherry-faced Meadowhawk ***Sympetrum vicinum*** Autumn Meadowhawk
Baileys wetland	NS1081	12	***Lestes disjunctus*** Common Spreadwing

Location	*ADIP Ref.*	*# Species Recorded*	*Species Recorded*
			Enallagma boreale Boreal Bluet ***Enallagma civile*** Familiar Bluet ***Enallagma hageni*** Hagen's Bluet ***Ischnura verticalis*** Eastern Forktail ***Aeshna u. umbrosa*** Shadow Darner ***Epitheca spinigera*** Spiny Baskettail ***Ladona julia*** Chalk-fronted Corporal ***Libellula quadrimaculata*** Four-spotted Skimmer ***Pantala flavescens*** Wandering Glider ***Sympetrum internum*** Cherry-faced Meadowhawk ***Sympetrum vicinum*** Autumn Meadowhawk
Schooner Pond Beach Road	NS1102	2	***Aeshna i. interrupta*** Variable Darner ***Pantala flavescens*** Wandering Glider

The yellow referenced species, muskeg emerald (*Somatochlora septentionalis*), identified in Section 4.4.7.1, was not among the 23 species found on the Donkin peninsula. One species of conservation interest in Nova Scotia, however, was encountered. This was the Sweet flag Spreadwing (*Lestes forcipatus*) which is identified by NSDNR. It is an inhabitant of diverse still and slow waters and was ranked as Indeterminate due to past confusion with the common *L. disjunctis*. It appears to be not uncommon in the Province. The species taken was of a single female in the Serpentine Settling Pond; it may have been wandering from the more mature DEVCO Settling Pond or from Baileys wetland.

4.4.8 Fish and Shellfish

DFO through the Significant Habitats Atlantic Coast Initiative ("SHACI") has designated Scaterie Island, the Donkin peninsula and the northern portion of Cape Breton as SHACI Unit area #11, or the Sydney Bight. The offshore marine waters of Sydney Bight are home to a diverse assemblage of fish species which inhabit a variety of habitat types. Some species migrate in and out of the area seasonally, using Sydney Bight as a spawning, nursery or overwintering area. Other species pass through on their way to the Gulf of St. Lawrence, the Bras d'Or Lakes and the many rivers and streams that run into Sydney Bight. There is a great deal of information on the commercially fished species, but little information on the non-commercial species (Schaefer et al, 2004).

The pelagic and demersal fish species found around the Donkin peninsula are those that are common to the nearshore waters of coastal Nova Scotia. At least 45 different fish species have been identified in the waters of Sydney Bight. Most are wide spread, and their species composition does not change markedly by season. There are a few species that are restricted to shallower reaches including the nearshore waters around the Donkin peninsula; these include immature cod (*Gadus morhua*), white flounder (*Pseudopleuronectes americanus*), immature white hake (*Urophycis tenuis*) and shorthorn sculpin (*Myoxocephalus scorpius*). Sydney Bight waters are recognized as important overwintering areas for migratory populations of cod, American plaice, white hake, witch flounder, redfish and herring (Schaefer, 2004). Several catadromous and anadromous fish species are also found in the estuaries and rivers feeding into Sydney Bight.

4.4.8.1 Fish Species at Risk or of Conservation Concern

As referenced in Table 4.13, three species of fish were identified as potentially inhabiting the waters in and around the peninsula. These are described below.

Atlantic Salmon (Salmo salar)

Atlantic salmon are anadromous, spending part of their life feeding and growing during long migrations in the sea, and then returning to reproduce in their natal streams. Thirty-two streams feeding into the Sydney Bight have been identified by DFO and anglers as salmon rivers, including Big Glace Bay Lake. Indeed, any river that is not intermittent in the study area is potential Atlantic salmon habitat (Hart, 2007 and Schaefer et al., 2004). In 2001, Inner Bay of Fundy populations were designated as endangered species by *SARA*. As a result, all Inner Bay of Fundy rivers have been closed to recreational and commercial fishing. The populations that utilize habitat within the study area, however, are not in danger of extinction, but they are of concern due to the declining numbers returning to their natal streams.

Young salmon (smolt) usually live in the shallow riffle areas that are between 25 to 26 cm deep that have gravel, rubble, rock or boulder bottoms. Adult salmon that have spawned either immediately return to sea before winter, or remain in the stream until spring (NSDNR, 2007). The preferred freshwater habitats for each life stage of Atlantic salmon are riffles and pools with a high percentage of pebble and gravel substrate. An optimal temperature for the growth of the Atlantic salmon is 16^{o}C (Scott and Scott, 1988). Given that most salmon stocks along the Atlantic coast of Nova Scotia are either extirpated, or at risk of extirpation, any river that currently supports salmon is important habitat for this species.

For Sydney Bight, Atlantic salmon return to spawn upriver in June and subsequently over-winter on the Grand Banks. Those that do not enter the rivers in June, tend to remain locally along the coast for longer periods. The resultant variability in the amount of time spent by salmon in the estuaries has important implications when estimating the effect of toxins and pollutants on salmon in the estuaries (Shaefer et al, 2004).

Brook Trout (Salvelinus fontinalis) and Brown Trout (Salmo trutta)

Brook trout have been listed as a species of concern by NSDNR. They spawn during October and November in shallow, gravelly areas of streams with clean bottoms and good water flows. Brook trout only migrate into the estuaries for short periods of time, and migrate to sea in response to crowded conditions, low food supplies, or unfavourable temperatures in the estuary waters. Not all fish in a population migrate, nor do they necessarily migrate every year (Gilhen, 1971). The DEVCO settling pond and Baileys wetland are currently stocked with brook trout by the Port Morien Wildlife Association (Kennedy, pers. comm., 2007).

Striped Bass (Morone saxatalis)

The Bay of Fundy population has been federally legislated as ‘Threatened’ by COSEWIC due to repeat spawning failure that has led to the disappearance of the Annapolis and Saint John River populations. It is known that Big Glace Bay supports a small run of striped bass, but little specific data is available. They are anadromous and spawn from May to June when temperatures are 15^{o}C. They prefer to spawn in tidal bores, or in river areas that are tidally influenced.

4.4.8.2 Results of Field Programs

The largest freshwater bodies in proximity to the project site are the DEVCO settling pond and Baileys wetland as well as their outlets into Schooner Pond Cove. As detailed in section 3.3.2.6, fish habitat assessments were conducted at three sites as depicted on Figure 3.4: Baileys wetland adjacent to the Schooner Pond Beach Road (FW-1); at the headwater stream of Baileys wetland (FW-2); and in the north eastern drainage channel of Baileys wetland (FW-3). Water quality samples were taken at each of these three sites. Table 4.16 presents the water quality results from the sites sampled and references criteria from the CCME Freshwater Aquatic Life Guidelines for TSS for salmonids.

Table 4-16: Water Quality Measurements at Selected Sites

			FW-1	***FW-2***	***FW-3***
		CCME FWAL Guidelines			
Coordinates	E		743758.0	743884.3	744073.8
	N		5118640.8	5118669.3	5118106.9
Time of sampling		July 15, 2008	09:45	11:30	14:00
pH		6.5-9.0	6.55	5	6.57
DO	mg/l	5.5-9.5	7.84	6.87	4.95
EC	Mm	50-800	190.2	129.1	2.88m*S*
Temp.	°C	10.8-21	21.7	17.6	24.8
TDS	Mm	No limits	162	101	2.62m*S*
TN	mg/l	1.37-2.20	0.85	0.54	0.23
TP	mg/l	*	0.05	0.06	0.07
TSS#	mg/l	10 *(above background levels)*	9	30	41

DO – Dissolved oxygen, EC - Electrical Conductivity, TDS – Total Dissolved Solids, Temp. – Water temperature, TSS – Total suspended solids, TP – Total phosphorus, TN – Total nitrogen

*Canadian trigger ranges, total phosphorus (mg/l):

Ultra-oligotrophic	<.0004	Meso-eutrophic	0.020-0.035
Oligotrophic	0.004-0.010	Eutrophic	0.035-1.000
Mesotrophic	0.010-0.020	Hyper-eutrophic	>1.000


Outlet of Baileys wetland (FW-1)

Baileys wetland surrounds a pond that is approximately 370 m long by 200 m, at its widest point. The pond at FW-1 is shallow, i.e., less than 1.5 m in depth. An existing control structure at the outlet of the pond constricts the flow of water into Schooner Pond Cove. The double metal culverts, 1 m in diameter, permit the overflow of water from the wetland into Schooner Pond Cove. Adjacent Schooner Pond Beach Road, the substrate characteristics in Baileys wetland were comprised of gravel (60%), cobble (35%) and sand (10%). Bank vegetation along the perimeter of the pond, adjacent to the road, was limited to grasses and low shrubs. Further inland the bank vegetation changed to black spruce and wetland vegetation. The clarity of the water diminished within approximately 3 m of the shoreline. Based on the concentrations of total phosphorus (0.05 mg/L) Baileys wetland is a productive system (eutrophic), well oxygenated and can be considered good habitat for brook trout. The water temperatures sampled in July, 2008 were high (21.7^{o}C), and no fish were sampled, or observed, at the site at that time; it is surmised that the fish were at cooler deeper depths, or under the shaded edges of the pond.

In July 2006, minnow traps had been set in both Baileys wetland and the DEVCO settling pond. Species sampled included ninespine stickleback (*Pungitius pungitius*) and the banded killifish (*Fundulus diaphanous*). No brook trout were sampled during the survey, although both ponds have been stocked with brook trout (Kennedy, pers. comm., 2007).

Headwater stream of Bailey's Wetland (FW-2)

FW-2 is a headwater stream feeding into Baileys wetland. At the time of sampling, there was little to no flow, and all the water was emponded. The substrate characteristics at the sampling site consisted of cobble (60%), gravel (15%) and sand (25%); the embeddedness was 25%. The stream banks were undercut, and the bank vegetation consisted of birch, maple and some spruce. The percentage of overhang vegetation was 85% while instream submerging vegetation was approximately 15%. The percentage of instream woody debris was 40%.

The dissolved oxygen concentrations were adequate (6.87 mg/l) and the pH was acidic (5.0). Based on the total phosphorus concentrations (0.06 mg/l), stream productivity was high. TSS concentrations at this site were also quite high (40 mg/l). When TSS concentrations are greater than 25 mg/l, salmonids, such as trout lose the ability to see drifting food; fish conditions are reduced the longer sediments are suspended, particularly during the growing season (DFO, 2006).

A 50 m stretch of this headwater stream was electrofished in 2008. No fish were sampled, likely related to poor water quality and little to no stream flow. The habitat characteristics of the stream could, however, accommodate brook trout during heavier flow events, during the spring and fall.

The third sampling location was FW-3 in the northeastern channel of Baileys wetland. Conductivity, TSS and TDS concentrations were quite high, 2.88 m*S*, 41mg/l and 2.62 m*S* respectively. The intrusion of salt water from Schooner Pond Cove has influenced the water quality in this channel, and it could not likely sustain fish populations.

In addition to the water quality sampling program, benthic macro-invertebrate samples were taken at each site: FW-1, FW-2, and FW-3

Drainage channel from the DEVCO Settling Pond near Baileys wetland (FW-3) using a Surber sampler. A sediment description for each Surber sample is presented in Table 4.17. Sediment characteristics at each of the sites varied from gravel and sand to black silt. Sediment at each of the sites also contained aquatic vegetation/ plant debris and animal and shell casings.

Table 4-17: Characteristics of Sediments in Surber Samples, 2008

Sample	***Sediment Description***
FW-1 (Replicates 1-3)	Gravel, aquatic vegetation and plant debris and animal casings
FW-2 (Replicates 1-3)	Sand to gravel sediment, animal casings, leaves and woody debris
FW-3 (Replicates 1-3)	Black silt, gravel aquatic vegetation and plant debris, shells and animal casings.
Grain size classes: cobble=6.4 cm and larger; pebble/gravel=4 mm to 6.4 cm; sand=0.063 mm to 2 mm; silt=0.004 mm to 0.063 mm; clay=<0.004 mm.	

Species identifications, abundance, number of species, % EPT and biomass for Surber samples are presented in Table 4.18. Since Surber samples represent an area of 0.09 m^2, the number of individuals and biomass in each Surber sampler were multiplied by a factor of 11 to give estimates per unit area (per square metre).

Table 4-18: Abundance of Biological Organisms in Aquatic Sediment Samples, 2008

	FW-1			***FW-2***			***FW-3***		
Species	***#1***	***#2***	***#3***	***#1***	***#2***	***#3***	***#1***	***#2***	***#3***
TRICHOPTERA									
Hydropsychidae-*Arctopsyche* sp?								11	
Lepidostomatidae-*Lepidostoma* sp?					44			33	
Polycentropodidae -*Neureclipsis* sp?	22	44	33	22	11			11	
Pupae								33	
Adult-emergent		22							
Unid/damaged				22				33	
DIPTERA									
Ceratopogonidae-*Bezzia* sp		22	11						
Chironomidae-larvae	44	616	1034	1386	363	165	429	77	319
Chironomidae-pupae *(Chironomus sp?)*		55	121						
Chironomidae-pupae *(Orthocladius* sp?)		11	22	99	33				
Diptera-pupae (unid/damaged)		11				11			
Empididae?				11					
Ptychopteridae							11		
Simuliidae pupae-								33	

	FW-1			FW-2			FW-3		
Species	***#1***	***#2***	***#3***	***#1***	***#2***	***#3***	***#1***	***#2***	***#3***
Simulium pictipes?									
Tabanidae						11		11	
Tipulidae-*Antocha*?								11	11
Tipulidae-*Prionocera*?							22		
PLECOPTERA									
Chloroperlidae-*Utaperla*?				429	198			143	
Nemuoridae-*Amphinemura*?								99	
Unid/damaged				11					
LEPIDOPTERA									
Aquatic Lepidoptera					11		11		
COLLEMBOLA									
Smiththuridae					11				
COLEOPTERA									
Dytiscidae-*Agabus sp*							143	11	
Gyrinidae-adult						11	11		
Haliplidae larvae-*Peltodytes* sp?		11				11	143		22
Haliplidae adult							33		11
Haliplidae-*Haliplus sp*?							22		
Hydrophilidae-*Hydrophilus* sp							11		
HYDRACHNIDIA									
Hydrachnidia sp A	11	44							
Hydrachnidia sp B	11	77	33						
Hydrachnidia sp C		11			11				
MEGALOPTERA									
Sialis sp							11		
ODONATA									
Calopterygidae-*Calopteryx sp*						22			
Libellulidae-*Perithemis sp*?				11	11				
HEMIPTERA									
Gerridae-*Gerris sp*	11			22	33				
Gerridae-*Gerris najas*?								11	
Corixidae-*Sigara dorsalis*?		132	33						
Nymph					11				
CRUSTACEA									
Amphipoda-		11	33			275	528		88

	FW-1			FW-2			FW-3		
Species	***#1***	***#2***	***#3***	***#1***	***#2***	***#3***	***#1***	***#2***	***#3***
Hyalella azteca									
Cladocera-*Bosmina sp*?							33		
Cladocera-*Sida crystallina*?	22	143	55						110
Copepoda		11							
Ostracoda						33			
ANNELIDA									
Oligochaeta	44	44		22	11		22		
BIVALVIA									
Pisidum							55		
Sphaerium							55		11
GASTROPODA									
Helisoma trivolvis							11		
Helisoma (Planorbella) campanulatum							99		11
FISH									
Pungitius pungitius-ninespine stickleback							11		
SUMMARY									
Total n/m^2	165	1265	1375	2035	748	539	1661	517	583
# of taxa	7	16	9	10	12	8	19	13	8
Biomass g/m^2	0.7	7.6	12.6	7.8	8.9	0.1	11.6	3.1	1.2
EPT%	13.3	5.22	2.4	23.8	33.8	0	0	70.2	0

Surber samples had a low to moderate diversity of freshwater animals; abundance was moderate to high; and the biomass was low. The % EPT (the ratio of abundance of the insect groups mayflies, caddisflies and stoneflies) ranged from 2.4% to 13.22% at FW-1, 0-33.8% at FW-2 and 0-70.2% at FW-3. Taxa richness of EPT species are useful measures of stream water quality as EPT are considered intolerant taxa to dramatic changes in aquatic systems, such as the release of mine discharge water into a watercourse.

4.4.8.3 Shellfish

The waters around the peninsula also provide a rich habitat for a diversity of marine invertebrates. These species are not endangered, but several species found in this area are commercially important to the surrounding communities; there are also several species that little is known about particularly in the intertidal zone. The distribution of the latter is dependent on daily and historic environmental factors, as well as manmade changes to the environment.

The intertidal zone of Schooner Pond Beach

Lobster (*Homarus americanus*), snow crab (*Chionoecetes opili*) and rock crab (*Cancer irroratus*) are the major commercially-fished invertebrates species in the area. Sea urchins (*Strongylocentrotus* *droebachiensis*) are harvested commercially in many parts of Nova Scotia, but the resource is largely unexploited in Cape Breton. These four species deserve consideration because of their importance as a fisheries resource and their known presence in the waters around the Donkin peninsula (MacLaren Plansearch, 1982). Each is described briefly in the paragraphs below.

American Lobster (Homarus Americanus)

Lobster stocks in Sydney Bight are historically among the most productive in coastal Nova Scotia. With the exception of areas of soft bottom, the entire shore of Eastern Cape Breton could be considered lobster habitat, particularly in waters 40 m deep or less (Figure 4.6). During the spring and summer, lobsters migrate to the shore, into shallower depths. The subsequent movement of lobster larvae, however, is not well understood. Circulation patterns suggest that a high proportion of larvae are retained within Sydney Bight, thus maintaining recruitment of the species along the coast of Cape Breton. Lobster occur nearshore and are present in significant numbers from 200 m to 1 km offshore as is evidenced by the importance of this species to the local fishery.

Atlantic Snow Crab (Chionoecetes opilio)

Snow crab is found in the offshore; they prefer mud or small gravel bottoms. Snow crab larvae may be planktonic for a period of 12 to15 weeks during which time larvae can travel with the currents some distance from their place of origin. Snow crab reach maturity over a period of eight to 10 years and tend to prefer cooler waters, with temperatures ranging between -1 to 4.5^{o}C. Snow crab will move towards shallower waters when the temperatures are optimal, and their food source is available. This tends to be during the winter months from October to May. Trawl surveys indicate that snow crab recruitment populations in Sydney Bight have shrunk since 1997; this trend is expected to continue (Collins et al, 2002).

Rock Crab (Cancer Irroratus)

Rock crab tend to be found in shallower waters, i.e., less than 20 m deep, with a sandy bottom. The Rock crab is an important food source for lobster and is sometimes used as bait by lobster fishermen. Although little is known about this species, it is commonly found in the nearshore of Sydney Bight and around Donkin peninsula on a variety of subtrate (Shaefer, et al., 2004).

Sea Urchin (Strongylocentrotus droebrachiensis)

Urchin roe fishery has not been fully exploited in Cape Breton, but this is slowly changing. Urchins are found in shallow, rocky bottom subtidal areas all along the coast of eastern Cape Breton, including habitat surrounding the Donkin peninsula. This species is usually found in high concentrations in feeding fronts bordering the deep edge of kelp beds. No urchin-kelp cycle has been documented in the Sydney Bight area, but detailed information is lacking making it difficult to draw conclusions. It is likely that urchin spawn in Sydney Bight in March and April and that the larvae are planktonic for several weeks (Shaefer, 2004).

4.5 Socio-economic Setting

4.5.1 Demographics and Economic Activity

The Donkin area is part of CBRM, and the economic challenges that have confronted this larger area have also impacted the local communities. CBRM, formerly known as Cape Breton County[11], is one of four counties on Cape Breton Island and the most densely populated. The economy of the entire area has undergone a major transition over the past decade as both the mines and the steel industry have closed, and the population trends affecting the Donkin area are embedded in the changes taking place within the larger regional economy.

Between 2001 and 2006, Canada's population grew by 5.4%, while Nova Scotia, New Brunswick and Prince Edward Island experienced only marginal population increases and Newfoundland and Labrador experienced a population decline. Within Nova Scotia, population growth was highly centered in a few census divisions while population decline was fairly widespread. According to the 2006 census, the population of CBRM dropped by 3.5 percent from 105,968 in 2001 to 102,250; this is the continuation of a trend that goes back 30 years though the rate of decline may be slowing. Much of this decline can be attributed to younger people moving to Halifax, Toronto and Alberta in search of employment.

The Port Morien census area which includes Big Glace Bay, Birch Cove, Broughton, Donkin, Homeville, Longbeach, Marconi Towers, Morien, Morien Junction, Port Caledonia, Port Morien, Round Island, Sand Lake, Schooner Pond, South Port Morien and Waddens Cove had a population in 2006 of 2,391. The age structure in this area mirrors that in the Province, i.e., "baby boomers" born in the two decades following World War II dominate the demographic profile with a second wave, the "echo boom" caused by those born to the boomers in the 1980s. It is the latter group that is today leaving Cape Breton in search of employment and leaving a top heavy population behind. 19.2% of the population in the Port Morien census division was over 65 compared to 17.7% in the Province and 13.7% in Canada.

In 2001[12], the average income for households in the Donkin area was $40,365 a year, slightly higher than the CBRM average of $39,000, but significantly lower than the Nova Scotia average of $48,657. With regards to income dependency, specific data for the study area was not available, but data derived from the 2003 tax returns for CBRM revealed a trend towards a relatively high dependency on government transfers (29.9%) compared to 21.4 % for Nova Scotia and 16.9% for Canada. The percentage of income generated through employment is therefore significantly lower than the provincial and national rate.
In 2006, unemployment levels in Donkin were approximately 5 percentage points higher than those in CBRM and about 7 percent higher than in the rest of Nova Scotia. Following a steep rise in unemployment levels in the area in the early 1990s, unemployment levels declined in the period between 1996 and 2001, and again between 2001 and 2006.

A breakdown of the 2001 employment base indicates that most of the area's inhabitants were employed in the health care and social assistance sector (16.4%), followed by (14.7%), administrative and support, waste management and remediation services (10%) and education services (7.8%).

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[11] On August 1, 1995, CBRM was formed through an amalgamation of eight former municipalities within the County of Cape Breton.

[12] There is no 2006 Census Income data available at the census subdivision level.

The health care sector has been an important source of employment to area's population for over a decade. It is, however, mainly woman who find employment in this sector. Jobs in the retail sector in contrast are fairly evenly split, while the construction sector employs the largest portion of the male labour force. The primary sector[13], once the dominating sector for male employment in this part of Cape Breton, is no longer as important and employs only 5% of the male labour force. The percentage of Donkin inhabitants, however, who are employed in the primary sector (19.5%) is significantly higher than in rural Nova Scotia as a whole (12.0%).[14]

4.5.2 Land Use In and Adjacent the Project Site

Although once settled and some of the lands grazed, since DEVCO closed the mine tunnels, the use of the peninsula has been sparse. Much of the area has been left to revegetate, and regular use has been limited to community access to the headland and the well used trails for walking and ATV use.

As is characteristic in many rural communities, the core social infrastructure in Donkin is the school. The elementary/junior high school accommodates grades primary to nine. Grade 10 to 12 students travel 11 km to Glace Bay High School. The Donkin School has been described as a modern, spacious facility with an excellent student/teacher ratio.[15] The school hosts two clubs – the Sea Cadets and the Boys & Girls Club. The area around the school is perceived as the centre of the community and recent improvements have been undertaken to strengthen this area's role. A new community centre which would also house the Volunteer Fire Department is planned adjacent to the school, community park and playground adding to the function of this area as the village centre. There are no retail outlets in Donkin and residents travel to Port Caledonia, or Port Morien, or beyond, for day to day purchases and other goods and services.

The Donkin community is served by three churches: St. Lukes United, St. Lukes Anglican and St. Gregory's Romanic Catholic Church. At the community level, groups support each other through dances, suppers, teas and other activities. The Donkin Volunteer Fire Department also plays a key role in the social life of the community. The Royal Canadian Legion Branch is active and, among other activities, sponsors a prize and scholarship fund for the Donkin and Glace Bay High Schools. Donkin has a Senior Citizen's Complex and a band hall that belongs to the Donkin Citizen's Brass Band.

Most of the residential development in Donkin is located to the north of the Donkin Highway and is well set back from the coast. The relatively dense settlement pattern is comprised of a traditional street grid which forms about a dozen residential blocks.

4.5.3 Commercial, Aboriginal and Recreational Fisheries

The fishery is an important economic activity for many in the area and the waters around the peninsula are extensively fished. These waters are part of the marine area known as the Sydney Bight which

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[13] The primary sector of industry generally involves the conversion of natural resources into primary products. Primary sector jobs in Donkin include agriculture, forestry, fishing and hunting as well as mining and oil and gas extraction.
[14] *Rural Profile of Nova Scotia,* Canadian Rural Partnership - Rural Secretariat, Atlantic Region, 2005, page 36.
[15] *Community Profile*, Donkin and Port Caledonia Development Association

extends from Cape North to Gabarus/Forchu. Sydney Bight lies within the Northwest Atlantic Fisheries Organization ("NAFO") Division 4Vn, which is further divided into species specific resource zones and areas. The boundaries for Lobster Fishing Area ("LFA") 27 are the same as those for Division 4Vn. This area is widely recognized as one of the most productive lobster fishing grounds in coastal Nova Scotia (Schaefer et. al., 2004). From 1990 to 1998 the volume of landings declined, but in 2001 landings increased (DFO, 2004). Presently, there are 503 licensed fishers in LFA 27, including First Nations fishers. Approximately 36 and 49 vessel operators from the study area consider Port Morien and Glace Bay as their home ports respectively. The annual lobster fishery, which usually lasts from May 15 to July 15, contributes significantly to the economic base of the community. The fishery is the most lucrative economic activity taking place in the immediate vicinity of the site.

Lobster is generally fished within 2.5 km of the shore in water depths of less than 32 m. Rockcrab, scallops, herring for lobster bait, capelin and mackerel are also fished in these nearshore waters. Snow crab and groundfish are fished offshore.

There are two fish processing plants within the study area: Chopper's Lobster Ltd. in Port Morien and Pittman's Lobster in Glace Bay.

Fishers from Membertou fish for lobster and snow crab from Glace Bay, while fishers from Eskasoni fish in the Port Morien and Main-a-dieu areas.

As is detailed in the Mi'Kmaq Ecological Knowledge Study undertaken by MGC (see Section 4.5.5 and Appendix I), fishing is an important tradition and commercial activity for the Mi'Kmaq. Indeed, the commercial and subsistence lobster (Jakej) fishery is one of the most significant traditional use activities identified in the coastal waters surrounding Glace Bay, around Whelan Point, from MacRae Point up to Schooner Pond Cove. Lobster fishing also takes place around Wreck Point and Northern Head and along Port Morien's coast towards Phalen's Bar and South Head. In the coastal waters surrounding the study area, several finfish and shellfish species are also harvested by Mi'Kmaq fishermen; these include mackerel (Amelamow), trout (atoqqwa'su), cod (peju), eel (katew), crab (Mnjinikej), scallops and to a lesser degree sea urchins. Second only to lobster, crab is one of the most important species to the Mi'kmaq fishing community. Inland, around Sand Lake, the Mi'kmaq have also been known to fish for American eel (katew) and Atlantic salmon (plamu).

There is no organized sport fishery within the study area. Several streams and ponds in the vicinity of the study area, including Baileys wetland and the DEVCO settling pond, have been stocked with brook trout by the Port Morien Wildlife Association (Kennedy, pers.comm., 2007). As noted there is no organized recreational fishery, but casual anglers do frequent these water bodies from time to time.

4.5.4 Archaeological Findings

As indicated in Section 3.2.2.8, an archaeological resource impact assessment was conducted on the Donkin peninsula. This was done in two parts: an archival research program and a subsequent field survey. The following sections provide the highlights of the work undertaken.

The earliest recorded land grants from within the study area date to the last half of the nineteenth century. At the southwest end of the study area, Catherine McPherson was granted 100 acres of land in 1860 which spanned both sides of No. 6 Mines Road (Long Beach Road). Immediately north of McPherson's property, Donald McDonald was granted two parcels of land, each 100 acres in size, in the same year. Between 1858 and 1873, John McDonald took up three grants of land amounting to 365 acres to the east, stretching from Schooner Cove to Northern Head. On the south shore of the peninsula, Sara, Ronald, and Alexander McDonald were granted 321 acres in 1879.

In the 1880s, after the property was granted to John McDonald, John McInnis purchased the property and built a Newfoundland-style saltbox house. Ms. Martha Bailey's parents, Ezra and Annie Bailey bought the house and the property from the second owner, one Mr. Baxter. Ms. Bailey lived in the house until the land was purchased by DEVCO in the late 1970s. An interview was conducted with Ms. Bailey and her nephew, Mr. Ronnie Bailey by April MacIntyre on 19 July 2006. Ms. Bailey remembered well the history of the community of Schooner Pond, including the 28 burials at Schooner Pond Head. According to Ms. Bailey, the graves predated her father's purchase of the property and Mr. Baxter, the previous owner, was also not aware of their age or the origin of those buried there. She did not believe that there had been any reports of eroding graves along the shoreline and, indeed, the location of the cemetery is far enough from the coast that they are not under immediate threat. According to Ronnie Bailey, the grave markers are still visible and are spaced approximately 1 m apart in two rows.

The Bailey family grazed cattle from Schooner Pond Head to Wreck Point and their extensive gardens reached the edge of the cemetery at Schooner Pond Head. Other than a farm at the south end of the peninsula owned by a McDonald family, neither Ms. Bailey nor Ronnie Bailey knew of any other homesteads within the study area. Ronnie Bailey did indicate that he knew the location of the McDonald house and that the foundation was still visible, but difficult to find in the overgrowth.

Ms. Bailey was not aware of any occupation or visitation of the area by First Nations peoples.

4.5.4.1 Resource Inventory

Figure 4.7 shows the locations of the several historic resources encountered during the fieldwork undertaken on the peninsula. Maritime Archaeological Resource Inventory Forms were completed for the two sites of high archaeological significance found within the area.

Figure 4.7: Location of Historic Resources on Donkin peninsula

The site of the Bailey homestead is on the south side of the Donkin Mine Access Road and directly to the northwest of the DEVCO settling pond. Located on a small hill, no structural remains of the house or outbuildings exist although the cleared patches of land where the buildings once stood can still be seen as can the driveway into the property. Ms. Bailey indicated that the homestead had been burned and the stone foundation removed when DEVCO acquired the property in the late 1970s. Because the homestead has been demolished, it is of low archaeological potential although it is of high historical sensitivity given its social significance within the community.

The land between the Bailey homestead and the mine site is low and wet and, therefore, is of low archaeological potential. The mine site itself has seen extensive modification relating to the excavation of the two tunnel portals as well as grubbing and clearing for accessory buildings and the land fill platform and disposal pile. At least three concrete building slabs were seen in this area. To the south of the mine site, the land has also been cleared, but now exhibits secondary growth – primarily alders and conifers as well as low blueberry brush. To the southeast of the mine site, a roadway leads to the wind monitoring tower and gravel pit. The land here is primarily black spruce swamp near the gravel pit and secondary alder and conifer growth surrounding the monitoring tower. A large radius of land (approximately 125 m) has been cleared for the tower. The land along this roadway is deemed of low archaeological potential.

To the north of the peninsula, a trail leads along the cliff above Schooner Pond Head and continues around the peninsula to the south. 140 m east of the shoreline of Schooner Pond Cove, an old roadway leads up the hill to the shore line at Schooner Pond Head and follows the shore to Wreck Point. Following the roadway up the hill from the Donkin Mine Access Road, 30 m to the west is the final resting place of the 28 men, women, and children reported to have been buried here, i.e., the Bailey cemetery. The graves are marked by standing sandstone slabs which have since broken and fallen over. At least four marked graves could be found during the field survey. This area is of high archaeological sensitivity.

Further along the shoreline trail, between Schooner Pond Head and Wreck Point, are at least seven cut posts extruding from the cliff face just above an exposed coal seam. This area was identified by Ms. Bailey to be an area where residents of the community extracted coal for their homes. Although the structural remains are related to modern activity, the presence of an exposed coal seam in this area suggests that earlier extraction may have also taken place here. No structural remains of earlier activity are likely to exist given that along the cliff from Schooner Pond to Wreck Point, there is heavy erosion, undercutting, and slumpage.

90 m southeast of this mining activity are the remnants of an old corduroy road over a wetland. Ms. Bailey indicated that this road was built when the SS Watford was grounded off Cape Percy and people from the community came to the shore to salvage metal and other materials from the wreck. Given its modern origin (1940s), this feature is not of archaeological significance. The land on either side of the corduroy road appears to have been cultivated although no evidence of archaeological features could be found, and its low elevation in relation to the high ground to the south suggests that this area, too, is of low archaeological potential.

A wooden cross to the north of Wreck Point serves as a memorial to Mrs. Anita Thiel who died sometime since 2000 and her ashes were spread offshore on Flint Island. Although this site is not one of archaeological significance, it is likely of significance to the community.

4.5.5 Mi'Kmaq Ecological Knowledge

As indicated in Section 3.3.3.2, MGC was contracted to undertake a MEK Study. This is provided in its entirety in Appendix I. The study involved both fieldwork and interviews and focused on an area that extended beyond the Donkin peninsula (see maps in Appendix I). Numerous locations of continued Mi'Kmaq use were identified; these are identified on the referenced mapping and their numbers summarized in Table 4.19.

Table 4-19: Findings of Mi'Kmaq Ecological Knowledge Study

Type of Use	*No. of sites or areas*	*Number of district species*
Food/sustenance	128	14
Medicinal/ceremonial	15	12
Tool/art	4	4

The data were then considered in terms of its availability within the study area, the 10 km buffer zone around the study area and throughout the province.
With respect to the plant and tree resources identified, the majority can be classified as commonly available, if not in the study area, than in other areas of Nova Scotia. This included such plants as Cow Parsnip (Pako'si), Golden Thread (Wisswtaqji'jkl), Flagroot (Ki'kwesu'sk), and Sweetgrass, (*Hierochloe odorata L.*) Switte'. None of the plants documented are provincially or federally protected. The majority of these plants, however, are considered to be very important resources in relation to traditional use in the Mi'kmaq community. Because of their availability, however, any effects from project activities should be minimal.

In regards to food resources, the most significant resource documented was lobster, jakej, and then crab, mnjinikej and urchin. Some of the Unama'ki Mi'kmaq communities utilize the waters off of Donkin, Big Glace Bay through to Borden's Head for their commercial lobster fisheries.

4.5.6 Traffic and Road Network

Coal extracted as part of exploratory works will be delivered to both the Lingan and Point Aconi power plants, as well as the International Coal Terminal in Sydney. As referenced in Section 3.3.3.3, Atlantic Road and Traffic Management have completed a draft TIS for this component of the Project in accordance with NSTIR's Guidelines for Completion of Traffic Impact Studies.

In late September, 2008, the Traffic Impact Study – Proposed Coal Mine, Donkin, Cape Breton Co., NS, was presented to NSTIR in draft form. Discussions between NSTIR, CBRM and the Proponent regarding what is necessary to upgrade the transportation infrastructure are ongoing; the baseline data collected, the assessment of infrastructure capacity and the general recommendations as per the methodology outlined in Section 3.3.3.3 are not expected to change.

4.5.6.1 Scope of TIS

The TIS examined the following within the area studied:

- Existing traffic patterns, including historical increases in traffic volumes and recent collision experience, i.e., during the past five years;

- Integration of expected changes to traffic flow, including the number of vehicle trips generated by the Project during weekday morning and evening peak hours for all Project phases, i.e., the construction and operation, and the distribution of this traffic within roads and intersections;
- Analysis of traffic impacts on roads and intersections, i.e., resulting changes to performance; and
- Road or intersection improvements that may be required to mitigate Project impacts on traffic movements.

The TIS focused primarily on the technical aspects associated with the flow of traffic and the capacity and ability of the road infrastructure to accommodate the anticipated changes in traffic volumes and types. The information and technical assessment completed in the TIS also serves as a resource for consideration of related issues that are of concern to the local communities, e.g., increased noise, dust and safety issues.

The analysis undertaken in the TIS considers the trucking route from the Project site to Route 4 and beyond, i.e., to the Grand Lake Road / SPAR / Highway 125 intersection. As Route 4 is designated as Schedule C maximum weight all year round, the geographical scope of the evaluation in this assessment is limited to the route as shown on Figure 2.5.

4.5.6.2 Conditions Along Proposed Trucking Route

It is anticipated that coal will be delivered to both the Lingan and Point Aconi NSPI plants and to the International Coal Terminal in Sydney. The route from the Project site travels through the communities of Donkin, Port Caledonia, and Big Glace Bay on the Donkin Highway then along Highway 255 to turn onto Dominion Street, just south of Glace Bay, and then onto Wilson Street toward Route 4 and beyond.

The following subsections provide a summary of the infrastructure, traffic loads and related observations as detailed in the TIS for each of the four main sections of the haul route:

i) From the Project site through Donkin along the Long Beach Road and the Donkin Highway, i.e, No. 6 Mines Road, to the intersection with Highway 255, i.e., Dearns Corner (6.8 km)
    - Typically the cross-section consists of a 6.4 m wide pavement with gravel shoulders which are approximately 1.3 m in width;
    - Posted speed limits are 70 and 80 kilometers per hour (“km/hr”) with the exception of that section through the community of Donkin which is posted at 50 km/hr;
    - Based on a machine count, the AADT volume is 1,480 vehicles per day (“vpd”) with 1650 vpd during the average weekday and 120 vehicles per hour (“vph”) during peak afternoon traffic, which is considered a low volume and will allow vehicles to operate safely;
    - Based on the NSTIR collision database for 2002 to 2006, seven collisions were reported, but this figure does not suggest a safety problem on this section of road;
    - Pavement strength testing undertaken by NSTIR indicates that additional asphalt depth is required to increase the pavement strength to enable the road to be designated for Schedule C loading; and
    - Total of 142 driveways were identified along the 6.8 km section of road, i.e., 21 driveways per kilometer, but there is a heavier concentration of driveways in the Donkin community, which has 89 driveways within the 2.7 km 50 km/hr zone i.e., 33 driveways per kilometer.

ii) Along Route 255 from Dearns Corner to the southern limit of Glace Bay (5.1 km)
- The cross-section consists of a 6.6 m wide pavement with gravel shoulders which are approximately 1.5 m in width;
- Upgrading of this section of road by NSTIR in 2006 involved both repaving and ditching;
- Posted speed limits are 70 and 80 km/hr with the exception of 0.5 km of Highway 255 at the south town limits of Glace Bay which is posted at 50 km/hr;
- Based on a machine count, the AADT volume is 2320 vpd with 2500 vpd during the average weekday and 190 vph during peak afternoon traffic, which is considered a low volume and will allow vehicles to operate safely;
- Based on the NSTIR collision database for 2002 to 2006, six collisions were reported, but this does not suggest a safety problem on this section of road;
- Pavement strength testing undertaken by NSTIR indicates that most of the road has sufficient strength for Schedule C loading with the exception of a relatively small length where additional asphalt depth is required to increase pavement strength; and
- Existing bridge at Glace Bay Lake on Highway 255 is not suitable for Schedule C loading.

iii) Along Brookside Street from the southern limit of Glace Bay to Dominion Street (1 km)
- The cross-section of the roadway is classified as suburban: approximately one half of the route consists of a 6.7 m pavement with 1.2 m gravel shoulders (there is a 2.1 m wide gravel walkway behind the ditching on other side of road); the other half of the route consists of a 8.6 m pavement with concrete curb and sidewalk on one side and a 1.3 m gravel shoulder on the other side;
- Posted speed limit is 50 km/hr throughout;
- Based on a machine count, the AADT volume is 4,050 vpd with 4,250 vpd during the average weekday and 350 vph during peak afternoon traffic, which is considered a low volume for a two lane road and will allow vehicles to operate safely;
- Based on the NSTIR collision database for 2002 to 2006, five collisions were reported, but this figure does not suggest a safety problem on this section of road; and
- Pavement strength testing by NSTIR indicates that there is sufficient pavement strength for the route to be designated for Schedule C loading.

iv) Along Wilson Street and Dominion Street to the intersection with Route 4 (4.1 km)
- On Dominion Street, the cross-section consists of a 9.6 m pavement with curb and gutter on both sides and a sidewalk on one side; on Wilson Street, the cross-section consists of a 7.6 m pavement with curb and gutter on the south side and an open ditch on the north side;
- Posted speed limit is 50 km/hr for the length of this suburban roadway and there are 10 pedestrian crosswalks along this stretch of road;
- While machine traffic counts were not available, the consultant estimated the AADT volume to be approximately 5,000 vpd based on manual count information obtained in August 2008;
- Based on the NSTIR collision database for 2002 to 2006, four collisions were reported at the Route 4 / Wilson Road intersection, four on Wilson Road, 20 on Dominion Street and six at the Dominion Street / Brookside Street /School Street intersection; these figures do not suggest existing safety problems on this section of road nor at the moderately traveled intersections;
- Pavement strength testing undertaken by NSTIR indicates that Wilson Road has sufficient pavement strength to be designated for Schedule C loading, but additional asphalt depth is

required on two relatively small portions of Dominion Street to increase pavement strength so that it can be designated for Schedule C loading; and
- The bridge over Renwick Brook to the east of Dominion Street needs to be further evaluated to allow a Schedule C designation.

4.5.6.3 Level of Service Analysis

As indicated in Section 2.4, the execution of the Project will involve increases in both employee vehicle and transport truck movements on these roads. Since most employee trips will be from the higher population areas, i.e., CBRM toward Glace Bay, it is expected that most will travel the Donkin Highway / Long Beach Road to the Project site. From the perspective of passenger vehicles, it was determined that these additional vehicles will not have any measurable effect on the level of service on this road. Further, the truck traffic associated with construction will be in compliance with current vehicle and weight regulations and is not expected to affect road operation.

For the proposed route, an assessment of traffic signals, left turn lanes and level of service ("LOS") was completed for operational traffic – both for 2008 and projected for 2014[16]. The results of the LOS analysis is summarized below.

i) An analysis of needs for traffic signals at the three intersections was undertaken to determine if installation of traffic signals would provide a net positive benefit to intersection operation
   - determined that traffic signals were not warranted at the three key intersections for either 2008 or 2014 projected volumes, including Project generated trips, as the latter will not have a noticeable impact on the traffic at the intersections;

ii) An analysis of the need for left turn lanes was completed at Brookside Street / Dominion Street to determine if the installation of a left turn lane was warranted, but no comparable analysis was completed at Highway 255 and Donkin Highway / Long Beach Road since the traffic volumes at these locations were low:
   - determined that a left turn lane was not warranted to accommodate morning peak traffic, but would be marginally warranted for the existing evening peak volumes; Project generated trips do not, however, have major impact on the need for a left turn lane;

iii) Intersection performance was determined by a LOS analysis, including both projected future traffic and anticipated Project traffic for each of the three major intersections:
   - Donkin Highway / Highway 255 (Dearns Corner) – this intersection has a good level of service and Project generated trips will not have any noticeable impact on intersection performance;
   - School Street / Brookside Street / Dominion Street – the eastbound approach experiences significant delays during the evening peak hour which will increase incrementally with the added Project trips; and
   - Wilson Road / Route 4 – the left turn movement from Wilson Road is expected to experience significant delays for projected traffic, e.g., 2014, with or without additional Project related traffic; Project related trips do not greatly impact overall intersection performance.

[16] A projected traffic volume for 2014 was presented as a reference (assuming 0.5% or 0.8% annual growth) though the Project itself will end before in 2012.

4.5.6.4 Recommendations of the TIS

To achieve designation of the route for Schedule C loading and as a B-Train Route, the TIS made the following recommendations:

- Width of the paved surface and gravel shoulders along the Long Beach Road / Donkin Highway needs to be upgraded to accommodate Project truck traffic, i.e., to the minimum level recommended by NSTIR, i.e., a paved surface of 7 m with gravel shoulders that are 1.5 m in width;
- Signage at 10 pedestrian sidewalks along the route, i.e., Wilson Road and Dominion Street, and should be checked periodically by NSTIR and/or CBRM to ensure that missing or damaged signs are replaced so that proper signage is maintained at all marked crosswalks;
- Improvements to both vertical and horizontal alignment should be considered wherever reconstruction is being undertaken, e.g., on the Donkin Highway where there are two locations of crest vertical curves that may restrict stopping sight distance to driveways;
- Increases in pavement thickness in a number of locations;
- Replacement of the existing timber bridge at Big Glace Bay; and
- Examination of the bridge over Renwick Brook;

The draft TIS also included the following recommendations that have been accepted by the Proponent:

- Liaise with School Bus Conveyance officials to ensure that trucks transporting coal do not operate on road sections at the same time as school buses;
- Disallow the use of engine brakes in residential areas;
- Provision of truck washing facilities at the Project site;
- Covering of loads, i.e., coal, as appropriate; and
- Compliance with all requirements of the Motor Vehicle Act.

Chapter 5 Community Engagement and Consultation Program

Since Xstrata first took over the interest in the Donkin subsea coal license, they have executed their commitment to keep the local communities and all interested parties informed of the work that is taking place, including the numerous studies that are being executed. The potential of reopening this mine would represent a substantive undertaking, and Xstrata has always been open and transparent in stating that the company must undertake the necessary steps to fully evaluate the coal resource. The Donkin Underground Exploration Project that is the subject of this environmental assessment is a critical step in this process, and this has been communicated to the CLC, to the local communities and to other involved and interested parties in various forums. The community has been informed as part of the ongoing community engagement and consultation program that the Project is an extension of the ongoing exploration activities undertaken by the Proponent under their Special License.

The purpose of the community engagement and consultation program with respect to this Project is twofold:

i) to inform stakeholders and the community about existing and proposed activities being undertaken with respect to the Donkin Mine including specific reference to the Underground Exploration Project; and
ii) to identify any issues of concern raised by the stakeholders during the planning and design phase of the Project.

Stakeholders are defined as individuals, communities, non-governmental organizations, private organizations, government agencies and others having an interest or a "stake" in the Project and its outcome. Stakeholders may be impacted by or may influence the planning and operations of the Underground Exploration Project to varying degrees through the different phases of study and project execution.

As an integral part of Xstrata's Community Engagement Strategy and the various regulatory processes necessary to advance the feasibility, assessment and design of the subsea mine, stakeholders have been identified depending on the anticipated level of impact that the anticipated works may have on them and their expected level of interest in the Underground Exploration Project; these stakeholder groupings are:

- **Level One (L1) Stakeholders -** Those expected to have a high level of interest in activities and decisions associated with works on the Donkin peninsula. These would include mine employees and neighbours, i.e., residents within 3 km of the site, residents of Donkin, Port Morien and Port Caledonia, government organizations and First Nations;
- **Level Two (L2) Stakeholders -** Those expected to have a medium/semi-frequent level of interest in activities and decisions associated with mining the Donkin Resource Block. These would include business interests, labour unions, academics, environmental and non-government organizations; and
- **Level Three (L3) Stakeholders -** Those expected to have a low, or infrequent, level of interest in activities and decisions associated with the Donkin mine; these would include residents and non-government organizations in the greater CBRM area, other parts of Cape Breton and Nova Scotia at large.

Appendix K provides data on the stakeholders identified, the anticipated concerns, and the community engagement measures that are or will be employed. The stakeholders' concerns are varied and include a range of issues that are assessed as part of this environmental assessment process, or will be addressed through detailed engineering and/or subsequent environmental management. Engagement measures since the outset of activities by Xstrata have included public meetings, surveys, the establishment of the Xstrata drop-in office at Glace Bay and the creation of the CLC.

5.1 Community Consultation

A stakeholder database was compiled in consultation with representatives of the NSDNR, through discussions with the business community in Sydney, Glace Bay, Donkin and Port Morien and through visits to area residents and community organizations who had expressed an early interest in the reopening of the Donkin Mine. The database includes organizations representing First Nations, businesses, academics, as well as environmental, health and safety and socially oriented stakeholder groups from the local area, CBRM and the Province. The focus of this initial stakeholder list was to identify and organize a first round of community meetings. As the early meetings took place, other stakeholders were identified and added to the list (see Appendix K).

Since the official announcement of the proposed reopening of the Donkin Coal Mine in December 2005, community consultation has been proactive and is ongoing. It has been an open, multi-dimensional process involving:

- the creation of a CLC;
- the establishment of a drop-in area at the Project office in Glace Bay;
- the preparation and distribution of Donkin Coal Link newsletters;
- the organization and holding of presentations and meetings;
- mail-drops;
- publicly advertised meetings and Open Houses; and
- the establishment of an issue tracking and response system.

Ongoing community engagement as this Project, i.e., the Donkin Underground Exploration Project, and other work progresses will continue to be founded on open dialogue with the identified stakeholder groups. The Donkin Coal Link newsletter will be prepared and distributed to ensure that a wide audience is kept informed of activities associated with the planning and execution of activities associated with this Project and, in the longer term, the longwall mine. Additional meetings and open houses will be planned as required as an integral part of the ongoing process. Beyond the environmental assessment of this Project, as indicted in Section 1.4.2, an environmental assessment for the proposed longwall mine and transportation corridor will be submitted to the regulatory authorities; further input will be sought from the community in respect to that undertaking. Further, given the Proponent's commitment to the local communities, stakeholders' input will continue to be identified, tracked and considered as the Project is implemented and goes into operation.

5.1.1 Project Office Drop-in area

The Proponent has established an open-door-policy in its Glace Bay Project office. Community residents are encouraged to visit the office to discuss their concerns and learn more about the overall project from Project staff in a comfortable atmosphere. A log of drop-in visitors' names, contact information, comments and concerns is maintained to ensure that the necessary information is passed on as warranted for a response or follow-up action.

Office drop in area

5.1.2 Donkin Link Newsletter

The Donkin Link community newsletter is an important communication tool and has been widely distributed. To date four newsletters have been distributed. The first newsletter was distributed in late May 2006 and focused on introducing the Project and the Proponent team members. The second distribution occurred in December 2006 and focused on the introduction of the CLC members, community initiatives and the site work that had to that date been undertaken. The third newsletter, distributed in October 2007, focused on the information presented and the findings of the Open Houses held in Donkin and Sydney in May, 2007; the fourth newsletter was distributed in August, 2008 and introduced the need to undertake additional exploratory work. Copies of the Newsletters can be viewed at www.doncal.com.

5.1.3 Community Meetings/Presentations

As part of its communication strategy, the Proponent prepared a presentation which introduces the Xstrata Plc (the parent company), Xstrata Coal, XCDM and the overall project. The presentation illustrates Xstrata Coal's commitment to its HSEC Vision and Values as demonstrated through the execution of the Company's Sustainable Development Policy (see Figure 5.1). Specifically these visions and values look for opportunities within the communities to provide support for projects that meet the Proponent's corporate social involvement criteria.

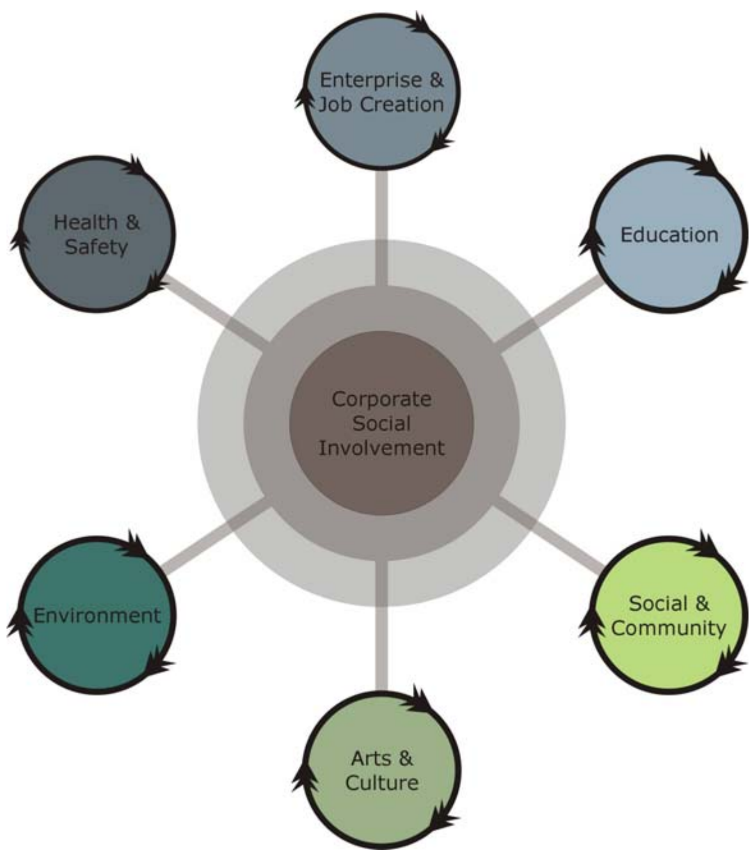

Figure 5.1 Corporate Social Policy

As of September 2008, 37 meetings and presentations had been held with 43 groups. The database created from the sign-in sheets and head counts indicates that approximately 700 participants have been involved. Meeting participants are always encouraged to ask questions and to enter into discussion. The feedback received from these sessions has been largely positive.

Meetings with stakeholders will continue as required to update individuals and groups on various issues as the Project moves forward. For example, the Port Morien Wildlife Association and the Port Morien / False Bay Fishermen's Associations contributed substantially to the terrestrial and marine databases and will be interested in contributing further to the layout of the surface facilities, to the monitoring of specific project components including the maintenance dewatering associated with the tunnels and to the design of habitat protection planning.

5.1.4 Community Mail Drops and Mail outs

To provide neighbours with every opportunity to discuss the proposed reopening of the subsea mine with the Proponent, a mail drop to all homes within 3 km of the site was undertaken in June 2006. A total of 50 letters were distributed. As a result of this initiative, one resident requested an in-home meeting. This response is an indication of the success of the broad community consultation program.

5.1.5 Community Liaison Committee

A decision was taken early in the consultation process to establish a CLC. The CLC's role is:

- to provide a forum for discussion between representatives of the Proponent, the community, the government and other stakeholders on issues directly relating to mine activities;
- to keep the community informed on work being undertaken; and
- to actively involve those with the greatest interest in the proposed activities.

Xstrata Coal organized Schooner Pond Beach Sweep

The Schooner Pond Beach Sweep has become an annual event having been held in 2006, 2007 and 2008

In July, 2006, an Expression of Interest inviting nominations for the CLC was published in the Cape Breton Post. It outlined the Proponent's desire to continue to build a constructive working relationship with the community and to facilitate community engagement. The resulting nomination process was transparent; community members were nominated by their peers and then independently selected based on their history of community involvement and experience of working with small groups. The nine member committee has seven community members, including a local fisher, CBRM Councillor from the Donkin and Port Morien constituency, Port Caledonia and Donkin and Port Morien Rural Development associations ("RDA") members, a shop owner and a retired school teacher. The remaining two members are the Donkin Project Manager and CBCL Community Support leader. The "Xstrata Coal

Donkin Mine Project Community Liaison Committee Guideline" meets the intent of NSEL's "Guidelines for Formation of a Community Liaison Committee" and is included in Appendix L.

The nine member committee held its first meeting on August 17, 2006. Meetings are scheduled to coincide with project milestones, or as needed to address community concerns. The CLC has had twelve meetings to date, including a meeting on the 15th of October to discuss, among other matters, the Donkin Underground Exploration Project. Information from these meetings has been, and will be, widely distributed within the community via CLC members, through the RDAs and through the online posting of meeting minutes at www.doncal.com.

Through this partnership, CLC members are helping the Proponent to define critical issues, shape aspects of the operating mine's design and execution and identify other community engagement opportunities as part of the Proponent's corporate social involvement policy. In addition to regular meetings, the CLC has organized community events such as the 2006, 2007 and 2008 Schooner Pond Beach Sweeps and a senior's lunch co-organized with local church representatives. CLC members also worked with the Proponent to organize and host the Open Houses held in Donkin and Sydney in May 2007.

5.1.6 Open Houses and Community Meeting

5.1.6.1 Open Houses

To date, two publicly advertised Open Houses have been held. The first took place on May 9th, 2007 at the Donkin Firehall between 2:00 pm and 9:00 pm. The second occurred on May 10th, 2007, at the Membertou Trade and Convention Centre in Sydney with the same hours. The Open Houses were advertised in the Cape Breton Post, on radio and through the distribution of posters in the Donkin/Port Morien area. Interested and involved First Nations officials, CBRM Council, and federal and provincial government regulators received mailed invitations. The intent was to provide information on the work that had been undertaken to that point in time, to indicate the data that had been compiled and to attain feedback on a number of issues, including coal transportation options.

The Open House display material included:

- 17 story boards providing information on the works proposed on the Donkin peninsula, the transportation options and the environmental work undertaken;
- a presentation of mine and area photographs;
- Donkin Link Newsletters;
- Xstrata Coal fact sheets on the Beltana Mine under the vineyards of the Hunter Valley in Australia; the Glennies Creek Rehabilitation Project; Biodiversity Management and Climate Change Policies; and
- Xstrata's HSEC Policy.

The sign-in sheets for these open house sessions indicate that at least 172 individuals were in attendance.

Summary of Open House Findings

Questions were raised, and there was discussion on several topics, but there was overall support for the intent to work towards the reopening of the Donkin Mine and appreciation expressed at the dialogue the

Proponent had entered into with the immediate community and all interested parties. Community priorities included the maintenance of peace, tranquility, environmental protection, safety and economic development.

Responses to the questionnaire indicated that:

- Survey respondents are confident that Xstrata Coal is and will continue to do a good job in engaging the community and in taking into account the issues raised;
- Most respondents supported rail transportation, while only a few supported the development of either a marine terminal or a purpose built trucking road; and
- Respondents opposed trucking on local roads.

5.1.6.2 Donkin Community Meeting

The Donkin Port Caledonia Rural Development Association invited the Proponent to a community meeting on October 16th, 2008, to provide an update on the Project including work that had been undertaken over the summer and, in particular, the purpose and timeline of the Underground Exploration Phase. Notice of this meeting was provided by:

- the distribution of approximately 200 fliers to residences along the Brookside, Dominion and Wilson roads; and
- posted notices at the Port Morien and Donkin post offices and at the Hoppers and Beachside stores.

In addition, a notice of the meeting was sent home via all students of the Donkin – Gowrie school complex and the meeting notice was also posted on the community website (www.doncal.com). The CLC worked closely with the Donkin Port Caledonia Rural Development Association in preparing for the meeting; most members of the CLC were in attendance. The proponents and members of the study team were also in attendance.

Val Istomin, the Donkin Project Manager, provided a comprehensive update on where Xstrata were with respect to the work that has been accomplished to date and the company's intent moving forward. He explained the need for the Project and what its execution would involve including the short term trucking of coal starting in 2010. After the presentation the floor was opened to questions and discussion. Although some expressed disappointment that coal had to be moved by truck, there was acceptance of this requirement provided that:

- necessary road and sidewalk improvements are undertaken;
- roads used have the requisite capacity and safety margins in place to accommodate the anticipated truck volumes; and
- necessary works are undertaken in a timely manner, i.e., "*roads before trucks*".

It was pointed out from the floor that the road verges along portions of the proposed haul route are used as paths by the elderly and by children. The need for side walks has been pursued by residents for many years and is seen as an integral part of the necessary road upgrading program to accommodate the trucks. Other issues raised included:

- the need to control the speed of the trucks;
- assurance that safety would be a priority, e.g., limiting truck movements during the periods when the school buses are operating on the haul route; and

- noise from the mine ventilation fans.

All questions were answered, and the issues raised are addressed in Chapter 7.

On balance, it was a well attended and supportive meeting. 76 attendees signed the attendance register, but there were likely closer to 100 people in the hall. Based on the information provided in the register, there was attendance from people from a wide area including Glace Bay, Port Morien, Lingan, Port Caledonia and Sydney; most, however, came from the Donkin area.

Of those in attendance, thirty completed and left questionnaires. Issues and observations raised in the questionnaires mirrored those discussed from the floor; the following are among the repeated issues raised:

- the haul route must be upgraded to a standard to accommodate predicted truck weights and volumes;
- the necessary improvements to the road must be undertaken before commencement of coal haulage, i.e., 2010;
- dust;
- noise;
- the need to control traffic speed; and
- the sooner coal can be transported by rail the better.

Beyond the issues that were raised, the following are some of the supportive observations provided in the questionnaires:

> *"in fifty years living here – this is the most positive advancement that I have seen"*

> *"trade off – 1-3 years of trucking for new road and concrete sidewalks – OK"*

Based on the issues and questions raised both from the floor and in the questionnaires, there was support for the Project moving ahead as long as the commitments made to address issues of road capacity and pedestrian safety were implemented. No one spoke against the Project as presented.

5.2 Regulatory Consultation

Stakeholder consultation with federal and provincial regulatory authorities commenced in 2006 and is ongoing. Much of the initial contact was associated with the dewatering of the tunnels. This involved consultation with DFO, NSE, NSDNR and EC. No formal permit was required for the discharge. DFO, however, did indicate that no discharge be released during the lobster fishing season (May 15 – August 1). The dewatering of the tunnels was an essential first step in the prefeasibility study; it was also a challenging task. Its successful execution is due in large measure to the successful dialogue that was established with the fishers and the regulatory departments involved.

The Proponent and the study team have independently and together met and communicated with representatives of several federal and provincial departments as well as staff at CBRM in the execution of this environmental assessment. This has involved requests for and discussions about specific databases, meetings to discuss the regulatory route for the Project and focused discussions on specific ecological databases as well as the technical requirements associated with the traffic impact study for the haul routes. These meetings will continue as necessary to share information and to respond to questions.

In June 2008, there were two meetings with regulators with respect to both the Donkin Mine and the Exploration Project. On June 6th the study team updated provincial and federal regulators, i.e., NSE, NSDTIR, NSDNR, Canadian Environmental Assessment Agency, DFO, EC, PWGSC, OHS, ECBC, OAA and Health Canada, about the status of:

i) the field programs being undertaken both on the Donkin peninsula and along the transportation corridor to address comments that had been raised following the submission of the draft environmental assessment to NSE in 2007 and the current design parameters of the proposed subsea mine and associated transportation corridor; and
ii) the data that Xstrata Coal requires before they can commit to a decision to reopen a commercial subsea longwall mine at Donkin.

The latter highlighted the fact that the Proponent would be seeking approval to conduct further exploration work subsea prior to making a commitment to proceed with the longwall mine. In turn, this raised the question as to whether the Underground Exploration Project as defined would itself be subject to an environmental assessment.

The Underground Exploration Project was subsequently the topic of a One Window meeting chaired by NSDNR at which time the Proponent outlined the need for additional data on the subsea coal resource prior to proceeding with the development of a longwall mine. The regulators provided details of the requirements of their respective regulatory processes. NSE participated in the One Window meeting, but indicated that they required additional time to review the scope of the Underground Exploration Project prior to making a decision as to whether an environmental assessment would be required. At the end of July, 2008, the Environmental Assessment Branch of NSE determined that the Project did trigger a Class 1 Environmental Assessment under the Environmental Assessment Regulations because it was deemed to be a facility engaged in the extraction or processing of coal. This document has been produced in response to that requirement.

5.3 First Nations

There are five Mi'kmaq communities in Cape Breton: Membertou, Eskasoni, Chapel Island, Wagmatcook and Waycobah. Membertou, located in Sydney, is the community located closest to the Project site. To date the following steps have been taken:

i) meeting with representatives of the Membertou First Nation in March 2007 to inform them of the Project, the work that had been done to date and to extend an offer to provide the same information to other First Nations communities on Cape Breton;
ii) meeting with members of the Chapel Island First Nation for a project update and briefing; and
iii) letters sent to the Union of Nova Scotia Indians, the Confederacy of Mainland Mi'Kmaqs and the Native Council of Nova Scotia informing them of the Open Houses in May, 2007.

Prior to the formal submission of this environmental assessment registration document to the Province, the Proponent provided written notice of the status of the Project to the following:

- Assembly of Nova Scotia Mi'Kmaq Chiefs;
- Union of Nova Scotia Indians;
- Confederacy of Mainland Mi'Kmaq;
- Kwilmu'ku-Klusaugn;
- Native Council of Nova Scotia;
- Nova Scotia Department of Aboriginal Affairs; and
- The Chiefs of the five Mi'Kmaq communities in Cape Breton as referenced above.

The above and the five Mi'Kmaq communities also receive copies of the newsletters.

The Proponent will continue to inform the First Nations about the status of the Project as studies proceed and will provide all parties the opportunity to meet with Project personnel, to visit the Project site and to learn more of the company's operating policies.

As an integral part of the environmental assessment process and as documented herein, the Proponent contracted MGC to conduct a MEKS.

5.4 Issues Tracked

The Proponent has instigated an issues tracking process to enable concerns or questions to be addressed in a timely manner. Issues raised through the engagement and consultation process have been tracked; actions arising have been assigned to appropriate team members to allow them to be directly addressed in a timely manner, or incorporated into the project planning and assessment processes. Issues raised have influenced the scope of the environmental assessment and are addressed in Chapter 7, as well as being discussed at the CLC.

The issues identified as part of the consultation process have been broad and have influenced the assessment process. Issues have included, but are not limited to: health and safety; truck traffic; project environmental and operational performance; support for neighbouring community events; economic development opportunities; and a general interest due to history of mining.

Chapter 6 Approach to Environmental Evaluation

6.1 Scoping: VECs and Socio-Economic Issues

It is impractical, if not impossible, for an assessment to address all of the potential environmental effects that might be directly or indirectly associated with a proposed undertaking. An important part of the assessment process, therefore, is to identify those matters upon which the assessment may be focused to ensure a meaningful and effective evaluation. This process is often referred to as scoping, i.e., an activity designed to identify those components of the biophysical and socio-economic environment which may be impacted by the Project and for which there is public and professional concern (Sadar, 1994). This section references the steps that were taken to focus this assessment and to identify the VECs and socio-economic issues.

As detailed in Chapters 3 and 4, there was both extensive documentary research and the execution of a range of field programs. The resultant database, the input received from federal and provincial authorities to the draft environmental assessment submitted to NSE in November 2007 for the operating mine and transportation corridor, in conjunction with extensive consultation, including consultation with pertinent provincial and federal departments, and the study team's professional expertise and experience, has enabled the definition of the VECs and socio-economic issues. This process has involved internal team workshops and discussions to ensure that the requisite interdisciplinary rigor brought focus to the assessment. These discussions have included the participation of the specialists contracted to execute specific field programs and the engineers involved in the delineation of the Underground Exploration Project. The informed professional judgement of this team, particularly those who have executed the various field programs, and the local knowledge that the CLC brought to the process were important inputs to the determination of the VECs and socio-economic issues identified in Section 6.3. It is these factors that are subject to evaluation in Chapter 7.

6.2 Boundaries

An important factor in the environmental assessment process is the determination of spatial and temporal boundaries for the assessment, i.e., those periods during which, and the areas within which, the VECs and socio-economic issues are likely to interact with, or be influenced by, the Project. Temporal boundaries in this case relate to the duration of the Underground Exploration Project. The latter is by its nature time limited, i.e., 24 to 36 months depending on progress and findings underground.

Spatial boundaries are the areas within which the Project activities are undertaken and associated facilities located, and the zone of influence associated with the effects of the Project, i.e., emissions, effluents and discharges. Although the area that will be impacted by the physical works may be referenced as the Project site, lands in proximity may be affected both directly and indirectly by the proposed works. For example, though Xstrata have committed to preserve public access to the headland, visitors are already aware that changes have taken place at the mine site, e. g., the establishment of the serpentine pond and the dewatering of the subsea tunnels. The execution of the Project will bring further activity to the site. The social and economic consequences of the Project will also have economic consequences not only for the communities in the immediate area, but for CBRM, for Cape Breton and for the Province. The boundaries for different subject matter therefore differ.

The appropriate boundaries are identified for each VEC and socio-economic issue as an integral part of the analysis. The execution of the Project involves the use of lands immediately to the south of the tunnels on the Donkin peninsula, the development of a new road from the active yard area to Long Beach Road. The bulk samples of coal will be trucked to various destinations on public roads; there are, however, no physical works associated with the Project beyond those indicated on Figure 2.2.

6.3 Potential Pathways and the Definition of VECs and Socio-Economic Issues

Once the scope of the Project is determined and the phases of the Project defined, it is possible to identify those facets of the Project that may cause consequences for the receiving environment. This is accomplished by identifying the linkages, or pathways, between the Project and the receiving environment. That is, those components and activities that will be carried out on the site during the execution of the Project that may have the potential to interact with the physical, ecological and/or socio-economic environment. Such pathways will include, but will not be limited to, the generation of effluents and emissions, including noise and dust.

The study team has determined the VECs and socio-economic issues that will be subject to assessment based upon its collective knowledge and experience; input received from the Proponent; review of the regulatory requirements and feedback from the regulatory authorities, the CLC and others as part of the extensive consultation program; and selected field programs. The VECs and socio-economic issues that will be evaluated are identified in Table 6.1.

Table 6-1: Potential VECs and Socio-economic Issues

Physical Components	***Ecological Components***	***Socio-economic Issues***
Surface water quality	Aquatic habitat	Land use
Marine water quality	Baileys wetland	Aboriginal use of lands and resources
Groundwater quality	Other wetlands	Archaeological resources
Air quality	Migratory and breeding birds	Recreation
Ambient light levels	Fauna (Bats)	Economic opportunities
Ambient noise levels	Flora	Traffic
	Odonata	Health and safety
	Species at Risk or of Conservation Concern	

6.4 Analysis and Evaluation Criteria

The definition of "environment" in the *NS Environment Act* is as follows:

> *"Environment" means the components of the earth and includes*
>
> *(i) air, land and water;*
>
> *(ii) the layers of the atmosphere;*

(iii) *organic and inorganic matter and living organisms;*

(iv) *the interacting systems that include components referred to in sub clauses (i) to (iii); and*

(v) *for the purpose of Part IV, the socio-economic, environmental health, cultural and other items referred to in the definition of environmental effect."*

In the provincial legislation *"environmental effect"* means in respect of an undertaking

a) *any change, whether positive or negative, that the undertaking may cause in the environment, including any effect on socio-economic conditions, environmental health, physical and cultural heritage or on any structure, site or thing including those of historical, archaeological, paleontological or architectural significance, and*

b) *any change to the undertaking that may be caused by the environment, whether that change occurs inside or outside the Province.*

This assessment focuses on the evaluation of potential interactions between the VECs and socio-economic issues and the various Project activities outlined in the Project description, i.e., in Chapter 2. A standard evaluation system has been developed to ensure that potential effects are clearly and completely evaluated. Residual environmental effects are those that remain after mitigation and control measures are applied. The prediction of residual environmental effects follows three general steps:

- determining whether an environmental effect is adverse;
- determining whether an adverse environmental effect is significant; and
- determining whether a significant adverse environmental effect is likely to occur.

Many, if not all potential adverse effects, can be avoided through the application of good engineering and construction practices, the careful timing of activities, and the adherence to appropriate environmental management techniques.

The effects evaluation for each VEC and socio-economic issue is conducted by Project phase, including malfunctions and accidents. For each phase, the study team selects those Project activities that may result in a positive or negative effect on the VEC or socio-economic issue. To determine if there are adverse effects, the study team took the following factors into account:

- negative effects on the health of the biota;
- loss of rare and endangered species;
- loss of critical and/or productive habitat;
- fragmentation of habitat;
- transformation of natural landscapes;
- discharge of persistent and/or toxic chemicals;
- reductions in the capacity of renewable resources to meet the needs of present and future generations, including those lands and resources used by aboriginal peoples; and
- interference with the use and enjoyment of property.

The analysis evaluates the interactions between Project activities and the VEC or socio-economic issue and determines the significance of any residual adverse environmental effects, i.e., effects that may persist after all mitigation strategies have been implemented. To determine and appreciate the relevance of residual effects following mitigation, the following definitions of impact have been adhered to:

- *Significant*: Potential impact could threaten sustainability of the resource in the study area and should be considered a management concern - research, monitoring and/or recovery initiatives should be considered; and
- *Negligible*: Potential impact may result in a slight decline in the resource in study area during the life of the project - research, monitoring and/or recovery initiatives would not normally be required.

As not all consequences of Project development and operation on the identified VECs and socio-economic issues are adverse, the above categories have been supplemented by the following two definitions:

- *no impact:* where the consequences of that phase of the Project have no effects on the specific VEC or socio-economic issue; and
- *beneficial impact:* where the consequences of that phase of the Project enhance the specific VEC or socio-economic issues.

6.5 Cumulative Effects

A consideration in any environmental assessment process is how the proposed Project may interact with past, present or likely, i.e., approved, future projects or activities within the defined spatial and temporal timeframes identified. It is, in fact, a way of setting the Project into its broader ecological and regional development context. As has been detailed in Chapter 4, both the peninsula and the marine waters surrounding the peninsula are ecologically rich, factors that are addressed in the evaluation.

The surface works on the peninsula associated with the Project are being planned in areas that have been substantially disturbed by previous industrial activity. There are no other known works proposed for these areas that would act cumulatively with the Project.

Other large capital intensive activities taking place in CBRM include the works being undertaken to remediate the Sydney Tar Ponds and Coke Oven sites in Sydney and, those being undertaken by Public Works and Government Services and by DEVCO to remediate abandoned mine sites. These works will generate demands for labour and equipment in the same general timeframe as the works proposed for the execution of the Project. The truck movements generated by this Project will add to the traffic already using the public road system. Each of these factors is discussed further in Chapter 7.

6.6 Effects of the Environment on the Project

Several naturally occurring environmental factors, including fire, extreme weather events and climate change, may to varying degrees have consequences for the execution of the Project. These are specifically referenced in Section 7.2.

7.1 VECs and Socio-economic Issues

As explained in Chapter 1, this Project will be undertaken within a defined timeline, i.e., a maximum of three years. The first year will involve preparatory works subsea and on the surface; coal will be extracted in years 2 and 3. The parallel testing and evaluation of the product will determine if and how the mining of the coal resources will proceed. This Project is seen as an essential step in the exploratory process and, as such, decommissioning and reclamation in the timeframe associated with the Project are not integral facets of the planned program. This is not to say that decommissioning and reclamation are not taken seriously; they are. They are important facets of the work planned at Donkin that will be addressed in the context of the development of the longwall mine. Should the latter for whatever reason not proceed, the Proponent, as stated in Section 2.4.3, will work with NSDNR under the Special Licence to determine the steps necessary to decommission the site. Such works will be executed in accordance with pertinent regulations and industry standards, as well as in accordance with the Proponent's sustainable development framework. What are evaluated in the sections that follow are the works and activities that will be undertaken in the execution of the Project. These were described in Section 2.4.1 and 2.4.2.

The VECs and socio-economic issues that form the basis of the environmental analysis were identified in Table 6.1. For an impact to occur, there has to be a link between the Project and the VEC or socio-economic issue, i.e., a pathway. Table 7.1 depicts potential interactions and where there is a possibility for impact. Where there is no pathway, there can be no impact on that VEC or socio-economic issue.

Table 7-1: Potential Interactions of Project Activities with VECs/Socio-Economic Issues

	Site Preparation and Construction						Operation and Maintenance						
	Sustainable Development Framework	Tunnel rehabilitation	Surface preparation	Buildings and equipment	Roadway and electrical requirements	Accidents and malfunctions	Sustainable development framework	Underground Exploration	Coal storage and handling	Wastewater treatment	Utilities support	Trucking	Accidents and malfunctions
Physical													
Surface water quality	●		●		●	●	●		●	●	●		●
Marine water quality	●					●	●			●			●
Groundwater quality	●					●	●			●			●

	Site Preparation and Construction						Operation and Maintenance						
	Sustainable Development Framework	Tunnel rehabilitation	Surface preparation	Buildings and equipment	Roadway and electrical requirements	Accidents and malfunctions	Sustainable development framework	Underground Exploration	Coal storage and handling	Wastewater treatment	Utilities support	Trucking	Accidents and malfunctions
Air quality	●		●		●	●	●		●			●	●
Ambient light levels	●						●		●				
Ambient noise levels	●		●	●	●		●		●			●	
Biophysical													
Aquatic habitat	●		●		●	●	●			●			●
Baileys wetland	●					●	●			●			●
Other wetlands	●												
Migratory and breeding birds	●		●		●		●		●	●			●
Fauna (bats)	●		●		●								
Flora	●		●		●								
Odonata	●								●				
Species at Risk or of Conservation Concern	●		●		●								
Socio-economic													
Land use	●		●	●	●				●			●	
Aboriginal use of lands and resources	●												
Archaeological resources	●		●	●	●								
Recreation	●		●				●		●	●		●	
Economic opportunities		●	●	●	●			●	●				
Traffic	●		●	●	●		●						
Health and safety	●	●	●	●	●	●	●	●	●	●	●	●	●

The following sections discuss the boundaries, pathway analysis, mitigative measures, cumulative effects, and predicted residual effects for each physical and biophysical VEC and socio-economic issue.

7.1.1 Surface Water Quality

The quality of the surface water on the Donkin peninsula is important to both the health of the area's ecosystems and to society. Maintaining surface water quality is key to wetland protection; this includes the protection of Baileys wetland, some 500m down gradient to the west of the mine yard. Surface water quality has therefore been identified as a VEC.

A significant environmental effect on surface water quality would result if a substantive change attributable to the Project was identified in the quality of the surface waters on the Donkin peninsula including those associated with Baileys wetland.

7.1.1.1 Boundaries

The spatial boundary associated with any effect on surface water quality is limited to the Donkin peninsula and those water bodies in proximity to the truck haul route. The temporal boundaries relates to the anticipated life of the Project, i.e., no more than 36 months.

7.1.1.2 Pathway Analysis

During surface preparation of the site and the construction of the new access road from Long Beach Road, there are two principle pathways that could affect surface water:

- earth works and grading which have the potential to cause erosion and sedimentation; and
- the leveling of the waste rock piles to accommodate the new road alignment, works which may create a potential for the mobilization of metals, contaminants or acidic runoff to the surface waters of the site.

The surface waters of the Project site are collected by the yard drainage ditch, which directs the water to the serpentine pond as described in Section 2.2.3.6. The serpentine pond also collects water pumped from the underground tunnels after it has passed over the cascade aeration. After treatment in the serpentine pond, the water flows through a drainage channel to the manmade settling pond that was constructed by DEVCO during the original site development. This pond drains through the overflow channel to Schooner Pond Cove. As explained in Section 4.3.5 and as shown on Figure 3.2, the existing surface topography and on-site water management ensures that no runoff from the active coal handling area leaves the site without treatment and monitoring.

Apart from the lining of the serpentine pond, no changes are proposed to this management and treatment system. As described in Section 4.3.6, this management process treated and discharged 470 million litres of mine water during the tunnel dewatering process. This was achieved without incident; the results were shared with and accepted by the CLC, fishers and the regulators.

The wastewater that will be pumped from the underground tunnels, collected as runoff from the Project yard and used as process water is expected to be comparable in quality and quantity to that encountered during the dewatering process. By the exploratory nature of the Project, the exact flows and chemical characteristics of the water cannot be predicted, but will be monitored.

Adverse impacts on surface water quality in this area, i.e., at the DEVCO settling pond or Baileys wetland could occur under the following circumstances:

- failure of the dedicated wastewater treatment system;
- water requiring treatment was not diverted to the system; or
- the dam between the DEVCO settling pond and Baileys wetland failed.

As depicted on Figure 3.2, surface water to the north, south and east of the Project footprint drains towards the coast of the peninsula. Surface waters from the Project yard and immediate environs drain towards the existing drainage channels, the DEVCO settling pond and Baileys wetland. It is these waters that may be impacted by Project activities.

Sewage flows from the wash house will be collected in a tank and regularly emptied by truck, as is currently the practice. The tank will be in-ground and situated for easy truck access (see Section 2.2.3.8). No pathway from this installation is predicted to negatively affect surface water if this system is managed according to industry standards.

Pathways associated with Project activities that may lead to adverse effects on down gradient surface water quality, include:

- Erosion and sedimentation during preparatory activities;
- Mobilization of contaminants from the waste rock piles that remain on site from past development activities;
- Run-off with high metal and sulphur content from the Project yard that drains away from the mine water collection and treatment system; and
- Spills, e.g., fuels or lubricants.

There are also several watercourses and wetlands adjacent the truck haul route, including Big Glace Bay Lake, which would be susceptible to an accidental event involving one of the trucks. Pathways associated with truck transportation that could lead to potential adverse effects on surface water quality in these areas include:

- transportation of sedimentation and coal fines from the site on the trucks being used; and
- spills, e.g., fuel, in the course of the trucking activities; or
- accidental events.

7.1.1.3 Mitigative Measures

The following mitigative measures are proposed to minimize the potential of degradation to surface water quality during the execution of the Project, or as a result of malfunctions and accidents:

- early and efficient installation of erosion and sedimentation control measures and surface water control features, e.g., silt fencing, before earth works within the active yard area and along the new access road are undertaken in accordance with the NSDE Erosion and Sediment Control Handbook;
- collection of all runoff from the active yard area via drainage ditching to the wastewater treatment system;
- collection of all water pumped from the underground tunnels to the same treatment system following its pre-treatment with cascade aeration;

- assessment and handling of contaminated material, if any, in accordance with all pertinent regulations[17] and prior to the instigation of surface preparation, N.B., further work is being undertaken as part of the site geotechnical investigations to further categorize the chemical composition of the waste rock piles as recommended in 2004 by Dillon Consultants;
- continuation of a rigorous and defined surface water quality monitoring program throughout the system to maintain an accurate baseline for comparison purposes, to recognize any change occurring in Baileys wetland and to identify those discrepancies that need to be addressed and managed;
- prohibition of vehicle maintenance and fueling within 30 m of all watercourses, wetlands and the high water mark;
- installation of a truck wash system within the active yard area to ensure that the transportation of sediments and coal fines onto the public road system is minimized;
- tarping of all trucks to minimize the transportation of coal fines during the product's transportation on public roads;
- establishment of protocols for the safe storage and handling of all hazardous materials, e.g., fuel; and
- preparation of a Contingency and Emergency Response Plan and the maintenance of spill response supplies on site.

7.1.1.4 Cumulative Effects

Beyond the existing site conditions associated with past DEVCO activities, i.e., the waste rock piles, there are no other known works within the boundary of the Project that would act cumulatively to adversely impact surface water quality on the peninsula; no cumulative effects are anticipated.

7.1.1.5 Residual Effects

The use of standard and accepted industry practices and procedures, the adherence to applicable regulations and guidelines, including the NSDE Erosion and Sedimentation Control Handbook for Construction Sites, and proactive environmental protection planning, including the implementation of the mitigative measures identified above, will allow the Project to proceed with a negligible residual effect on surface water quality on the peninsula and beyond.

7.1.2 Marine Water Quality

The protection of marine water quality within the study area is important not only for fishers, including aboriginal fishers, but for the avian and aquatic species that breed and feed in these waters. Marine water quality has therefore been identified as a VEC.

A significant environmental effect on marine water quality would result if a discernible effect from Project activities on the fishery, including the Mi'kmaq fishery, or on an avian and aquatic species that breed and feed in the waters of the area, could be identified.

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[17] This includes the Sulphide Bearing Material Disposal Regulations pursuant to the *Environment Act*. This regulation stipulates the requirements associated with the disposal of material containing a sulphide sulphur concentration of equal to or greater than 0.4% by weight (12.51 H_2SO_4/tonne). If the material on testing is defined as a sulphide bearing material and is net acid producing, it is required to be disposed of at an approved disposal site.

7.1.2.1 Boundaries

The spatial boundary associated with any unplanned releases from a spill, or from erosion and sedimentation, is limited to the near shore marine waters around the Donkin peninsula, but particularly to those at Schooner Pond Cove. The effects of sediment runoff on the marine environment, if any, would be temporary. An accidental release of hazardous materials, e.g., fuels, depending upon the quantities involved, could impact marine water quality for a longer period of time. An unplanned release could conceivably occur at any time over the anticipated 36 month life of the Project.

7.1.2.2 Pathway Analysis

The possible pathways associated with the Project that may have potential adverse effects on marine water quality include:

- sediment laden runoff reaching marine waters during site preparation activities, such as clearing, grubbing and earth works;
- malfunctions that result in a release of untreated or partially treated wastewater into the DEVCO settling pond and hence into Schooner Pond Cove; and
- accidental releases of hazardous materials, such as fuels, directly or indirectly, into the marine environment.

A water quality receiving study was completed as part of the planning for tunnel dewatering (see Section 4.3.5.4). This study was based upon effluent dispersion rates achieved during the tunnel dewatering operations and worst case monitoring results. The results, based on the measurement of temperature, salinity and density and the modeling undertaken, demonstrated that any discharge form a point on the shore in water depths greater than 10 cm would be completely mixed with the water column. As the proposed treated discharge associated with the Project is estimated to be an order of magnitude less and the installed treatment system more rigorous than that deployed during tunnel dewatering, no adverse impact on marine water quality is predicted.

7.1.2.3 Mitigative Measures

The following mitigative measures are proposed to minimize potential impacts to marine water quality during the execution of the Project, or as a result of malfunctions and accidents:

- the surface water mitigation measures outlined in Section 7.1.1.3;
- operation of the same wastewater treatment system as employed during the successful tunnel dewatering program;
- continuation of a comprehensive monitoring program throughout the system, including periodic toxicity evaluations; and
- spill prevention and contingency planning as outlined in Section 7.1.1.3.

7.1.2.4 Cumulative Effects

There are no other known works within the boundary of this assessment that would act cumulatively with the Project to adversely impact marine water quality in Schooner Pond Cove; no cumulative effects are anticipated.

7.1.2.5 Residual Effects Assessment

The proposed Project is anticipated to have a negligible, if any, residual effect on marine water quality at Schooner Pond Cove or beyond. This determination is further justified by the proven absence of any discernible effect on the marine waters of Schooner Pond Cove during tunnel dewatering.

7.1.3 Groundwater Quality

Maintaining groundwater quality on the peninsula, particularly that of shallow groundwater, is important given its interconnectivity with the surface water regime, including that of Baileys wetland. As the closest well is approximately 1.5 km distant, groundwater on the peninsula is not considered a VEC from the perspective of potable water. The activities associated with the Project will not alter the physical flow characteristics of the bedrock aquifer. Regional groundwater flow on the peninsula is radial, discharging to coastal and offshore areas. Groundwater quality is identified as a VEC primarily due to its interconnection with the surface water.

A significant environmental effect on groundwater quality would result if a substantive change attributable to the Project was measured directly, or in groundwater discharge areas, i.e., surface waters such as Baileys wetland.

7.1.3.1 Boundaries

The spatial boundary for the assessment of Project activities on groundwater encompasses the shallow groundwater system and its surface discharge areas; the latter include the surface soil, till and shallow bedrock hydrostratigraphic units. The study area perimeter extends to the south and west of Baileys wetland. The temporal boundaries relate to the anticipated life of the Project, i.e., a maximum of 36 months.

7.1.3.2 Pathway Analysis

Infiltration of wastewater into the shallow aquifer during the execution of the Project is the most direct pathway that could adversely impact ground water in the area of interest. As has been noted in Section 4.3.4, any impact to the shallow aquifer, i.e., < 10 m, in the surface soils of the Donkin peninsula may affect the surface water bodies, including wetlands. It is therefore important that a comprehensive groundwater monitoring program based on the existing monitoring wells be maintained throughout the execution of the Project[18]. The results will enable:

- the determination of changes in wetland sediment and water chemistry due to discharge of wastewater to the DEVCO settling pond; and
- the identification of any effects on shallow groundwater quality via infiltration of runoff from the coal handling areas.

The underground activities, i.e., the extraction of the coal, occurs in the deeper groundwater regime, namely the Morien Bedrock hydrostratigraphic unit. The existing mine tunnels were excavated through the Portal Sandstone with flow into the tunnels resulting from fracture sets, some of which were created by tunnel development, including drilling. The mine tunnel extends from the Donkin peninsula to the

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[18] This monitoring program can utilize the monitoring wells installed in 2006 (see Section 3.2.2.5). As the program evolves the parameters of interest and the monitoring frequency may change. These details can be determined in collaboration with NSE based on the continual collection of data.

north, i.e., subsea. Given the fact that the proposed coal extraction will take place at depth and at a considerable distance removed from the Donkin peninsula, the mine workings will not interact with the groundwater regime of the peninsula itself.

Accidental releases of hazardous materials, such as fuels, into the environment as a consequence of Project activity may have a negative impact on groundwater quality in the surface hydrostratigraphic unit; appropriate and timely emergency responses would limit or negate any such impact.

7.1.3.3 Mitigative Measures

The following mitigative measures are proposed to minimize potential impacts to groundwater quality during the execution of the Project, or as a result of any malfunction and accidents:

- as per Section 2.4.1.3, a clay liner will be installed in the serpentine pond to minimize potential infiltration of wastewater into the groundwater;
- construction and use of a coal handling and storage pad lined with low hydraulic conductivity material, e.g., benonite;
- collection of all runoff from the active yard area, including the coal pad, to the wastewater treatment system;
- as per Section 7.1.1.3, work will be undertaken to determine the chemical profile of the waste rock piles prior to any work that would disturb them;
- establishment of controls to minimize the volume of site water requiring treatment and to reduce the likelihood of adverse infiltration to shallow groundwater;
- further delineation of shallow groundwater flows and the determination of their connectivity to Baileys wetland via monitoring using the existing wells as shown on Figure 3.3;
- design and construction of the fuel storage area with a secondary containment system in a manner that prevents hydrocarbon contamination of the area; and
- spill prevention and contingency planning as outlined in Section 7.1.1.3.

7.1.3.4 Cumulative Effects

Beyond the existing site conditions associated with past DEVCO activities, i.e., the waste rock piles, there are no other known works within the boundary of this assessment that would act cumulatively with this Project to adversely impact groundwater quality on the peninsula; no cumulative effects are anticipated.

7.1.3.5 Residual Effects Assessment

The use of standard and accepted industry practices and procedures, adherence to applicable regulations and guidelines, and proactive environmental protection, including the implementation of the monitoring and mitigative measures as identified above, will enable the Project to proceed with negligible residual effects on shallow groundwater quality within the peninsula. No impact is expected to deeper aquifers in the study area.

7.1.4 Air Quality

Air quality has been identified by the community as an issue of concern. The rural communities located along the coast of eastern Cape Breton enjoy an ambient air quality that is minimally impacted by industrial activity. Air quality is recognized as important to both the ecosystem and to human health; it is identified as a VEC.

A significant environmental effect on air quality would be a measurable local impact attributable to the Project that is identified through real-time air quality monitoring for particulate matter.

7.1.4.1 Boundaries

The spatial boundaries associated with the generation of particulate matter emissions during construction activities are restricted to the site itself and its immediate environs. The associated temporal boundaries are defined by the construction schedule. The construction of site infrastructure, for example, will require the completion of a number of earth moving tasks over the initial 9 – 12 months of the project, i.e., in 2009.

The spatial boundary, in terms of the release of fugitive coal dust emissions during the active removal of coal, includes the Project yard and its environs. The corresponding temporal boundary is year 2 and 3.

In terms of the release of GHGs, methane will be released during the operational phase of the Project via the underground main development. Other GHGs, associated with the operation of equipment and vehicles, will be released during all phases of the Project. The spatial boundaries related to the release of GHGs are, at a minimum regional, but in some respects global due to the influence of climate change.

7.1.4.2 Pathway Analysis

The possible pathways associated with the Project that may have potential adverse effect on air quality include:

- on site airborne dust emissions generated by site preparation and construction activities including the handling of overburden soils, the grading and placement of gravels, excavation and trenching for services, as well as the stockpiling of materials;
- downwind emissions of fugitive coal dust from the active yard including the movement of coal dust from the covered conveyor, the stockpiling of coal and the loading of product for transportation by truck;
- combustion of fossil fuels including that generated by equipment and vehicles operating on the Project site and the vehicles using the haul route;
- emissions of fugitive coal dust from the transportation of coal by trucks on public roads; and
- generation of methane from work underground during the execution of the Project.

The quantities of methane associated with the Project are expected to be relatively small and cannot be predicted. It has also been stated in Section 2.1.3 that an integral reason for the execution of this Project is to attain a better understanding of the gas regime associated with the Harbour Seam coal. A standard atmospheric monitoring system will be deployed subsea to monitor at all appropriate points for methane, carbon monoxide, oxygen, smoke, air velocity and differential pressure. This serves two purposes: to facilitate the safe operation of the exploration activities and to attain a data base that will enable a better understanding to be attained of the subsea gas regime. Once this has been completed and an assessment of the predicted emissions established, the Proponent will be in a better position to determine the best management of the methane that will be generated during a future longwall mining operation. This work will be undertaken as an integral part of the Proponent’s commitment to its corporate HSEC protocols.

7.1.4.3 Mitigative Measures

It is possible to identify in general terms some of the actions that will be taken to minimize and control airborne emissions. These can be determined by actions taken at comparable sites, e.g., the International Coal Pier in Sydney, and at other sites operated by the Proponent.

The following mitigative measures are proposed to minimize potential impacts to air quality, particularly particulate matter, during the execution of the Project, and as a result of malfunctions and accidents:

- use of water as a dust suppressant during site preparation including clearing and grubbing activities, especially during dry and windy conditions;
- prohibiting fires and the burning of waste materials;
- wetting of the stockpiled ROM coal via rainbirds to prevent blowing coal dust as described in Section 2.6.1;
- transporting coal in covered containers, i.e., trucks fitted with tarpaulins;
- regular maintenance and inspection of vehicles and equipment to minimize their emissions; and
- monitoring of particulate levels at selected locations using real-time instrumentation to provide quantitative feedback as to the efficiency of the mitigative measures used to control fugitive dust.

Baseline real-time ambient air quality monitoring was undertaken by the Proponent to characterize pre-activity levels of particulate matter near the mine site, specifically to respirable fractions PM_{10} and $PM_{2.5}$; results are presented in Section 4.3.6. The finding indicated a natural fluctuation of PM_{10} and $PM_{2.5}$ readings over the 24-hour monitoring period. The real-time instruments, i.e., aerosol monitors, however, were found to be sensitive to reading moisture particles as part of the overall measurement of particulate matter. When relative humidity levels started to approach 100%, high particulate matter readings were recorded, but can be attributed to weather conditions and high moisture levels in the ambient air.

The baseline study concluded that background dust levels in the local air shed were less than $5ug/m^3$ when moisture levels were not high. Average readings taken during periods of lower relative humidity, e.g., 60 – 70%, are likely representative of the actual background dust levels. These data will be used as a benchmark for future monitoring programs for particulate matter at the site; due to the proximity, however, of the site to the ocean, a real-time monitor that is not as sensitive to the influence of high moisture levels in the air will be used.

7.1.4.4 Cumulative Effects

There are no other known works within the boundary of this assessment that would act cumulatively with this Project to adversely impact air quality from the perspective of particulate matter; no cumulative effects are anticipated for particulate matter.

The volume of methane that may be released as a result of the underground workings associated with the execution of this Project is unknown. The volumes will be measured as an integral part of the proposed subsea works, but over the maximum operational period of 24 months, these are expected to be relatively small. Similarly, the GHGs associated with the operation of equipment and vehicles are anticipated to be small. The amounts of methane and GHGs emitted will add to the totals generated from other sources in CBRM, i.e., there will be a cumulative effect, but given the maximum subsea operational timeline of 24 months, the impact is considered negligible.

7.1.4.5 Residual Effects Assessment

The use of standard and accepted industry practices and procedures, adherence to applicable regulations and guidelines and proactive environmental protection planning, including the evaluation of data and the implementation of monitoring and mitigative measures as identified above, will enable the Project to proceed with negligible residual effects on air quality.

7.1.5 Ambient Light Levels

Though the mine site is located approximately 1.5 km from the nearest dwelling, lighting was taken into consideration in the layout of the surface facilities. An increase in light levels may have an impact on VECs, e.g., birds. Ambient light levels have, therefore, been identified as a VEC.

A significant effect to ambient light levels is defined as a measurable local impact attributable to the Project that is identified through repeated concerns as expressed by area residents, or a noticeable effect on a VEC, e.g., birds.

7.1.5.1 Boundaries

The spatial boundary associated with the production of light during construction and operations of the Project is restricted to the active work site and its immediate environs. The corresponding temporal boundary is the anticipate life of the Project, i.e., a maximum of 36 months.

7.1.5.2 Pathway Analysis

The pathways associated with the Project that may have potential adverse effects on light levels include:

- lighting used during the early morning or evening site preparation work, i.e., heavy equipment used at the site;
- structure lighting on equipment used at the site including the drift conveyor – there will be limited general outdoor lighting since coal is not expected to be handled at night; and
- lighting of the Project site for security, e.g., parking areas.

7.1.5.3 Mitigative Measures

The following mitigative measures are proposed to minimize the potential adverse effects of lighting associated with the execution of the Project:

- planning of the surface facilities at the site to take into account the potential effects of lighting on offsite receptors and biophysical VECs;
- using appropriate lighting standards as required for safety; and
- consideration of feedback from local residents through the CLC.

7.1.5.4 Cumulative Effects

There are no other known works within the boundary of this assessment that would act cumulatively with this Project to adversely impact light levels; no cumulative effects are anticipated.

7.1.5.5 Residual Effects Assessment

The use of standard and accepted industry practices and procedures, adherence to applicable regulations and guidelines and proactive environmental protection planning will allow the Project to proceed with negligible residual effects on ambient light levels.

7.1.6 Ambient Noise Levels

As the mine site is located approximately 1.5 km from the nearest dwelling, noise from the site is not anticipated to be a major issue. It has been taken into account in the planning of the layout of the surface facilities and in the selection and operation of equipment. Noise emanating from ventilation fans has been identified as a concern. As indicated in Section 4.3.8, noise associated with transportation, both in the context of using equipment during the construction phase and for the exportation of bulk coal from the site, has also been raised as an issue by Donkin area residents. Ambient noise levels have, therefore, been identified as a VEC.

A significant effect to noise levels is defined as a measurable local impact attributable to the Project that is identified through noise monitoring that exceeds regulatory requirements, or by repeated concerns expressed by area residents.

7.1.6.1 Boundaries

The spatial boundary associated with the production of noise during site construction is restricted to the active work site and its immediate environs. The corresponding temporal boundary is the construction phase, i.e., year 1 of the Project.

In terms of the transportation of coal via trucks on the public roads, the spatial boundary is the hauling corridor and its immediate environs. With respect to activity on the surface during active mining, the spatial boundary is the immediate area of the Project site. The spatial boundary for both is the operation phase, i.e., years 2 and 3 of the Project.

7.1.6.2 Pathway Analysis

The pathways associated with the Project that may have potential adverse effects on baseline noise levels include:

- heavy equipment used at the site during preparation activities including the construction of the access road;
- trucks using the public roads to transport coal to various destinations as outlined in Section 2.2.4; and
- equipment, including the ventilation fans, used at the site during Project operation and maintenance.

As referenced in Section 2.2.1.3, the design of the ventilation system addresses in the first instance the requirements of the subsea operation and will be designed to maximize both the efficiency and reliability of the system. The tested technology associated with modern ventilation systems and the design of the fans will also minimize the noise generated on site. The equipment will not be visible or audible from any residential property due to the intervening topography, vegetation and noise attenuation measures.

Until such time as equipment has been tendered, however, it is not possible to provide decibel ratings for the machinery that will be used. This information will be provided to NSE as required.

7.1.6.3 Mitigative Measures

The following mitigative measures are proposed to minimize the potential adverse effects of noise associated with the execution of the Project:

- the deployment of equipment, e.g., ventilation fans, that have been shown to operate efficiently and quietly;
- planning the surface facilities at the site to take the potential effects of noise on offsite receptors and biophysical VECs into account;
- ensuring that regular maintenance and inspection of vehicles and equipment is carried out;
- using the baseline monitoring data referenced in Section 4.3.8 as the reference against which to measure noise throughout the execution of the Project; and
- consideration of feedback from local residents through the CLC.

7.1.6.4 Cumulative Effects

There are no other known works within the boundary of this assessment that would act cumulatively with this Project to adversely impact noise levels on the site; no cumulative effects are anticipated.

7.1.6.5 Residual Effects Assessment

The use of standard and accepted industry practices and procedures, adherence to applicable regulations and guidelines, and proactive environmental protection planning, including the evaluation and implementation of monitoring and mitigative measures as identified above, will allow the Project to proceed with negligible residual effect on ambient noise levels.

7.1.7 Aquatic Habitat

The importance of the aquatic habitat to many interests was reinforced by the feedback received from community stakeholders from the outset of activities in 2006. This included the results of the MEK Study which identified the coastal areas accessed by First Nation fishers. Given the importance of marine and freshwater aquatic habitat and the associated ecology of the marine inlets and freshwater of the study area, aquatic habitat has been identified as a VEC.

A significant environmental effect on aquatic habitat would result if there was a discernible effect on the aquatic ecology of the marine and freshwaters that could be linked to Project activities.

7.1.7.1 Boundaries

Spatial boundaries associated with the assessment of the Project on aquatic habitat include the freshwater habitats within the study area, such as Baileys wetland, as well as the marine habitat of Schooner Pond Cove. The temporal boundary is the anticipated life of the Project, i.e., a maximum of 36 months.

While the DEVCO settling pond is stocked with trout by the Port Morien Wildlife Association, it is considered part of the constructed treatment system and is not in this sense considered freshwater habitat. The stocked fish act as a biological indicator of water quality. The stocking of the DEVCO settling pond provided additional confidence to the Port Morien Wildlife Association and the Port Morien/False Bay Fishermen's Association with respect to efficacy of the treatment sequence and of the formal monitoring completed by the Proponent during tunnel dewatering.

7.1.7.2 Pathway Analysis

The pathways associated with the Project that may have an effect on aquatic habitat are the same pathways assessed in the analysis of project impacts on surface, marine water and groundwater quality in

Sections 7.1.1, 7.2.1 and 7.3.1. These include potential erosion and sedimentation during site preparation; discharge of untreated wastewater to Schooner Pond Cove via the existing discharge channel; discharge of untreated wastewater to the surface water systems, e.g., to Baileys wetland via the DEVCO settling pond; and the potential for unplanned releases due to an accident or malfunction during any activities or component of the Project, most likely a spill of fuel, lubricants or the hydraulic fluid associated with the equipment. As indicated in the referenced sections, practices will be defined and enforced to minimize the occurrence of the events described. Not only will such practices substantially minimize the likelihood of such an event, the distances to and the dynamics of the marine environment further reduce the possibility of any adverse impact on aquatic habitat (see also Sections 3.3.2.6 and 4.4.8).

7.1.7.3 Mitigative Measures

The mitigative measures proposed to protect aquatic habitat are those proposed for the protection of surface water quality, marine water quality and groundwater quality in Sections 7.1.1, 7.1.2 and 7.1.3 respectively. The use of standard and accepted industry practices and procedures, adherence to applicable regulations and guidelines, and proactive environmental protection planning, including the evaluation and implementation of monitoring and mitigative measures as recommended will protect the habitat of the fresh and marine waters that interact with the proposed Project.

7.1.7.4 Cumulative Effects

There are no known proposed works within the boundary of this assessment that would act cumulatively with this Project to adversely impact aquatic habitat, particularly that habitat associated with Baileys wetland and Schooner Pond Cover; no cumulative impacts are anticipated.

7.1.7.5 Residual Effects Assessment

Surface water, marine water and groundwater act as pathways to fresh and marine aquatic habitat; the residual effects assessment for these three VECs concluded that the Project would have a negligible residual effect on them. As a result, the proposed Project is anticipated to have a negligible residual effect on freshwater and marine aquatic habitat in the immediate area down gradient of the Project site.

7.1.8 Baileys Wetland

The proposed Project site is approximately 500 m to the east of Baileys wetland. The latter is surrounded by a fringing marsh which grades into wet forest and has substantial peat deposits around the lake margin; in places floating peat mats support herbaceous plants (see Section 4.4.2). Baileys wetland is considered an important habitat for birds, filters water as it enters Schooner Pond Cove and is stocked with brook trout by the Port Morien Wildlife Association. Given the importance of Baileys wetland to the community, to the hydrology and the overall ecology of the area, Baileys wetland has been identified as a VEC.

A significant environmental effect on Baileys wetland would result if it could be demonstrated that a decline in the ecological diversity and/or hydrologic function of the wetland was directly attributable to the Project.

7.1.8.1 Boundaries

The spatial boundary associated with an effect on Baileys wetland is the wetland itself. The temporal boundary is the anticipated life of the Project, i.e., a maximum of 36 months.

7.1.8.2 Pathway Analysis

The pathways associated with Project activities that may lead to adverse effects on Baileys wetland include:

- erosion and sedimentation during site preparation;
- mobilization of contaminants from the existing waste rock piles into surface water or groundwater that flows into Baileys wetland and can be demonstrated to degrade the latter;
- high metal and sulphur content in runoff from coal stock piles draining overland toward Baileys wetland, or infiltrating into groundwater;
- a measureable increase in the hydraulic connection between Baileys wetland and the DEVCO settling pond either via leaks in the dam separating it from Baileys wetland, or via shallow groundwater; and
- spills, e.g., fuel, during the execution of the Project that drain to Baileys wetland through surface water or groundwater.

7.1.8.3 Mitigative Measures

The mitigative measures proposed to protect Baileys wetland are those proposed for the protection of surface water and groundwater quality in Sections 7.1.1 and 7.1.3. It is also worth noting that, based on the monitoring that was undertaken, the successful completion of the tunnel dewatering did not create a discernible effect on Baileys wetland.

Monitoring will continue and will include the chemical, physical, and biological monitoring of groundwater, surface water and freshwater habitat in the vicinity of the wetland. It will also include continued liaison with the Port Morien Wildlife Association with respect to the health of the stocked fish in the wetland. Should the results indicate a trend towards a discernible negative effect on Baileys wetland, it would indicate a need to further evaluate the integrity of the dam and berm structures between the DEVCO settling pond and Baileys wetland to determine if improvements are necessary to minimize the hydraulic connection between the two. Work was undertaken to improve the control structure prior to tunnel dewatering; careful monitoring will contribute to the analysis and determination of the need, if any, for further work.

The location of Baileys wetland has also been taken into account in preparing the layout of both the surface works and the proposed access road. The access road, for example, was aligned and indeed lengthened to avoid Baileys wetland.

The use of standard and accepted industry practices and procedures, adherence to applicable regulations and guidelines, and proactive environmental protection, including the evaluation and implementation of the monitoring and mitigative measures recommended for surface water and groundwater will protect Baileys wetland from any adverse interaction with the proposed Project.

7.1.8.4 Cumulative Effects

There are no other known works within the boundary of this assessment that would act cumulatively with this Project to adversely impact Baileys wetland; no cumulative effects are anticipated.

7.1.8.5 Residual Effects Assessment

Surface water and groundwater act as the pathways to Baileys wetland; the residual effects assessment for these two VECs concluded a negligible residual. Through the continued execution of a comprehensive monitoring program, changes can be identified and further mitigation determined to ensure the protection of Baileys wetland including any improvements necessary to the dam structure that separates Baileys wetland from the DEVCO settling pond. The Proposed project is anticipated to have a negligible residual effect on Baileys wetland.

7.1.9 Other Wetlands

In general, wetlands provide distinctive habitat and an important link between terrestrial and aquatic environments; there are wetlands on the Donkin peninsula other than Baileys including a number scattered throughout the forest that surrounds the Project site. To the east, for example, there are many smaller wetlands that have developed in depressions and along natural drainage channels as described in Section 4.4.2. Given the importance of wetlands in general to ecological systems and diversity, these wetlands have been grouped and identified as a VEC.

A significant environmental effect on these wetlands would result if it could be demonstrated that a decline in the ecological diversity and/or hydrologic function of any one of them could be attributed to the Project.

7.1.9.1 Boundaries

The spatial boundary associated with an effect on other wetlands is the physical delineation of the wetland involved. The temporal boundary is the anticipated life of the Project, i.e., a maximum of 36 months.

7.1.9.2 Pathway Analysis

The pathways associated with Project activities that may lead to adverse effects on other wetlands include:

- erosion and sedimentation during site preparation;
- mobilization of contaminants as a result of site works, including proposed work around the existing waste rock piles;
- shallow groundwater or surface water transport of drainage from the Project site to other wetlands on the Donkin peninsula; and
- spills during any phase of the Project that would impact wetlands through surface water or groundwater pathways.

Since none of these smaller wetlands are within the proposed footprint of the Project, and no surface or ground water from the execution of the Project will flow to the east of the work yard, there is no pathway between the Project and these other wetlands.

7.1.9.3 Mitigative Measures

The mitigative measures proposed to protect these wetlands to the east of the work yard are those proposed for the protection of surface water quality and groundwater quality in Sections 7.1.1, and 7.1.3. In addition to the protection of these pathways, any direct interaction with these wetlands, i.e., those to the east of the Project site, has been avoided by the siting of the proposed facilities. The locations of wetlands on the peninsula, for example, were considered and avoided in the layout both of the surface works associated with the Project and of the proposed access road.

The development and application of proactive environmental protection planning, standard and accepted industry practices and procedures and adherence to applicable regulations and guidelines, including NSE's requirements under the Activities Designation Regulations for a Wetland Alteration Approval as required since July 20, 2007, and the *Environmental Goals and Sustainable Prosperity Act*, will protect all wetlands on the peninsula. No wetlands on the Donkin peninsula will be altered as part of the Project.

7.1.9.4 Cumulative Effects

There are no known proposed works within the boundary of this assessment that would act cumulatively with this Project to impact these wetlands; no cumulative effects are anticipated.

7.1.9.5 Residual Effects Assessment

Surface water and groundwater do not act as pathways to the wetlands to the east of the Project yard; there is no direct interaction. The proposed Project has no residual effect on these wetlands.

7.1.10 Migratory and Breeding Birds

Birds breed, feed and migrate over the lands and waters of the Donkin peninsula. In particular, the peninsula is well known for the incidence and abundance of migrant and vagrant birds, primarily due to its eastern location and wind patterns. As identified in Section 4.4.4 and Appendix J, the majority of the routine migrant and many of the vagrant birds recorded in the Province have been sighted on the peninsula, including a number that have been identified as valued by one or more of the ranking agencies. Based on these circumstances, birds have been identified as a VEC.

A significant environmental effect on birds would result if a discernible effect on an individual species or its habitat could be attributed to the Project.

7.1.10.1 Boundaries

The spatial boundaries of the analysis extend beyond the Project site to include those areas that are known to be valued bird habitat, including Baileys wetland and the headland cliffs. The temporal boundaries relate to the anticipated life of the Project, i.e., a maximum of 36 months.

7.1.10.2 Pathway Analysis

The pathways that could have a potential adverse effect on birds include those that may impact surface water and wetlands as described in Sections 7.1.1, 7.1.7, and 7.1.8, as well as noise, light and dust generated by the Project. Additionally, the disturbance of existing habitats within the area that have become bird habitat, such as the waste rock piles, may cause disturbance to certain bird species.

The Project does not involve the extension of the present development footprint to the east, i.e., towards the valued wetlands or sea cliffs. The planned expansion to the south is preferable from an ornithological perspective. The latter involves less forest clearing and does not intrude into valued wetlands and bird habitat. It has also been advocated by the ornithologists on the study team that a sufficient area be cleared on either side of the new access road to establish a wide swath of new edge habitat.

7.1.10.3 Mitigative Measures

The following mitigative measures are proposed:

- minimize disturbance to and protect the headlands of the peninsula which have been identified as important to numbers of bird species;
- determine the width to be cleared on either side of the access road in conjunction with local ornithologist and maintain the margins of the resultant corridor with alder thickets to supply food and shelter for birds;
- schedule clearing and grubbing to protect the eggs and nests of migratory birds in accordance with the federal *Migratory Bird Convention Act*;
- deploy all recommended mitigation for the protection of surface water, air quality, ambient noise and light levels and wetlands;
- install only necessary lighting along the mine access road and within the mine site as required to ensure safety; and
- prepare and implement a biodiversity conservation plan as per Section 1.2.1.3 that takes into account the diversity of bird species that frequent the Donkin peninsula.

7.1.10.4 Cumulative Effects

There are no known proposed works within the boundary of this assessment that would act cumulatively with this Project to adversely impact birds in the area; no cumulative effects are anticipated.

7.1.10.5 Residual Effects Assessment

Based on field work completed, the implementation of recommended mitigative measures, and the negligible residual effects on surface water, air quality, baseline noise levels and wetlands, the Project is anticipated to have a negligible residual effect on migratory and breeding birds.

7.1.11 Fauna (Bats)

Fauna on the Donkin peninsula are known to include a range of mammals, including white-tailed deer, coyotes, red squirrel, snowshoe hare and red-backed voles; there are, however, no significant areas for these species and all are common throughout the Province. Bats, however, were identified as a mammal of interest as they often find habitat in disturbed landscapes, particularly the little brown bat and the northern long-eared bat. Bats, therefore, have been identified as a VEC.

A significant environmental effect on bats would result if a discernible effect on an individual species or its habitat could be attributed to the Project.

7.1.11.1 Boundaries

The spatial boundaries of the analysis included the mine site on the peninsula and its immediate environs. The temporal boundaries relate to the anticipated life of the Project, i.e., a maximum of 36 months.

7.1.11.2 Pathway Analysis

The pathways that could have an adverse effect on bats include:

- removal of foraging and roosting resources; and
- activities that may impact ambient noise and light levels.

As described in Section 4.4.6, lactating or post-lactating females and juveniles of both bat species were captured in the survey traps; it can therefore be deduced that maternity roosting colonies exist on the peninsula.

As indicated in Section 4.4.6.2, the little brown bat is a generalist species known to forage in a variety of habitats, including open areas, along forest edges and over water; they are also generalists in terms of roosting as they roost in buildings as well as cavities and cracks in trees. The long eared bat inhabits forests, both deciduous and coniferous, and has been found to forage under the forest canopy in areas characterized by vernal pools and forest streams. The Donkin peninsula provides the foraging conditions required by both species. Although there will be clearing to the south of the existing footprint to accommodate the infrastructure associated with the transportation corridor, the amount of clearing beyond the heath is minimal in respect to the deciduous and coniferous cover on the peninsula. Further field work to identify the location and size of the colonies could be useful, but both species, the little brown bat and the northern long eared bat, are ubiquitous in the Province.

7.1.11.3 Mitigative Measures

The mitigative measures proposed to protect bat habitat and the species involved primarily include minimizing both the footprint of the surface workings and the extent of clearing to be undertaken beyond the heath. The measures proposed for the protection of air quality and ambient noise and light levels will also serve to minimize impact on the little brown bat and the long-eared bat. Bats and their habitat will also be taken into consideration in the preparation of a biodiversity conservation plan for the Donkin peninsula.

7.1.11.4 Cumulative Effects

There are no known proposed works within the boundary of this assessment that would act cumulatively with this Project to impact bats; no cumulative effects are anticipated.

7.1.11.5 Residual Effects Assessment

Based on field work completed and the negligible residual effects anticipated on air quality and baseline noise levels, the Project is anticipated to have a negligible residual effect on bats.

7.1.12 Flora

The diversity of the flora on the Donkin peninsula is high as the area accommodates six distinct habitats; over 150 species of plants were found. Based on this diversity and its value to society and the ecosystem, flora has been identified as a VEC.

A significant environmental effect on flora would result if a discernible effect on an individual species, or its habitat, could be attributed to the Project.

7.1.12.1 Boundaries
The spatial boundaries of the analysis include the Project footprint and the Donkin peninsula. The temporal boundaries relate to the anticipated life of the Project phases, i.e., a maximum of 36 months.

7.1.12.2 Pathway Analysis
The potential pathways that could have an adverse impact on flora include:
- disturbance to valued habitat on or in proximity to the project area; and
- those activities that may generate the deposition of particulate matter or otherwise disturb particular habitats including wetlands.

7.1.12.3 Mitigative Measures
The mitigative measures proposed include those proposed for the protection of surface water quality, groundwater quality, air quality and wetlands. As a general precept, an effort will also be made to minimize the Project footprint to maintain the diversity of the vegetation. The diversity of flora on the Donkin peninsula will also be taken into consideration in the preparation of a biodiversity conservation plan for the area.

7.1.12.4 Cumulative Effects
There are no known proposed works within the boundary of this assessment that would act cumulatively with this Project to impact flora; no cumulative effects are anticipated.

7.1.12.5 Residual Effects Assessment
Based on field work completed, the implementation of recommended mitigative measures and the negligible residual effects anticipated on surface water quality, groundwater quality, air quality, and wetlands, the Project is anticipated to have a negligible residual effect on flora.

7.1.13 Odonata
As detailed in Section 4.4.7 and more fully in Appendix G, 23 species of odonata were recorded at the Project site through the summer of 2008. This represents 24% of the 98 species that have been encountered in Cape Breton.

A significant effect on odonata is defined as a loss of a Species of Conservation Concern, or a measurable reduction in the species number and diversity across the site that could be attributed to the Project.

7.1.13.1 Boundaries
The spatial boundary of the analysis with respect to odonata is restricted to the habitats surveyed during the 2008 field program, i.e., the serpentine settling pond, the drainage channel from the serpentine settling pond, the DEVCO settling pond, the discharge channel from the DEVCO settling pond, Baileys wetland and the Schooner Pond Beach Road.

The temporal boundaries relate to the anticipated life of the Project, i.e., a maximum of 36 months.

7.1.13.2 Pathway Analysis

There are three general categories of activity that may impact odonata:

i) broadcast impacts including widely dispersed pesticides and other chemicals which enter the aquatic environment and can affect immature or adult odonates directly, or their prey;
ii) direct impacts where individual odonata, generally flying adults, are harmed by human activities such as collection for scientific purposes or road-kill; and
iii) habitat alteration.

As there are no broadcast activities associated with the execution of the Project, there can be no related impacts. Manual collection of specimen odonates for scientific purposes within the boundaries as defined is not considered sufficiently efficient to pose a threat to the populations. Road kill could be a factor for some species at certain times of the year, but in the opinion of Dr. Brunelle, if the posted speed limits in the area are enforced, the speeds would be too low to pose a threat. The construction of the new access route to the site from Long Beach Road will also remove trucks and other vehicles from the Schooner Pond Beach Road thereby further protecting odonates breeding in several of the habitats referenced above.

Habitat destruction is the greatest threat to odonata populations. With the exception of Baileys Wetland, all of the aquatic habitats surveyed are to a greater or lesser extent man made, and it might be argued, have been and will be beneficial to odonates. Indeed, the one Species of Conservation Concern, the Sweetflag Spreadwing, was recorded at the most recently created aquatic feature, i.e., the serpentine pond. Dr. Brunelle acknowledged that it may have been wandering from the better established DEVCO settling pond or Baileys wetland.

7.1.13.3 Mitigative Measures

Apart from the monitoring of the waters from the serpentine pond to their discharge from the DEVCO settling pond, no specific mitigative measures are proposed or required. Dr. Brunelle in his report (Appendix G) suggests that depths in the various aquatic habitats should be maintained, but such changes are not anticipated.

7.1.13.4 Cumulative Effects

There are no other known works within the boundary of this assessment that would act cumulatively with this Project to impact odonata on the site; no cumulative effects are anticipated.

7.1.13.5 Residual Effects Assessment

Based on the field work undertaken and in the opinion of an odonata expert, the Project will have no impacts on odonata. Indeed, the maintenance of the habitats may prove to be beneficial.

7.1.14 Species at Risk or of Conservation Concern

Under federal and provincial legislation, an environmental assessment must consider impacts of the proposed Project on listed flora and wildlife species, as well as their critical or core habitat, and residences of individuals of that species. A list of the potential species of interest that may reside on, or migrate through, the Donkin peninsula was compiled from the legislated designated lists, i.e., the Atlantic CDC and the NSDNR General Status Ranks. This list is presented and discussed in Section 4.4.3.

As protection of Species at Risk or of Conservation Concern is ecologically and socially important, as well as being required by legislation, these species have been identified as a VEC.

7.1.14.1 Boundaries

The spatial boundaries of this analysis encompass the Donkin peninsula. The temporal boundaries relate to the anticipated life of the Project, i.e., a maximum of 36 months.

7.1.14.2 Pathway Analysis

The possible pathways associated with the Project that may have adverse effects on listed species include physical disturbance to the habitat necessary to their life cycle and those activities that may impact other VECs including surface waters, wetlands, etc. The following observations focus on the potential interactions that may occur.

Birds

- as identified in Section 4.4.4.1, many of the bird species listed under legislation or identified via NSDNR General Status Ranks and Atlantic CDC Ranks are vagrant or uncommon to the area;
- the eight federally and/or provincially regulated bird species under the *SARA* and *Endangered Species Act* that may be present on or near the Project site include:
    - Bicknell's Thrush – a very rarely recorded migrant on the Peninsula, and a species that may have a greater presence in the larger study region;
    - Piping Plover – known to inhabit the shoreline of Big Glace Bay Lake and Glace Bay, but not Donkin peninsula;
    - Harlequin Duck – a very rare winter visitor to the coast of the Donkin peninsula;
    - Savannah (Ipswich) Sparrow – the peninsula offers neither suitable breeding habitat, nor particularly attractive stopover habitat;
    - Yellow-breasted Chat, Prothonotary Warbler, and Hooded Warbler – vagrants to the area; the Donkin peninsula is considered insignificant to their welfare;
- three NSDNR Yellow-listed species are of interest:
    - Razorbill – this is considered the most vulnerable seabird nesting in the area;
    - Boreal Chickadee and Gray Jay – nest commonly or fairly commonly respectively in the mature coniferous forests on the peninsula.

It is thought that both the Barn Swallow and the Common Nighthawk may inadvertently benefit from the development of the surface works and infrastructure as they nest in buildings and clearings respectively.

Overall, the peninsula's major attributes for the bird populations are its sea cliffs as they provide important nesting habitat, its relatively mature forests and its ponds and wetlands.

The Project's potential impacts on migratory and breeding birds are discussed in Section 7.1.10 above.

Flora

- Of the four plants listed in Table 4.12, only one species, the Spurred Gentian, was identified and confirmed to be present on the peninsula; this species is Yellow-listed by the NSDNR General Status

Ranks. It was found in a colony of approximately 40 specimens in a grassland environment on the headlands near Wreck Point.

Based on the work undertaken and the planned footprint of the Project in relation to the location of this and other species (see Figures 4.5 and 4.6), it is not anticipated that the Project will disturb listed plant species.

The Project's potential impacts on flora are discussed in Section 7.1.12 above.

Bats

- two types of bats, the Northern Long-eared Bat and the Little Brown Bat, found on the Donkin Peninsula are categorized as Yellow by NSDNR;
- population of the Little Brown Bat, while declining, is widely abundant in the Province, and the Northern Long-eared Bat, which typically use caves and abandoned mine shafts, as night roosts is also resident on the peninsula.

The Project's impacts on these bats are discussed in Section 7.1.11 above.

Fish

- three types of fish are identified as potentially present in or in proximity to the study area and are federally and/or provincially listed;
- Striped Bass, which has been federally legislated, is known to be present in Big Glace Bay and Big Glace Bay Lake;
- Atlantic Salmon is federally legislated and is expected to be found in rivers in the regional area, including Big Glace Bay Lake;
- Brook Trout, Yellow-listed by NSDNR, can be found in most of the streams in the regional area, including Doctors Brook, Renwick Brook, Blackwater Brook, Big Glace Bay Lake, as well as the DEVCO settling pond[19] and Baileys wetland, where they are stocked by the local community.

As detailed in Section 7.1.4, the Project will have a negligible, if any, impact on aquatic habitat. The waters providing habitat to the above referenced species are some distance removed from the Project area.

Odonata

- One species of odonata, the Muskeg Emerald, has been Yellow-listed by NSDNR and is known to reside on the Cape Breton Island on wetland areas comparable to some in the study area; it was not found during field work.

The Project's potential impacts on odonata are discussed in Section 7.1.13 above.

7.1.14.3 Mitigative Measures

The mitigative measures to protect Species at Risk or of Conservation Concern are those proposed for the protection of other physical and biophysical VECs, including water quality and air quality. As a

[19] The DEVCO settling pond was stocked with brook trout to gauge the impact of the dewatering of the tunnels.

fundamental precept, every effort will be made to minimize the Project's footprint on the Peninsula. The preparation of a biodiversity conservation plan for the area will take into account the presence of Species at Risk and of Conservation Concern.

7.1.14.4 Cumulative Effects

There are no other known works within the boundary of this assessment that would act cumulatively with this Project to impact species at risk; no cumulative effects are anticipated.

7.1.14.5 Residual Effects Assessment

Based on the field work undertaken, the implementation of recommended mitigative measures and the negligible residual effects anticipated on aquatic habitat, migratory and breeding birds, flora and fauna, the proposed Project is anticipated to have a negligible residual effect on Species at Risk or of Conservation Concern.

7.1.15 Land Use

The communities located in the general area of the Project site include Donkin, Port Morien and Port Caledonia. The regional area that encompasses the proposed trucking route includes the larger settlements of Glace Bay and Reserve Mines. As discussed in Section 4.5, the immediate Project area is distinctly rural in character, but is located 11 km from Glace Bay, which is one of the most densely populated communities in CBRM. Today no one lives on the Donkin peninsula, and the land, as described in Section 1.4.2, is owned primarily by the Proponent.

As land use was an issue raised during the scoping process, it is included as a socio-economic issue to be assessed. A significant effect on land use attributable to the Project would be an adverse change identified by the community and a demonstrated lack of adherence to municipal land use planning requirements.

7.1.15.1 Boundaries

The spatial boundary includes the lands of Donkin peninsula. The temporal boundary is the anticipated life of the Project, i.e., approximately 36 months.

7.1.15.2 Pathway Analysis

Potential pathways include community and regulatory acceptability of the proposed use of the lands on the Donkin peninsula to support underground exploration. Consideration must also be given as to whether such uses will in any way effect the use or enjoyment of adjoining properties.

The use of lands on the Donkin peninsula to support underground exploration reflects the prior intent of and the work undertaken by DEVCO. Not only was that activity accepted by the local community, but there has also been support shown for the Proponent's current initiatives in the area. Certainly, the Project in its proposed location is not expected to have significant adverse effects on land use on, or in proximity to, the peninsula.

Consultations in the local communities has identified continued access to Schooner Pond Beach and the headlands as being valued. It is the Proponent's intent that this access will be maintained. With the proposed development of a new operating access road to the Project site from the Long Beach Road, project related traffic will no longer use the Schooner Pond Beach Road. This will serve to protect both Baileys wetland and Schooner Pond Beach. In turn, this should make community access to both the beach and the headland more enjoyable for those who use these areas.

7.1.15.3 Mitigative Measures

As long as the mitigation measures advocated to protect other VECs and to address other socio-economic issues are adhered to, land use will be protected and no other mitigative measures are necessary.

7.1.15.4 Cumulative Effects

There are no known proposed works to be undertaken within the boundary of this assessment that would act cumulatively with this Project to adversely impact current or future land use on the Donkin peninsula; no cumulative effects are anticipated.

7.1.15.5 Residual Effects Assessment

Based on the work undertaken including the consultations that have taken place, the Project is anticipated to have negligible residual effects on land use.

7.1.16 Aboriginal Use of Land and Resources

As is detailed in the MEK Study undertaken by MGC (Appendix I), fishing is an important traditional and commercial activity for the Mi'Kmaq. Numerous locations of continued Mi'Kmaq use of natural resources were identified, i.e., 147 in the general categories of food/sustenance, including the fishery, medicinal/ceremonial and tool/art. As such, aboriginal use of land and resources is defined as a socio-economic issue to be assessed.

A significant effect on the aboriginal use of land and resources is defined as a discernible effect on the ability of First Nation's peoples to rightfully access the land and their resources.

7.1.16.1 Boundaries

The boundaries of the assessment of Project impacts on the aboriginal use of land and resources reflect the area considered in the MEK Study.

7.1.16.2 Pathway Analysis

The potential pathways to link the Project to the aboriginal use of land and resources parallel those identified for the evaluation of habitats and ecological features. The issue of access to resources is also of primary importance. No works are proposed, however, that will impact, or inhibit, access to the coastal fishery. Access to the active yard will be restricted, but there will continue to be access to the Donkin headland and other lands on the peninsula.

7.1.16.3 Mitigative Measures

The mitigative measures proposed for the Project, as well as malfunctions and accidents, are broadly the same as those proposed for flora and aquatic habitats. The plants identified as important resources in the context of traditional Mi'Kmaq use are widely available throughout the Province.

7.1.16.4 Cumulative Effects

There are no other known works within the boundary of this assessment that would act cumulatively with this Project to impact the aboriginal use of land and resources; no cumulative effects are anticipated.

7.1.16.5 Residual Effects Assessment

Based on the implementation of the recommended mitigative measures, the negligible residual effects on biophysical VECs, the proposed Project is anticipated to have no residual effect on the aboriginal use of land and resources.

7.1.17 Archaeological Resources

Five historic resources were encountered during the fieldwork undertaken on the Donkin Peninsula. The potential for archaeological resources on the peninsula was identified in preliminary scoping as a socio-economic issue to be assessed and archaeological resources have been identified as a socio-economic issue.

A significant effect on archaeological resources is defined as a loss or destruction of a cultural resource either of European or pre-contact nature.

7.1.17.1 Boundaries

The spatial boundaries of the analysis on archaeological resources relate to the peninsula. The temporal boundaries relate to the anticipated life of the Project, i.e., a maximum of 36 months.

7.1.17.2 Pathway Analysis

The possible pathways associated with the Project that may cause adverse effects on archaeological resources include disturbance to the five historic resources identified on Figure 4.7. The Baileys homestead is located directly to the northwest of the DEVCO settling pond. Because the homestead has been demolished, it is considered of low archaeological significance. The other identified sites, i.e., the Bailey cemetery, the coastal mine, the Corduroy Road and the McDonald Farm are at some distance removed from the footprint of the Project and will not be impacted at all by the proposed workings. The Bailey cemetery on the seaward side of the current access road to the mine site is considered to be of high archaeological sensitivity and has been registered in the Maritime Archaeological Resource Inventory.

7.1.17.3 Mitigative Measures

The proposed mitigative measures relate solely to site works. They include:

- minimizing the footprint of the Project on the headland by delineating the active area during site preparation and thereby avoiding all of the identified locations of historic resources, including the cemetery; and
- contract specifications, as an integral part of specific EPPs, will define protocols that should be deployed should a cultural resource be identified during site preparation work, including stoppage of work and immediate notification of the Nova Scotia Museum.

The Project footprint as depicted on Figure 2.2 and the proposed alignment of the new access road, have been determined with the knowledge of the location of the identified historic resources. Given the importance of the Bailey cemetery, its proximity to the DEVCO settling pond and its interest to the community, it is the intention of the Proponent to have the boundaries of this cemetery determined, the site fenced and an information board designed and installed as part of its Community Engagement Strategy.

7.1.17.4 Cumulative Effects

There are no other known works within the boundary of this assessment that would act cumulatively with this Project to impact archaeological resources; no cumulative effects are anticipated.

7.1.17.5 Residual Effects Assessment

Based on the implementation of the recommended mitigative measures, including the deployment of standard engineering practices and policies and the enhancement of a community historic resource, the proposed Project would not only have no residual effect on archaeological resources in the area, but works undertaken to enhance the historic context of the peninsula would be deemed by many to be a distinct Project benefit. Table 7.2 summarizes the residual effects of the proposed works on those archaeological resources identified as present on the Donkin peninsula.

Table 7-2: Residual Effects on Archaeological Resources on Donkin Peninsula

Resource	***Archaeological Evaluation***	***Residual Impact***	***Notes***
McDonald Farm	High archaeological potential; high archaeological significance	No impact.	Project footprint will not impact site.
Bailey Homestead	Low archaeological significance	No impact.	Project footprint will not impact site.
Bailey Cemetery	High archaeological potential; high archaeological/spiritual significance	Positive impact.	Project footprint will not impact site; Proponent also plans to enhance site.
Coastal mining at Schooner Pond Head	Low archaeological potential; low archaeological significance	No impact.	Project footprint will not impact site. Coastal erosion will cause further impact.
Corduroy Road at Schooner Pond Road	Low archaeological potential; low archaeological significance	No impact.	Project footprint will not impact site.

7.1.18 Recreation

The current access to and use of the Donkin peninsula as a recreational area is important to the local community. Access to the headlands on the Donkin Peninsula, Baileys wetland and Schooner Pond Beach were identified in the scoping process as preferred destinations. The potential for community use of these areas identified recreation as a socio-economic issue to be assessed.

A significant effect on recreation attributable to the Project is defined as a loss of access to areas that the public has used, or as a significant depletion in recreational opportunities in the area.

7.1.18.1 Boundaries

The spatial boundary of the analysis with respect to recreation includes the peninsula. The temporal boundaries relate to the anticipated life of the Project, i.e., a maximum of 36 months.

7.1.18.2 Pathway Analysis

The possible pathways associated with the Project that may have implications for the recreational use of the peninsula include:

- Use of the Schooner Pond Beach Road by heavy vehicles to access the Project site; and
- Inhibiting public access to the headland.

7.1.18.3 Mitigative Measures

The Proponent is developing a new access road to the site from Long Beach Road which will remove heavy vehicular traffic from the Schooner Pond Beach Road once the access road is complete. This will serve to protect Baileys wetlands and Schooner Pond Beach, a provincially designated beach.

Public access to the beach will be maintained and pedestrian access to the headlands will not change. Access to the headland has been identified as an important recreational resource by the community, in part due to the bird watching opportunities afforded in the area, and, in part, because it is a favoured walking and ATVing destination.

The construction of the access road may take up to six to nine months. During this time, vehicular traffic will continue to use Schooner Pond Beach Road; no coal, however, will be hauled along the Schooner Pond Beach Road. The access road will be complete before the operation stage of the Project starts; at this time, all traffic associated with the Project will use only the new access road.

7.1.18.4 Cumulative Effects

There are no other known works within the boundary of this assessment that would act cumulatively with this Project to impact recreational opportunities in the area; no cumulative effects are anticipated.

7.1.18.5 Residual Effects Assessment

Based on the relocation of vehicular traffic to the new access road, implementation of good engineering practices and further public consultation with respect to the use of the transportation corridor the proposed Project will have negligible residual effects on recreational opportunities in the area.

7.1.19 Economic Opportunities

The proposed site is within a predominantly rural area which has suffered job losses and economic decline for many years. Circumstances, however, are slowly changing. Participation rates in CBRM have risen over the past 10 years and unemployment rates have fallen in the same period, i.e., from 22.5 in 1996 to 15.9 10 years later. Nevertheless, the prospect of new economic opportunities has been identified as a primary consideration throughout the consultation process. As such, economic opportunities have been included as a socio-economic issue to be assessed.

A significant impact on economic opportunities is defined as a discernible effect on the overall economy of both the local communities and of CBRM.

7.1.19.1 Boundaries

The spatial boundary is in one sense the employment catchment area, i.e., the area from which employees are drawn; in another sense it relates to how expenditures and taxes will be distributed. The Project will source materials and services from a wide area. The temporal boundaries encompass the duration of the Project, i.e., a maximum of 36 months.

7.1.19.2 Pathway Analysis

There are two primary pathways: employment and expenditures. As discussed in Section 1.4.3, the Proponent anticipates that the initial capital cost of the Project to be in the vicinity of CDN $100 million; it will generate up to 45 employment opportunities. Indirectly, the development and operation of the Project will support further commercial and residential development in the region, thereby creating secondary employment and incremental investment. Indeed, there have been new businesses created in the local area as a result of the dewatering of the tunnels. More can be anticipated.

7.1.19.3 Mitigative Measures

Given the economic benefits attributable to the development and operation of this Project, no mitigative measures are required. Yet the demonstrated intent to source materials and services locally is to be commended and encouraged. This approach maximizes the benefits that accrue within the local area, CBRM and Cape Breton.

7.1.19.4 Cumulative Effects

The execution of the Project is expected to generate both direct and indirect benefits for the economy of the CBRM. This effect will act cumulatively, in a positive manner, with the works being undertaken to remediate the Sydney Tar Ponds and Coke Oven sites in Sydney and the work being undertaken by Public Works and Government Services Canada to remediate abandoned mine sites across CBRM. The Project will also generate demands for labour and equipment in the same general timeframe as the other works proposed in the region. The Proponent, however, does not feel that the supply of labour or equipment will pose an obstacle to the proposed work associated with the execution of this Project.

7.1.19.5 Residual Effects Assessment

The Project is predicted to have residual beneficial effects on economic opportunities in the local area and in CBRM; it will contribute positively to the region's economic base.

7.1.20 Traffic

As detailed in Section 4.5.6, the road network, both near the Project site and towards and including Route 4, requires some upgrading to be designated as a Schedule C weight rated year round route and therefore suitable for B-train trucks. Although CBRM has completed some upgrades to Highway 255, i.e., the Donkin Morien Highway, as well as to Route 4, many in the area have expressed concern at the potential pressure that additional truck traffic may impose on local and regional roads. Vehicular traffic has therefore been identified as a socio-economic issue to be assessed.

A significant effect on vehicular traffic attributable to the Project is defined as a discernible effect on the safe flow of traffic on the Long Beach Road to the Donkin Highway and along Highway 255 to Brookside Street, Dominion Street and Wilson Street to the intersection with Route 4.

7.1.20.1 Boundaries

The spatial boundaries of the analysis include the trucking route as shown on Figure 2.5 leading from the Donkin peninsula on the Donkin Highway through to the intersection of Wilson Street with Route 4. Beyond this intersection, truck traffic will travel on Schedule C roads that can and have the existing capacity to carry B-train trucks to the NSP plants and the International Coal Pier. The temporal boundaries relate to both the construction phase of approximately 12 months and the subsequent 24 month operational phase of the Project.

7.1.20.2 Pathway Analysis

The possible pathways associated with the development and operation of the Project that may have adverse effects on vehicular traffic patterns include:

- construction and other mine related vehicles accessing the Project site during site preparation and construction activities (as per Section 2.2.4.1) via either the existing road along Schooner Pond Beach, as is now the case, or the new access road off Long Beach Road once it is constructed;
- employee and contractor vehicles accessing the Project site during Project operation (as per Section 2.2.4.2); and
- coal transportation by truck on the trucking route as shown on Figure 2.5.

As per the TIS that has been completed, the development and operation of the proposed Project will increase traffic volumes on local roads. Based on the analysis that has been undertaken, it has been determined that the anticipated number of Project generated trips will not have a substantial impact on the performance of the transportation infrastructure, e.g., at intersections. The current traffic volumes, the projected traffic growth and predicated Project related movements do not warrant the addition of traffic signals at any intersection. It has been determined that there will generally be no noticeable impact on the safe flow of traffic due to Project related trips; the exception will be an incremental lengthening of the delays experienced in the eastbound direction at peak evening times on Dominion Street/Brookside Street (as per Section 4.5.6.3).

Discussions with TIR and CBRM are ongoing with respect to the advocated improvements to the road network to allow its designation as Schedule C and allow the passage of B-train trucks in a manner that will ensure efficiency and the safety of both the driving public and pedestrians. The recommended works are the responsibility of the public sector, and there was a commitment made at the Donkin community meeting on October 16, 2008 that these works would be undertaken to accommodate the Project.

7.1.20.3 Mitigative Measures

The proposed mitigative measures include:

- continued discussions between NSTIR and CBRM to facilitate the necessary upgrades of the road, i.e., pavement strength, pavement width, sidewalks, pedestrian signage and traffic signals based upon the results of the TIS;
- consultation with CBRM with respect to the traffic control measures necessary to facilitate site preparation and trucking during the operations phase, including limiting truck operation during school bus travel times and upgrades to sidewalks and road pavements as a long term benefit to the community of Donkin;

- washing of trucks prior to their leaving the Project site and the use of tarpaulins to cover the coal transported from the site to inhibit the entrainment of dust in the air; and
- preparation of contract specifications that define protocols, e.g., speeds and timing, for truck movements associated with the Project on defined routes.

7.1.20.4 Cumulative Effects

Beyond the existing traffic patterns, as referenced in Section 4.5.6.3, there are no known other works that would act cumulatively with this Project to substantially increase truck volumes and impact the safe flow of traffic on the Long Beach Road to the Donkin Highway and along Brookside Street, Dominion Street and Wilson Street to its intersection with Route 4.

7.1.20.5 Residual Effects Assessment

There will be increased truck traffic on local roads for the defined period associated with the execution of this Project. Based on the implementation of the recommended mitigation measures, however, including those advocated in the TIS, the proposed Project is anticipated to have a negligible residual effect on vehicular traffic in the region.

7.1.21 Health and Safety

Both community and worker health and safety were identified as concerns during the consultations. They are also matters that are addressed by regulatory requirements. Health and safety is therefore identified as a socio-economic issue.

A significant impact on worker or community health and safety attributable to the Project can be defined as a discernible effect on community health risk associated with the enjoyment of the local area, including Schooner Pond Beach, or a catastrophic or major hazard as identified in Section 2.4.4.

As is stated clearly in Section 1.1.2, the Proponent places considerable emphasis on the provision of a safe working environment for all employees including contractors and for the community at large. This emphasis is underpinned by the Proponent's total commitment to its HSEC values. The implementation and maintenance of a robust HSEC Management System consisting of standards and procedures provide the framework that serves to protect both employee and community health and safety and provides the framework for a Project Specific Health and Safety Plan.

7.1.21.1 Boundaries

The spatial boundaries include the Project site and the transportation haul routes; the temporal boundaries relate to the anticipated life of the Project, i.e., a maximum of 36 months.

7.1.21.2 Pathway Analysis

There are direct pathways to worker health and safety associated with every Project activity, but the risks associated with underground operations are the greatest. As referenced in Section 2.3.1, these risks relate to strata fall or collapse; explosions; fires; mobile equipment and pedestrian interactions; failure of surface containment structures; in rush; and inappropriate emergency responses.

In terms of community health and safety, potential interactions include accidents involving mobile equipment and community vehicles or pedestrian accidents. No other catastrophic or major hazard is predicted to involve the local community.

As indicated in Section 2.3.1.2, the Proponent has developed a core catastrophic risk register to document catastrophic events across its global business and has developed a range of protocols to minimize the likelihood of a catastrophic event and to protect both community and worker health and safety at all its sites. These are matters that are taken very seriously. The Proponent is required corporately to undertake a risk assessment at each phase of the Project to identify, assess, manage and monitor any potential for accidents against its internal standards and core catastrophic hazards.

7.1.21.3 Mitigative Measures

In accordance with corporate protocols, the following mitigative measures will be implemented:

- completion of a BBRA for each phase of the Project to identify the potential for HSEC hazards;
- preparation of protocols and documentation that is comparable to or exceeds the requirements of the Nova Scotia *Environment Act* and the *Nova Scotia Occupational Health and Safety Act*;
- the design and implementation of emergency drills to ensure the adequacy of, and familiarity with, the plans in association with the pertinent regulatory and response agencies, including those who would be categorized as first responders[20] in CBRM; and
- development of Project specific Contingency and Emergency Response Plans including TARPs.

The development and instigation of these procedures, in conjunction with the implementation of a behavioural safety program will enable the Proponent to effectively manage all levels of risk to minimize injury and illness and ensure that Xstrata Coal maintains its high standards globally with respect to health, safety, environment and community well being.

7.1.21.4 Cumulative Effects

There are no other proposed works within the boundary of this assessment that would act cumulatively with this Project to impact worker and community health and safety; no cumulative effects are anticipated.

7.1.21.5 Residual Effects Assessment

Given implementation of risk management and contingency planning as specified and ensuring compliance with requirements of the Nova Scotia *Environment Act* and the Nova Scotia *Occupational Health and Safety Act*, the proposed Project is anticipated to have negligible residual effects on worker and community health and safety.

7.2 Effect of the Environment on the Project

While the Nova Scotia *Environment Act* and its pursuant Environmental Assessment Regulations do not define a requirement for assessing the effect of the environment on the Project, it has been included as a requirement of the “Guide to Preparing an Environmental Assessment Registration Document for Mining Developments in Nova Scotia”. Additionally, assessing the predicted effects that the environment may

[20] It is recognized that there is a need to establish a Comfort Centre in the community and to upgrade the equipment and facilities of the Donkin Volunteer Fire Department.

have on the proposed Project allows a complete assessment of the Projects interaction with the environment to be undertaken.

7.2.1 Potential Effects of Environment

In the case of the proposed Project, potential effects of the environment on the Project will include severe weather conditions, such as floods, blizzards, hurricanes, which are predicted to increase in intensity with climate change. Other potential effects of the environment on the Project will include other natural disasters, such as earthquakes or forest fires.

7.2.1.1 Severe Weather

Atlantic Canada is subject to severe weather events including, for example, Hurricane Juan in September, 2003 and White Juan, the unofficial name given to the blizzard of February 2004. In August 1873, a hurricane known as the Great Nova Scotia Cyclone swept over Cape Breton Island resulting in property losses of around $3.5 million, an amount equivalent to $70 million in 1990; it was at that time recorded as the worst gale since 1810 (EC 2007a). Fall and winter “Nor'easter” storm events often bring heavy rain and strong winds to the Atlantic coast.

Blizzards and significant snow accumulation may have a short term impact on Project operations for several reasons including the inability of shift workers to commute to the Project site. As most work will occur subsurface, extreme surface weather conditions are not anticipated to have a significant effect on that facet of the Project. The access road, employee parking lot and surface infrastructure will be cleared of snow and undergo winter maintenance to minimize any effects from the winter storm events.

Since 1895, the overall region’s temperature has experienced a warming trend of 0.6 ºC. Although this temperature change is not considered statistically significant (NRC 2007), climatologists tracking extreme weather events world-wide are indicating an upward trend in weather-related disasters (EC 2007b).

7.2.1.2 Earthquakes

As part of the Proponent’s review of viability of the Project, the occurrence and risk of earthquakes was investigated. According to the Geological Survey of Canada records, a summary of available crustal stress and earthquake epicenter data was produced. A cross check of this information was completed via the United States of America Geological Survey web site. All available earthquake data from 1568 to October 2006 was reviewed. The data indicated most epicenters are associated with continental sutures related to the mid Atlantic ridge sea floor spreading. A cluster of 25 epicenters, with magnitudes ranging from 2.0 to 4.2 on the Richter scale, occurred approximately 160 km to the east-southeast of Donkin.

The nearest largest event occurred in 1929; this was a 7.2 Magnitude event located approximately 330 km to the east-southeast of Donkin. This earthquake caused a chain of events including a submarine slump (landslide) on the Laurentian slope, which then caused a Tsunami that brought a water wave to the southern Newfoundland and Cape Breton coastline. Generally, this water wave resulted in approximately a 7 m rise in water levels. In Newfoundland, however, destruction directly associated with the same tsunami was recorded where water levels reached 27 m above sea level.

Overall, the Geological Survey of Canada rates the immediate Donkin area as a low to moderate earthquake hazard area.

7.2.1.3 Forest Fires

There is the potential for forest fires to occur on the Donkin peninsula due to the density of tree cover. During periods of dry weather the potential would increase and an incident could impact the surface operations. In the event of a naturally occurring forest fire, the Proponent's emergency response plan will be implemented to reduce the impact such an event might cause.

7.2.2 Mitigative Measures

There are a number of planning, design, construction and emergency preparedness strategies, based on Xstrata Coal Sustainable Development Framework, which will minimize the potential effects of the environment on the Project to a level of risk to acceptable levels. These strategies are discussed in Section 2.3.

Extreme precipitation events and surface runoff may cause temporary delays in Project activity. Mitigation measures will include, but are not limited to, designing and installing erosion and sediment control structures during project construction and the installation of stormwater management systems which direct surface runoff into designated settling ponds for treatment before runoff interacts with the natural environment. The layout of surface facilities is designed to direct water away from the portals. The tunnels will be equipped with a pumping system capable of managing the water accumulating within the underground workings. Backup power will be supplied on the site to ensure continuous pumping even during an electrical power outage resulting from a storm event.

7.2.3 Residual Effects

In summary, the environment is not anticipated to significantly affect the Donkin Underground Exploration Project.

7.3 Summary of Residual Environmental Effects

Residual environmental effects are those predicted to remain after the proposed mitigative measures have been implemented. The following summarizes the positive and negative residual environmental effects of the proposed Project for each VEC and socio-economic issue where a residual effect was identified. Mitigative measures are discussed in the various sub-sections of 7.1, as well as integrated into Project description in Section 2.0; therefore, they are not repeated in this sub-section.

A discussion of significance of environmental effects is presented in terms of magnitude, reversibility, duration, timing and aerial extent for the VECs and socio-economic issues. These are defined as:

- nature of effect, i.e., positive (+) or negative (-);
- magnitude of effect on background levels, i.e., small, moderate or large;
- reversibility of the effect, i.e., reversible or irreversible;
- timing of effect typically during construction or operation, i.e., short- or long- term respectively; and
- aerial extend of the effect, e.g., immediate area of construction/discharge is considered local.

This is an important Project and information collected from the exploratory activities will provide essential input to the Proponent's determination of whether to proceed to the development of a commercial longwall mine. Given the scale and nature of the works being considered in the long term, there are numerous studies and evaluations being conducted simultaneously to ensure that all the necessary issues are addressed and that both corporate and regulatory decision makers have the information that they require to make decisions in a timely manner. It is a complex, progressive and iterative process. The range of environmental and related studies necessary is itself extensive, and this environmental assessment registration document for this specific Project, i.e., underground exploration, is an important planning tool in this process.

Environmental work continues to be executed and will be an integral work stream throughout the corporate decision making process and, should a decision be made to proceed with the development of a longwall mine, throughout detailed engineering, construction and beyond. As further work is executed, whether in response to conditions of release from this environmental assessment process, as part of ongoing project design or environmental monitoring, or in response to a permitting process, the studies and findings will be shared with the regulatory authorities and the CLC, as well other stakeholders upon request.

Table 7.3 communicates the findings of the environmental evaluation undertaken and presented in this document.

Table 7-3: Residual Effects Assessment

	Nature	***Magnitude***	***Reversibility***	***Timing***	***Extent***
Surface water quality	-	Small	Reversible	Short	Local
Marine water quality	-	Small	Reversible	Short	Local
Groundwater quality	-	Small	Reversible	Short	Local
Air quality	-	Small	Reversible	Short	Local
Ambient noise	-	Small	Reversible	Long	Local
Ambient light	-	Small	Reversible	Long	Local
Aquatic habitat	-	Small	Reversible	Short	Local
Baileys Wetland	-	Small	Reversible	Short	Local
Other wetlands	-	Small	Reversible	Short	Local
Migratory/ breeding birds	-	Small	Reversible	Short	Local
Fauna (Bats)	-	Small	Reversible	Short	Local
Flora	-	Small	Reversible	Short	Local
Odonata	+	Small	N/A	Long	Local
Species at Risk	-	Small	Reversible	Short	Local
Land use	-	Small	Reversible	Long	Local
Archaeological resources	+	Small	N/A	Long	Local
Recreation	-	Small	Reversible	Long	Local
Vehicular traffic	-	Moderate	Reversible	Short	Regional
Economic opportunities	+	Small	N/A	Long	Regional
Health and safety	-	Small	Reversible	Long	Local

Because the adverse residual effects are primarily small to moderate in magnitude, mostly short-term, reversible and local, it is concluded that the undertaking can be executed with negligible residual effects on VECs and socio-economic issues with the application of standard and accepted industry practices and procedures, adherence to applicable regulations and guidelines, and proactive environmental protection planning, including implementation of mitigative measures as identified.

Chapter 8 Approach to Environmental Management

8.1 Purpose and Format of an Environmental Management System

The purpose of an EMS is to implement safe and environmentally responsible engineering, construction, operation and training practices. An effective EMS employs a continuous, rigorous, self-monitoring cycle for continual improvement of environmental performance. Improvement is achieved by:

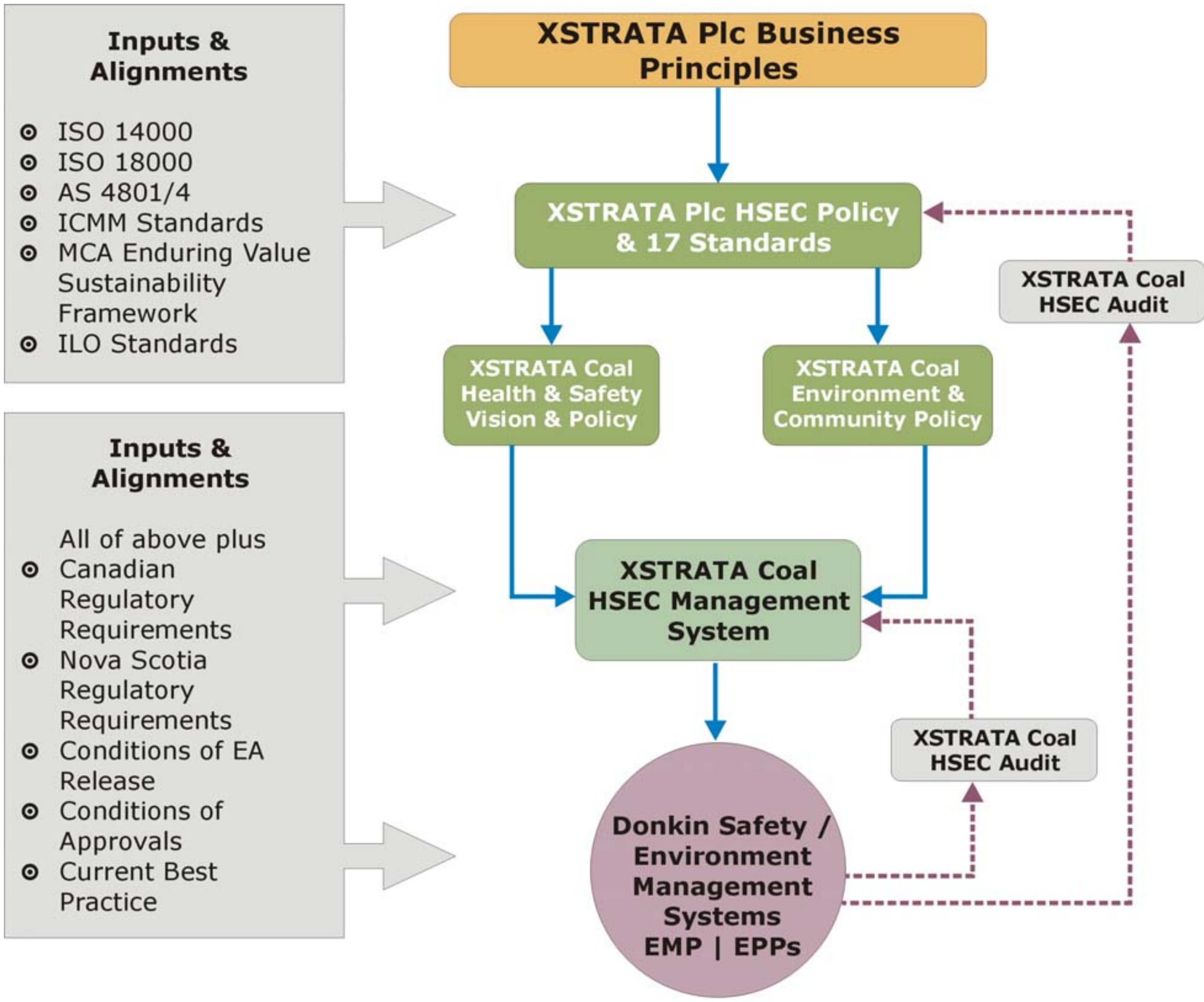
- identifying how the activities, products, and services interact with the environment to cause environmental impacts;
- establishing and maintaining environmental objectives and targets;
- training staff and clearly defining responsibilities;
- instituting operational controls, emergency procedures and monitoring; and
- taking corrective action whenever necessary to avoid and reduce adverse impacts, using the "plan-do-check-act" model.

The Proponent is fully committed to articulate and to adhere to systems, procedures, practices and materials that will ensure the development and operation of the Project in a manner that protects the environment and facilitates the safety of all who work or visit the site. The principle components of an EMS include the preparation of the following:

- an EMP that documents all measures that will be taken to protect the environment and to ensure safety including the commitments made in the environmental assessment, the conditions of release and any subsequent approvals;
- various EPPs that succinctly detail the specifications that contractors will adhere to on site; and
- a Contingency and Safety Plan that lays out the measures that will ensure safety on site.

The principles of these plans are currently included in the Proponent's HSEC policies which have been developed to provide a co-coordinated and consistent approach to environmental management across all of the company's operations. As depicted on Figure 8.1, these plans are based on ISO 14001 principles and other international and national standards. The details of the HSEC, which incorporate the principles of EMP and EPPs, will be specific to the Project, but will only be fully articulated once the Project design is finalized. These plans will also evolve and be amended as the Project progresses from engineering and into execution. Specific components of an effective EMP include:

- a plan and defined procedures to ensure compliance with all pertinent legislation, regulations and government policy;
- environmental practices and procedures that establish standards for all operations that have a potential to cause environmental problems including minimum standards for contractor safety and environmental protection;
- the articulation of minimum safety standards to ensure that all personnel are aware of potential hazards and are informed of safe work practices and emergency procedures;
- defined training and awareness protocols; and
- an accident/incident reporting system that standardizes prompt reporting of all injuries and environmental incidents.



Souce: Adapted from Xstrata Coal Environmental Management Framework HSEC POL1.4

Figure 8.1: HSEC Management Framework

This environmental assessment registration document is the first of the many steps necessary to ensure that the Project is developed in an environmentally sound manner. This awareness comes from two sources. Firstly, there is the knowledge that there will be subsequent approval requirements for specific activities as the design for the works evolve and the need to submit the HSEC policy and standards to be implemented, i.e. EMP and EPP information to the NSE to ensure that activities are executed in accordance with all regulatory requirements. Secondly, the Proponent through the parent company, Xstrata Coal, is committed to executing an effective EMS, through its HSEC policies, for all their operations. This includes the definition of environmental objectives and definitive targets and the preparation of plans to meet those targets within the legislative framework of the jurisdiction in which the Project is located. The Environmental Management Framework for Xstrata Coal New South Wales is provided in Appendix N as an example of the corporate standard. This framework provides an important reference for the preparation of the materials referenced above for the Project as defined in this environmental assessment registration document.

8.2 Commitments

The Proponent will honour and comply with:

- all commitments made in this environmental assessment registration document;
- all conditions attached to the release from the environmental assessment process and attached to subsequent approvals; and
- all applicable laws and regulations.

As summarized in Table 7.3, there are no significant adverse effects associated with the execution of the Underground Exploration Project. The residual effects can be avoided or mitigated through good engineering design, responsible construction practices and the execution of the subsea exploration works in a manner that incorporates appropriate environmental management techniques, including the HSEC protocols, into every day practices.

The environmental commitments made by the Proponent in this environmental assessment registration document will ensure that there are no significant adverse residual effects on identified VECs and socio-economic issues as a result of the execution of the Project as defined, i.e., the Underground Exploration Project. Many facets of the Project will, of necessity, be further detailed in subsequent documentation including the HSEC policies as engineering proceeds. The key commitments made include, but are not limited to, the following:

- inclusion of environmental performance specifications in tender documents;
- implementation of appropriately designed, placed and managed erosion control measures to protect surface waters and wetlands;
- establishment of protocols to ensure the frequent inspection of erosion and sedimentation control features;
- protection of Baileys wetland, including the direction of surface water runoff from the active yard area away from that wetland to the mine water treatment system;
- prohibiting vehicle maintenance and fueling within 30 m of a watercourse, wetland or the high water mark;
- establishment of protocols for the safe storage and handling of all hazardous materials, e.g., petroleum, oils and lubricants ("POLs");
- establishment of protocols for the proper management of all wastes produced on site;
- development of TARPs, similar to Contingency and Safety Plans, to address potential malfunctions and accidents; and
- installation of necessary planting to provide additional buffers to sensitive areas, enhance terrestrial habitats, protect the headland and improve aesthetics.

The first versions of the HSEC policies and standards, i.e. EMP and EPPs, will be prepared and submitted to the regulatory authorities as soon after release from the environmental assessment process as possible and in a timeframe that will enable the principles and specific requirements to be written into tender documents for works on site.

Xstrata Coal implements TARPs which are similar in nature to Contingency Plans prepared for industrial operations in Canada. The TARP system embodies a formalized reporting system and reaction to hazards, which relies on an escalation of decision making. There are four conditions for the development of a TARP:

- Normal – Green;
- Level 1 – Yellow;
- Level 2 – Orange; and
- Level 3 – Red.

There are clear guidelines as to what actions should be taken at each trigger level. Conditions (triggers) for activating TARPs will be prepared for each of the environmental monitoring programs implemented for the Project. An example of a TARP developed for the tunnel dewatering operations is provided in Appendix B.

8.3 Environmental Monitoring and Reporting

Based on the data that has been compiled and the analysis that has been undertaken, the proposed scope of the environmental monitoring is referenced below. The detailed requirements of the monitoring program will be developed not only in consultation with the regulatory authorities as part of the detailed approval processes and the Project's release from the environmental assessment process, but also in consultation with the CLC.

During the execution of the Project, the Proponent commits to the implementation of:

- a surface water monitoring program to ensure that there are no impacts to the surrounding freshwater and marine aquatic environments;
- an air emissions monitoring program with a specific focus on particulate matter with measurements taken at the two locations used to establish ambient air conditions;
- a noise monitoring program to ensure that noise generated on the peninsula does not adversely impact nearby residents; and
- groundwater monitoring program to ensure that there are no adverse impacts or degradation of the groundwater environment in the vicinity of Baileys wetland.

The findings of all programs will be shared with the pertinent regulatory authorities and all interested stakeholders, including the CLC.

Xstrata has established a comprehensive Sustainable Development Framework for the welfare of both the workers and the environment at their operations world wide (see Section 1.2.1 and Appendix A). These corporate principles and frameworks for its environmental management are aligned with the ICMM principles of sustainable development and with ISO 14001 (information from http://www.xstrata.cc/sustainability/environment). In accord with the conditions of release from the environmental assessment process and all subsequent approvals, the Proponent shall revisit and revise the environmental monitoring protocols to fully account for the operational status of the Project.

This Project is of its very nature of limited duration, and it is anticipated that its successful execution will lead to further phases of work associated with the potential development of a longwall mine at Donkin. The Proponent believes it highly unlikely that the workings on the Donkin peninsula will be closed out in

36 months time. It is nevertheless important to stress that Xstarta adheres to the highest standards of close out planning for all its works. Should such an unanticipated decision be warranted, Xstrata will ensure:

- the safe abandonment and closure of the mine tunnels;
- the removal of structures and associated infrastructure for which no alternative has been identified; and
- the restoration of the Project site in a manner that enables its reuse for another purpose or its rehabilitation as natural areas.

8.3.1 Malfunctions and Accidents

Although the required monitoring and follow up associated with a malfunction or accident depends on the specifics of the event, Xstrata Coal, as referenced in Section 2.3.1, has:

- developed a core risk register to document catastrophic hazards across its global business;
- established procedures whereby project specific risks are identified, i.e., BBRA;
- requires the preparation of High Hazard Management Plans; and
- institutes a schedule of emergency drills on all its sites.

The prepared plans and protocols cover all aspects and phases of the Project. The development of site specific procedures and standards will be comparable to or exceed the requirements of the Nova Scotia *Environment Act* and the Nova Scotia *Occupational Health and Safety Act.*

Chapter 9 Conclusions

The purpose of the proposed Project is to provide the Proponent with sufficient confidence in data with respect to the geology, coal quality, hydrology and subsea methane gas regime to allow the determination of a business case for the development of an underground coal mine on the Donkin peninsula. This Project will involve:

- modifications to surface infrastructure at the Project site, including the ongoing management of water, improvements to road access, and necessary underground prepatory works, including ventilation system improvements;
- the extraction, by a continuous miner system, of up to 2,000 tonnes of coal per day for up to two years via the two existing tunnels; and
- the trucking of bulk samples of coal via public highways to various destinations in Cape Breton and beyond.

The work undertaken to prepare this environmental assessment registration document was designed to:

i) identify the potential environmental effects of the execution of the proposed Underground Exploration Project; and
ii) satisfy the requirements of the *Nova Scotia Environment Act* for a Class I Environmental Assessment.

The study area for this environmental assessment includes the Donkin peninsula, the trucking routes from the site to a location west of Glace Bay on Route 4, and those communities that may be affected by the Project. Both the landscape around the site and much of the land along the proposed truck routes has been influenced by human activity and infrastructure development. Much of the development on the peninsula is due to the previous work done by DEVCO. Some of this infrastructure has been upgraded; work completed by the Proponent includes securing the site and successfully pumping and treating 470 million litres of water from the tunnels.

Field investigations and database searches were carried out to describe the valued physical, biophysical and socio-economic resources present in the study area. Specific studies included, but were not limited to, field programs to collect data on birds, bats, plants, groundwater and surface water quality, traditional uses and archaeological resources. Additional programs on the peninsula with respect to birds, air, noise and the hydrology / hydrogeology interface around Baileys wetland are ongoing. The range of environmental and related studies undertaken is extensive, and this environmental assessment registration document is an important planning tool in this process. Should a decision be made to proceed with the development of a longwall mine at Donkin as a result of this Project, the environmental field programs still to be executed will continue as an integral work stream throughout the corporate decision making process, detailed engineering, construction and beyond.

Consultation with the local community and other stakeholders, including federal and provincial regulators and First Nations, was instigated at the outset and has been extensive. A corporate decision was made to form a CLC early in the consultation process which led to the first regular meeting in August of 2006. Open houses were held in May, 2007 and community meeting in October, 2008. The Proponent has developed a positive working relationship with the local community and will continue to address issues as they arise in consultation with the CLC. As further work is executed, whether in response to conditions of release from this environmental assessment process, as part of ongoing Project design, environmental monitoring, or in response to a permitting process, the studies and findings will be shared with the regulatory authorities and the CLC, as well other stakeholders upon request.

As is summarized in Table 7.3, the adverse residual effects are primarily small to moderate in magnitude, reversible and local. It is, therefore, concluded that the proposed Underground Exploration Project can be executed with negligible residual effects on VECs and socio-economic issues with the application of standard and accepted industry practices and procedures, adherence to applicable regulations and guidelines, and proactive environmental protection planning, including implementation of the mitigative measures as identified.

The Proponent is fully aware that this environmental assessment registration document is the first step of the many necessary to ensure that work on the Donkin peninsula proceeds in an environmentally sound manner. As previously referenced, an environmental impact assessment is being prepared for the longwall mine and associated dedicated transportation corridor. Additional approvals and authorizations will be required going forward. Corporately, the Proponent's parent company, Xstrata Coal, is committed to executing an EMS for all of their operations. Xstrata Coal is taking the initiative not only to pursue goals with respect to climate change, sustainability, carbon neutrality and a commitment to biodiversity, but also to execute and support pertinent research in these fields, to lead by example and to embrace these objectives throughout their operations, including the work that will be undertaken at Donkin.

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