APPENDIX F
Solid Waste Management Plan

1.0 Introduction

The Donkin Export Coking Coal Project will generate solid waste materials (*e.g.*, domestic waste, construction and demolition debris) during construction, operation and decommissioning and reclamation. Solid waste materials management will be a component of the Environmental Management Plan (EMP) developed for the Project. In in the interim, to satisfy EIS Guidelines requirements for a Draft Solid Waste Materials Management Plan in EIS, draft procedures are included below. These procedures will be updated as necessary and incorporated into the EMP for the Project. The Solid Waste Management Plan (SWMP) does not include coal and mineral rock disposal which is addressed separately.

2.0 Scope of the Program

Solid waste will be generated during site preparation and land and marine-based construction. Potential sources of solid waste generated by Project activities may include scrap metals, wood, insulation waste, packing/crating metals, domestic wastes (*e.g.*, office and lunchroom waste), paper, and cardboard. Generated wastes could be non-hazardous (*e.g.*, domestic) or hazardous in nature (*e.g.*, fuels, oils). This SWMP contains procedures for waste minimization, recycling and disposal.

3.0 Environmental Issues

Solid waste, if not properly controlled and disposed of, can be unsightly and cause human safety and health concerns. Disposal of solid waste in the marine environment has potential to harm marine life. Uncontrolled hazardous waste can contaminate soils, surface and groundwater, and can be toxic to vegetation, fish and wildlife if ingested in sufficient quantities.

3.1 RELEVANT REGULATIONS, GUIDELINES AND COMMITMENTS

- Section 36 of the federal *Fisheries Act* prohibits the discharge of deleterious substances into any type of water frequented by fish.

- The Garbage Pollution Prevention Regulations under Part XV of the *Canada Shipping Act* (CSA) prohibit the discharge of garbage, including solid galley waste, food waste, paper, rags, plastics, glass, metal, bottles, crockery, junk, or similar refuse.

- The Oil Pollution Prevention Regulations under Part XV of the CSA stipulate the requirement for installations capable of retaining oil residues on board for subsequent discharge to a reception facility and equipment that meets oily mixture discharge requirements set out in Sections 31 and 33.

- Section 5.1 of the *Migratory Birds Convention Act* prohibits any person or vessel from depositing any substance that is harmful to migratory birds (*e.g*., oil, oil wastes, *etc.*) in waters or an area frequented by migratory birds, or in a place from which the substance may enter such waters or such an area.

- The Solid Waste-Resource Management Regulations pursuant to the Nova Scotia *Environment Act* prohibit release of litter from construction sites in areas other than approved sites. Schedule "B" of these regulations lists materials banned from landfills and incinerators in Nova Scotia.

- NSE's *Guidelines for Disposal of Contaminated Solids in Landfills* (1994) address procedures to be followed to determine if soils or other solids would be acceptable for landfill disposal based on parameters of concern.

- Any transportation of hazardous waste that is classified as dangerous goods under the *Transportation of Dangerous Goods Act* must adhere to the Act and follow the documentation requirements as outlined in the regulations made pursuant to the Act.

4.0 Environmental Protection Procedures

4.1 NON-HAZARDOUS WASTE

XCDM and its contractors will be responsible for implementation of non-hazardous waste management procedures as follows:

- Waste management procedures will comply with federal and provincial waste management regulations, as well as additional municipal and disposal facility requirements;

- All construction waste and any other refuse associated with the Project will be sorted and segregated as recyclable and non-recyclable;

- Recyclable material will be collected and transported to a licensed recycling facility using local services authorized by the Company;

- An effort will be made to minimize the amount of waste generated by application of the "4-R" principals (*i.e*., reduce, reuse, recycle, recover) to the extent practical;

- Non-recyclable wastes will be hauled off-site to an approved landfill by a qualified waste management company;

- Domestic waste will be gathered daily and stored in closed containers until disposed of at an approved waste disposal site;

- Food waste will be stored in a manner that avoids attracting wildlife. Effort will be made to compost organic material if practical; and

- Waste containers will be covered to prevent the escape of windblown debris and will be clearly labeled.

4.2 HAZARDOUS WASTE

XCDM and its contractors will be responsible for implementation of hazardous waste management procedures as follows:

- Waste management procedures will comply with federal and provincial waste management regulations, as well as additional municipal and disposal facility requirements;
- Waste oils and lubricants will be stored separately in a tank or closed container;
- All used oil, petroleum products and other hazardous materials, will be removed and disposed of in an acceptable manner in accordance with federal and provincial regulations and requirements;
- Waste oil will be collected separately and offered for recycling or stored for collection by an approved special waste collection and disposal company;
- Greasy or oily rags or materials subject to spontaneous combustion will be deposited and kept in an appropriate receptacle. This material will be removed from the work site on a regular basis and will be disposed of in approved waste disposal facilities; and
- Efforts will be made to reduce waste where applicable and to recycle as required under the provincial Waste-Resource Management Regulations and good industrial hygiene practices. Waste materials will be hauled by qualified waste management companies to approved disposal or recycling facilities.

5.0 Training Requirements

All persons working on the site will receive EMP orientation training prior to the start of construction. All personnel who may be handling dangerous wastes for transport shall have WHMIS and Transportation of Dangerous Goods training. All Company staff and Contractors will be made aware of the facilities and systems in place to promote waste diversion (*i.e.*, recycling and composting containers).

6.0 Records

The Company shall maintain records of environmental training. Records associated with waste management may include the following manifests:

- TDG Shipping;
- Hazardous Waste (generator); and
- Non-hazardous regular shipping.

APPENDIX G
Draft Conceptual Habitat Compensation Plans

Draft Conceptual Wetland Habitat Compensation Plan – Donkin Peninsula

and

Draft Conceptual Fish Habitat Compensation Plan – Donkin Peninsula

Draft Conceptual Wetland Habitat Compensation Plan – Donkin Peninsula

Draft Conceptual Wetland Habitat Compensation Plan – Donkin Peninsula

PREPARED FOR:
Xstrata Coal Donkin Management Limited

PREPARED BY:

Stantec Consulting Ltd.

File: 121510478

April 2012

Table of Contents

LIST OF TABLES

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide Nova Scotia Environment (NSE) a high level conceptual strategy and plan to compensate for anticipated wetland alterations related to the Donkin Export Coking Coal Project (the Project).

1.2 Regulatory context

Wetlands are protected through federal policy, provincial legislation and provincial policy.

Wetland conservation is federally promoted by the Federal Policy on Wetland Conservation (Environment Canada 1991). The objective of this policy is to "promote the conservation of Canada's wetlands to sustain their ecological and socio-economic function, now and in the future". The Federal Policy on Wetland Conservation sets a conservation goal of no net loss of wetland function. Wetland function is defined by the Federal Policy on Wetland Conservation (Environment Canada 1991) as:

> *…the natural processes and derivation of benefits and values associated with wetland ecosystems, including economic production (e.g., peat, agricultural crops, wild rice, peatland forest production), fish and wildlife habitat, organic carbon storage, water supply and purification (groundwater recharge, flood control, maintenance of flow regimes, shoreline erosion buffering), and soil and water conservation, as well as tourism, heritage, recreational, educational, scientific, and aesthetic opportunities.*

Coordination of implementation of the Federal Policy on Wetland Conservation is the responsibility of Environment Canada, specifically the Canadian Wildlife Service (CWS) and the Environmental Conservation Branch (ECB). Although there is no specific federal legislation regarding wetlands, they may be protected federally under the *Species At Risk Act*, if they contain critical habitat for Species At Risk, the *Migratory Birds Convention Act*, if they contain nests of migratory birds, and / or the *Fisheries Act*, if the wetland contributes to existing or potential fish habitat.

Provincially, wetlands in Nova Scotia are protected by the Nova Scotia *Environmental Act* (NS 1995), where "wetland" is defined as:

> *land commonly referred to as a marsh, swamp, fen or bog that either periodically or permanently has a water table at, near or above the land's surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation and biological activities adapted to wet conditions.*

In October 2011, NSE released the Nova Scotia Wetland Conservation Policy. The Wetland Conservation Policy provides context to legislation, regulations and operational policies designed to protect and guide management of wetlands in Nova Scotia. Most importantly, the policy establishes a specific goal of no loss of Wetlands of Special Significance and no net loss in area and function for other wetlands. The government considers the following to be Wetlands of Special Significance (NSE 2011): all salt marshes; wetlands that are within or partially within a designated Ramsar site, Provincial Wildlife Management Area (Crown and Provincial lands only), Provincial Park, Nature Reserve, Wilderness Area or lands owned or legally protected by non-government charitable conservation land trusts; intact or restored wetlands that are project sites under the North American Waterfowl Management Plan and secured for conservation through the Nova Scotia Eastern Habitat Joint Venture; wetlands known to support at-risk species as designated under the federal *Species At Risk Act* or the Nova Scotia *Endangered Species Act*; and wetlands in designated protected water areas as described within Section 106 of the *Environment Act*. Any project with the potential to alter a wetland (filling, draining, flooding or excavating), including direct and indirect effects, requires a Water Approval from NSE, pursuant to the Activities Designation Regulations (NSE 2010), prior to starting the work. If alterations exceed two hectares of any wetland, the project is also subject to registration under the Environmental Assessment Regulations.

Prior to any alteration to wetland habitat, a Wetland Alteration Approval must be sought from NSE. Applications for Wetland Alteration Approval must be supported with details of the unavoidable nature of the proposed wetland alterations, the measures to minimize or compensate for wetland alteration, and the character and function of wetlands to be affected. These applications are evaluated in the context of the mitigative sequence. The mitigative sequence for decision-making is the foundation for achieving wetland conservation in Nova Scotia. The sequence – avoidance, minimization, compensation – assists proponents in planning and designing project proposals that will be acceptable to NSE. Avoidance is the priority, and requires consideration of project alternatives that would have less adverse effects on the wetland. Minimization requires that the project be designed and implemented using techniques, materials and site locations that reduce or remediate the project effects on the wetland. Compensation requires that the residual effects on the wetland functions are compensated for by the enhancement, restoration or creation of wetland habitat at an area ratio commensurate with the loss. Any loss of wetland habitat, either through direct or indirect Project effects, requires compensation to replace the wetland functions lost as a result of the wetland alterations.

1.3 Scope

The Project has considered and incorporated the mitigative sequence, as directed by NSE. Where possible, the Project is planning to avoid wetland habitat, and impacts will be minimized during the construction and operation and maintenance phases of the Project. However, not all wetland habitat could be avoided by the Project, and permanent alteration will occur which will require wetland compensation.

The coal extraction will occur in phases, and wetland alteration will occur at various stages in mine development over the life of the mine (e.g., initial site construction, Phase I/II coal waste pile and Phase III coal waste pile). It is proposed that wetland compensation will also be conducted in phases, prior to the alteration.

This document is a Draft Conceptual Wetland Habitat Compensation Plan to support the Project EIS as required by the EIS Guidelines. A Detailed Conceptual Wetland Compensation Plan will be required post-environmental assessment (EA) (including elements of final design and EIS/CSR commitments) to support future Wetland Alteration Approval applications to NSE. The plan will be developed to accommodate the Project phases.

2.0 STAKEHOLDER ENGAGEMENT

Detailed wetland compensation planning will include stakeholder engagement with governmental and non-governmental groups. The main governmental group will be NSE, but the Nova Scotia Department of Natural Resources and Environment Canada may also be consulted. Non-governmental groups will likely include the Atlantic Coastal Action Program (ACAP). ACAP is a non-for profit organization with local expertise and a working knowledge of coastal environments in Cape Breton. Other local community stewardship groups with an interest in wetlands may also be involved as appropriate.

Enterprise Cape Breton Corporation (ECBC) may also be consulted with respect to their experience with wetland creation in the context of mine site remediation. The ECBC, a federal corporation that promotes development in Cape Breton, is another organization with experience in wetland creation. The ECBC have been involved in creating wetlands in mine reclamation projects, and have developed wetlands that function as bio-filters to remove toxic contaminants from upslope water sources. The detailed Wetland Compensation Plan will incorporate relevant stakeholder input and will be submitted to NSE for review and approval.

3.0 DETERMINING WETLAND COMPENSATION

3.1 Current Conditions

A total of 85 wetlands, accounting for over 120 ha, have been identified on the Donkin Peninsula through a combination of field surveys and desktop analyses. Of these, 74 wetlands were delineated during field surveys; the boundaries of eight were identified through a combination of air photo interpretation and provincial wetland mapping; and the extent of three were estimated using a combination of field and desktop data. All recognized wetland classes (NWWG 1997) are present on the Peninsula, including swamp, bog, marsh, shallow water, and fen (Table 1). Wetland complexes (identified as wetlands which are comprised of two or more wetland classes) comprise over 85 ha, or approximately 69 percent of the wetland area of the peninsula, and include marsh/shallow water, marsh/shallow water/swamp/bog, swamp/fen,

swamp/marsh, swamp/fen/marsh, and swamp/shallow water/fen/marsh. The three largest wetlands on the Peninsula are: a) Baileys Wetland (~43.0 ha) which is comprised of a combination of swamp, shallow water, fen, and fringing marsh; b) DEVCO wetland (~18.1 ha) which is primarily comprised of marsh and shallow water classes but also includes fringing swamp and a small section of bog; and c) a swamp/fen in the northeast quadrant of the Peninsula which has a relatively small area of marsh located at its western end (~13.4 ha).

Table 1 Wetland Number and Area on Donkin Peninsula by Class

Wetland Class[1]	Number	Area (ha)	Proportion of Total Wetland Area by Class (%)
Marsh	4	0.4	0.3
Marsh / Shallow Water	1	0.3	0.2
Marsh / Shallow water / Swamp / Bog[2]	1	18.1	14.8
Swamp	68	37.6	30.8
Swamp / Fen	3	6.0	4.9
Swamp / Fen / Marsh	1	13.4	10.9
Swamp / Marsh	6	3.4	2.7
Swamp / Shallow water / Fen / Marsh[3]	1	43.0	35.2
Total	85	122.3	100.0

[1]Wetland classification data based on field surveys, air photo interpretation, and wetland inventory from the NSGC and NSDNR
[2]DEVCO Wetland
[3]Baileys Wetland

3.2 Anticipated Compensation Requirements

It is anticipated that the Donkin Export Coking Coal Project will directly affect 42.2 ha of wetland habitat on the Donkin Peninsula. Compensation will be required through the enhancement, restoration, or creation of wetland habitat at an area ratio commensurate with the loss. As such, the objective of the compensation is to ensure no net loss of wetland area or wetland function as a result of Project activities on the Donkin Peninsula. It is anticipated that a 2:1 ratio of will be required, based on the Nova Scotia Wetland Conservation Policy, for areas of wetland habitat loss, which equates to 84.4 ha of wetland compensation.

Wetland Alteration Approvals are required from NSE before wetlands can be altered once the project has received EA approval. Approvals will be sought for wetlands that cannot be avoided and for wetlands that may be indirectly affected by the development despite the employment of appropriate mitigation measures. The appropriate application forms (Water Approval) will be accompanied by the requisite information for each site, as outlined in the Operational Bulletin Respecting Alteration to Wetlands (NSEL 2006). Additionally, site specific plans for minimization of wetland alteration will be developed in accordance with the Bulletin (or relevant policy guidance at the time of application). The final compensation requirement will be directed by NSE, upon review of Wetland Alteration Approval submissions.

3.3 Project Design Considerations

Surveys for wetland habitat have been conducted on the Donkin Peninsula, which determined that wetland habitat is common and covers large areas of the Peninsula. Given the extent of mining activities, as well as the presence of existing wetland habitat, there is limited opportunity to compensate for wetland loss within the Peninsula. Therefore, although opportunities for on-site compensation will be explored (e.g., enhancement or creation of wetlands on degraded lands), off-site compensation is required (opportunities close to the Donkin Peninsula will be initially investigated).

Given the anticipated scale of wetland alteration, compensation opportunities will need to yield an area commensurate to the proposed wetland alteration at each main phase of the Project. The large amount of wetland compensation may require several projects in different locations during the life of mine.

3.4 Hierarchy for Identifying Wetland Compensation Options

Opportunities on or near the Donkin Peninsula will be preferentially explored. Wetland compensation opportunities could include the restoration of a degraded wetland, enhancement of a poorly functioning wetland, and the creation of new wetland habitat. Wetland compensation efforts on the Donkin Peninsula may include the restoration or creation of wetlands in areas which have been disturbed by the Project. Publicly owned lands near the Donkin Peninsula will be identified to determine whether there are opportunities on these lands to restore or create wetland habitat. In general, permission to restore and/or create wetland habitat is more likely to be granted by a government body, than by private landowners, particularly as the restored and/or created wetland is to be held in perpetuity. However, if suitable opportunities are identified on privately owned land, these opportunities will be investigated as well, which will involve engaging landowners.

Large scale wetland compensation projects have been successfully completed in Nova Scotia through the removal of tidal restrictions. A culvert or inlet that restricts the flow of tide water can cause areas of coastal salt marsh to dry and cease functioning. The amount of salt marsh habitat has dramatically been reduced in Nova Scotia, through historical development along coastlines. NSE considers salt marshes to be a Wetland of Special Significance (NSE 2011), and would therefore likely be supportive of wetland compensation projects that involve the restoration of salt marsh habitat. Therefore, wetland compensation investigations will initially target opportunities for the removal of tidal restrictions along coastal areas of north-east Cape Breton.

4.0 APPROACH TO DEVELOPING A DETAILED CONCEPTUAL WETLAND COMPENSATION PLAN

Once a viable opportunity has been identified, a Detailed Conceptual Wetland Compensation Plan can be developed for review by NSE. A Detailed Conceptual Wetland Compensation Plan is typically prepared subsequent to completion of an environmental assessment process (if required) and in conjunction with the Wetland Alteration Approval application process.

In developing the Detailed Conceptual Wetland Compensation Plan, desktop research and field assessments will be conducted to refine the Plan, particularly related to overall compensation objectives and goals, construction methods and timelines, future monitoring expectations, and potential strategies to address adaptive management needs or other contingencies. Contents of the Plan will include:

1. Introduction (overall project description and history);

2. Overview of the wetland impacts that require compensation (wetland types and functions)

3. Descriptions of potential wetland compensation sites (soils, hydrology, vegetation, landscape context, level of disturbance, etc.);

4. Concept plan for compensation including the following;

    - description of project components
    - list of general compensation goals, including wetland types and sizes to be restored or created
    - general discussion of potential risks and limitations
    - expected functions and values
    - general construction methods
    - approximate timeline/schedule
    - list of potential remedial measures or adaptive management options
    - responsibility for each component of the project

5. Conceptual plan figures (project location map, plan views, typical details and sections)

6. List of potential follow-up tasks (e.g., implementation plan, post-construction monitoring plan, adaptive management plan, etc.);

7. Appendices (supporting data, reports, etc.)

8. References cited section (as needed)

Once the Plan is approved by NSE, further drawing plans, including any engineering components, can be created as required.

5.0 MONITORING

Once constructed, the monitoring of wetland compensation projects will be a critical component in determining the success of the projects and in guiding adaptive management. Typically, NSE will prescribe five years of post-construction monitoring, and will review annual reports to determine the need for further monitoring. Site specific monitoring plans will be developed through consultations with NSE.

6.0 REFERENCES

Environment of Canada. 1991. The Federal Policy on Wetland Conservation.

NS (Province of Nova Scotia). 1994. Environment Act. c. 1, s. 1. An act to reform the environmental laws of the Province and to encourage and promote the protection, enhancement and prudent use of the environment. Available online: www.gov.ns.ca/legislature/legc/statutes/envromnt.htm [accessed September 2009].

NSDEL (Nova Scotia Department of Environment and Labour). 2006. The Operational Bulletin Respecting Alteration of Wetlands.

NSE (Nova Scotia Environment). 2010. Activities Designation Regulations made under Section 66 of the Environment Act. Available online: http://www.canlii.org/en/ns/laws/regu/ns-reg-47-95/latest/ns-reg-47-95.html [accessed October 2010].

NSE (Nova Scotia Environment). 2011. Nova Scotia Wetland Conservation Policy. Halifax.

NWWG (National Wetland Working Group). 1997. The Canadian Wetland Classification System. Second Edition. Wetlands Research Centre. University of Waterloo.

Draft Conceptual Fish Habitat Compensation Plan – Donkin Peninsula

Draft Conceptual Fish Habitat Compensation Plan – Donkin Peninsula

PREPARED FOR:
Xstrata Coal Donkin Management Limited

PREPARED BY:

Stantec Consulting Ltd.

File: 121510478

April 2012

Table of Contents

LIST OF TABLES

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide the Department of Fisheries and Oceans Canada (DFO) with a high level conceptual strategy and plan to compensate for any anticipated alterations, disturbances, or destruction of fish habitat related to the construction and installation of facilities for the Donkin Export Coking Coal Project (the Project).

1.2 Regulatory context

DFO has overall responsibility for the administration of the federal *Fisheries Act*, which establishes the necessary provisions to protect fish and fish habitat in Canadian marine and fresh waters. This responsibility includes the issuance of authorizations for the harmful alteration, disruption, or destruction (HADD) of fish habitat associated with the construction of aquatic-based structures.

Fish, as defined under the *Fisheries Act*, includes "(a) parts of fish, (b) shellfish, crustaceans, marine animals and any parts of fish, shellfish, crustaceans or marine animals and (c) the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals". Fish habitat, as defined under the *Fisheries Act*, includes "spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes".

Section 35(1) of the *Fisheries Act* protects fish habitat from HADD, while Section 35(2) allows DFO to authorize activities that will result in a HADD of fish habitat under specific conditions. Fish habitat is further protected by the Policy for the Management of Fish Habitat (DFO 1986). This policy applies to all projects and activities in or near water that could "alter, disrupt or destroy fish habitats, by chemical, physical, or biological means", or, in other words, projects and activities that could constitute HADD of fish habitat. The Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff[1] was developed to support DFO staff in making decisions associated with HADD of fish habitat under the above Policy and the *Fisheries Act*.

1 The guide is available at: http://www.dfo-mpo.gc.ca/habitat/role/141/1415/14155/risk-risque/pdf/Risk-Management-eng.pdf

1.3 Scope

The DFO Habitat Policy and Directive, as listed above, are based on the guiding principle of "no net loss" of fish habitat, with a focus on the productive capacity of existing or potential fishery resources. In applying this principle, the first preference of DFO is to avoid any HADD of fish habitat or loss of productive capacity. However, if a HADD is likely to occur, the application of appropriate mitigation measures should be implemented to minimize the HADD to the extent possible if technically and economically feasible. Any residual HADD that cannot be mitigated will require the implementation of a fish habitat compensation plan.

Although the planning and design of Project structures is ongoing, activities that will interact with the marine fish habitat[2] include:

- Construction of the Barge Load-out Facility in Morien Bay that encompasses a breakwater, wharf, and mooring chains and anchors for a barge swing circle; and
- Installation of a Single Buoy Mooring system containing chains and anchors at the transshipment location in Mira Bay.

Project activities that will interact with fish habitat[3] in the freshwater environment include:

- Infilling of watercourses within the Donkin Peninsula for the construction of the coal waste disposal piles.

Since these construction activities and/or the presence of Project facilities in the aquatic environment are to likely result in a 'harmful alteration'[4], 'disruption'[5], or destruction of fish habitat[6] as defined under the *Fisheries Act,* Xstrata Coal Donkin Management (XDCM) will be required to provide fish habitat compensation deemed appropriate by DFO. The draft fish habitat compensation plan presented in this appendix is conceptual and subject to change as the final Project design evolves.

XDCM has committed to developing an effective fish habitat compensation plan, in consultation with DFO and stakeholders, to address any potential HADD of fish habitat. Depending on the location and timing of Project activities, XDCM will submit a fish habitat compensation plan to DFO that outlines measures to offset the losses in fish habitat relevant to Section 35(2) of the *Fisheries Act*.

---

2 Further details of Project design can be found in Section 2.0

3 Further details of Project design can be found in Section 2.0

4 Any change to fish habitat that indefinitely reduces its capacity to support one or more life processes of fish

5 Any change to fish habitat occurring for a limited period which reduces its capacity to support one or more life processes

6 Following mitigation to avoid or minimize interactions between the Project and the environment

2.0 STAKEHOLDER ENGAGEMENT

A critical part of any fish habitat compensation plan is engagement of stakeholders, including governmental and non-governmental groups. Governmental groups include DFO, Environment Canada and provincial departments. Non-governmental groups include affected commercial fishing associations, including identified First Nations communities, conservation organizations and watershed groups. This stakeholder engagement is required for final approval by DFO of the fish habitat compensation plan.

XDCM will continue to meet with and/or provide information to stakeholders to discuss the fish habitat compensation plan for the Project and seek their input on potential compensation projects. The final compensation plan will incorporate relevant stakeholder input and will be submitted to DFO.

3.0 DETERMINING HADD COMPENSATION

As a result of the infilling in the marine and freshwater environments and the destruction of benthic fish habitat in the footprints of the barge load-out facility and coal waste pile, respectively, XCDM will require DFO authorization for the HADD of fish habitat prior to conducting infilling operations. To compensate for the direct loss of benthic habitat, XCDM will be required to create new habitat (or improve existing habitat) to meet DFO's policy of no net loss under the *Fisheries Act.* The type and area of habitat to be created/enhanced will be detailed in a Habitat Compensation Agreement signed by both the XCDM and DFO. The specifications of the HADD compensation program will depend on the type of habitat compensation employed and assessed ecological value of existing habitat at the proposed infill sites. Conceptual options for fish habitat compensation projects for the marine and freshwater HADD are presented below.

3.1 Project Design Considerations

3.1.1 Marine Environment

The colonization by marine benthic organisms has been shown to occur shortly after the introduction of anthropogenic structures such as armour stone and caissons/cribwork in the marine environment (Pister 2009). Marine seaweeds, which are important components of lobster and other commercially valuable marine organism habitat, will also quickly colonize the hard substrate of in-water structures. Complete colonization of the armour stone and caissons of the barge load-out facility is expected to occur 2 to 3 years after the completion of construction; this timeframe is based on observations in the region from various projects. In a recent study, granite armour stone was compared to the natural rocky sandstone shoreline habitat in coastal waters and results indicate that species diversity and composition is similar once colonization occurs (Pister 2009). The armour stone of the breakwater will provide benthic habitat for lobster, crab, sea urchin and many other marine species and will create a diverse

ecological community similar to that observed on boulders in the existing marine environment of the Project Development Area (PDA). The colonization of the anthropogenic structures will attract other mobile species (*e.g.,* fish) for feeding and refuge, ultimately creating a "reef effect", with similar biodiversity as in the natural marine environment. The armour stone will be layered with smaller stones under the main armour layer which could also provide habitat for a range of lobster sizes, including juvenile lobsters, as well as fish species of varying lengths. The vertical timber cribwork or concrete wall of the caissons will also create new fish habitat by providing a hard substrate for marine organisms to attach to. The attachment of the marine organisms to the vertical structures will also likely attract free-swimming species providing foraging opportunities as well as shelter. The placement of anchors on the seafloor to stabilize the barge swing circle and transshipment mooring will initially disrupt marine benthic habitat, but then these anchors and mooring chains will be become surfaces for the colonization of marine organisms and habitat creation similar to the armour stone. At the transshipment facility, the four anchors will simulate the rocky habitat observed in the surrounding area, creating like-for-like habitat. At the transshipment mooring location the substrate was entirely composed of silty sand and the addition of four anchors will increase the potential attachment area for algal species, tunicates, sponges, bryozoans, hydroids and other species which inhabit reef-type habitats. The colonization of these structures is anticipated to improve habitat characteristics and colonization is expected to occur shortly after introduction of the anthropogenic structures to the marine environment.

Table 1 provides a summary of the surface area of marine habitat lost from the installation of marine-based infrastructure and the creation of new habitat through the placement of armour stone, caissons/cribwork and anchors, along with the resulting net change in the quantity of marine habitat. The alteration or destruction of benthic habitat is anticipated to be restricted to the PDA and which will be permanent except for the removable components of the moorings.

Table 1 Total Area of HADD for the Marine-Based Infrastructure Associated with the Project

Marine-Based Infrastructure	Reduction in Quantity of Marine Habitat from Construction (m^2)		Increase in Quantity of Marine Habitat from Construction (m^2)		Net Gain(+)/ Loss (-) of Benthic Marine Habitat (m^2)	Net Gain(+)/ Loss (-) of Vertical Marine Habitat (m^2)	Total Gain(+) /Loss (-) of Marine Habitat (m^2)
	Project Task	Area	Project Task	Area			
Breakwater Structure	Infilling breakwater footprint	42,062	Breakwater Surfaces (Armour Stone)	11,804	-30,258	0	-30,258
Wharf Structure	Placement of Caisson/ Construction of Cribwork	4,385	Caisson/cribwork surfaces	1,450	-4,385	+1,450	-2,935
Barge Swing Circle	Placement of Anchors	55	Anchor Surfaces	55	0	0	0
Cumulative Total for the Barge Load-out Facility	**All tasks**	**46,502**	**All Tasks**	**13,309**	**-34,643**	**+1,450**	**-33,193**
Transshipment Mooring Location	Placement of Anchors	55	Anchor Surfaces	55	0	0	0

3.1.2 Freshwater Environment

The freshwater environment is expected to interact with the Phase III (western) coal waste disposal pile footprint. There are four (4) streams located within the proposed footprint, all of which drain into Schooner Pond (refer to Figure 5.6.1 of the EIS). Stream 1 and Stream A are located at the edge of the Phase III coal waste disposal pile footprint and it is anticipated that avoidance and buffering can be achieved through final design of the coal waste disposal pile; therefore no HADD authorization is expected for these watercourses. The remaining two watercourses (Stream 2 and Stream B) will be infilled during the construction of the Phase III coal waste disposal pile. Stream 2 originates from off XCDM property boundaries and discharges a significant volume of water; as such, a diversion channel will be constructed to divert this volume of water into an adjacent watercourse which drains into Schooner Pond. This will aid in maintaining the hydraulic regime in Schooner Pond. The smaller stream (Stream B) with headwaters originating from within the Phase III coal waste disposal pile footprint will be infilled with no diversion channel created, the surface water associated with this watercourse will be captured and conveyed to the water treatment facility before discharge into Schooner Pond.

It is proposed that the diversion channel for Stream 2 be constructed to maintain fish passage into the upper reaches of the watercourse (off XCDM property) and maintain adequate water levels to provide fish habitat downstream. The diversion channel will be constructed to simulate the surrounding natural environment in both geophysical (width, depth, sinuosity, stream slope, substrate type, flow type, pool/riffle sequence) and biological characteristics (native plantings, overhead cover, riparian vegetation, organic instream cover). Table 2 provides a summary of the amount of freshwater habitat surface area lost due to the infilling of streams within the coal waste disposal pile. This table also includes the freshwater habitat gained through the construction of the diversion channel associated with Stream 2. The net change in quantity of freshwater habitat (HADD) is estimated to be 1,059 m^2.

Table 2 Total Area of Freshwater HADD Associated with the Project

Infrastructure	Change in Quantity of Marine Habitat from Construction (m^2)		Total Gain(+) /Loss (-) of Freshwater Habitat (m^2)
	Project Task	Area	
Coal Waste Rock Piles	Infilling Streams 2 and B	2,034	-2,034
	Creation of a Diversion Channel for Stream 2	975	+975
Net Change in Freshwater Fish Habitat (HADD)	**All tasks**		**-1,059**

3.2 DFO HADD Compensation Hierarchy Options

The overall goal of habitat compensation is to maintain the productive capacity of affected fish habitat that supports local fishery resources. In determining fish habitat compensation requirements, DFO not only considers the area and type of habitat affected but also the

productive capacity of that habitat. DFO also considers the utilization of that area by various species and their different life stages, particularly those species which support a fishery or are an important forage fish for species which support a fishery. Due to the challenges in effectively compensating for fish habitat loss, DFO typically requires compensation to be provided at a minimum ratio of 1:1 for the area affected which depends in large part on the utilization of the affected habitat by various species.

A gain in habitat is contingent upon several factors including: the intrinsic value of the existing habitat being covered, the habitat requirements of species in the area, and the nature/quality of the substrate being relocated. Typically, the creation of productive fish habitat requires the addition of rocky materials, over relatively featureless habitat (i.e., fines) that is clean and free of sediment and is a combination of equal portions of boulder (250-750 mm), rock (130-225 mm) and cobble (65-130 mm).

Colonization of the anthropogenic structures could reduce the environmental effects of the HADD as identified in Table 1. When considering habitat compensation proposals, DFO follows a hierarchy of several preferred compensation options (from most to least preferred):

1. Create habitat or increase the productive capacity of 'like-for-like' habitat in same ecological unit;

2. Create habitat or increase productive capacity of 'unlike' habitat in same ecological unit;

3. Create habitat or increase productive capacity of 'unlike' habitat in a different ecological unit;

4. Measures of last resort[7]: Artificial propagation, including seeding of cultured species; restoration of chemically contaminated sites; and deferred compensation.

In selecting fish habitat compensation projects, DFO's first preference is to compensate 'like' habitat for 'like' habitat in the same ecological unit as the HADD, which is more likely to be achieved in the immediate area of where the HADD of fish habitat has occurred. If insufficient compensation opportunities are available, the area of potential compensation is expanded as necessary to other areas. In many cases, the final compensation plan could include elements at more than one level, with some 'like-for like' habitat and some 'unlike' habitat creation.

In the unlikely event, that compensation options are not considered practicable in the same ecological unit (i.e., Hierarchy no. 1 and 2 above), DFO may consider that any net gain in habitat estimated for the marine environment could offset corresponding losses of habitat in the freshwater environment (i.e., application of hierarchy above).

7 These options should only be utilized in exceptional circumstances.

4.0 OPTIONS FOR FISH HABITAT COMPENSATION PROJECTS

4.1 Marine Environment

4.1.1 Artificial Reefs

The creation of shallow subtidal artificial reefs is a well-established and proven technique to create and/or enhance fish habitat. This plan may include habitat compensation measures such as those accepted for the recent Sydney Harbour channel dredging and infill project (Jacques Whitford 2009). Habitat compensation approved for the Sydney Harbour project included converting areas of flat sand bottom (such as found near the Donkin transshipment area) to a more biologically diverse and productive habitat by placing rock piles (i.e., creating artificial rock reefs) to reproduce the rocky subtidal habitat lost from the infilling. It is believed that such an approach could also be used to offset habitat losses associated with the Donkin barge load-out facility. Consistent with DFO's preferences, these rock piles could be placed within the same ecological unit as the HADD and, if practical, within Morien or Mira Bay away from shipping lanes, anchoring area and barge transit routes.

Rock piles could be placed on hard sand bottoms to provide anchoring substrate for marine plants and to improve the diversity of available habitats for fauna. Varied patch sizes and spacing could be used to accomplish this because different life stages and species use different patch sizes. Miller *et al.* (2006) demonstrated in a laboratory study that artificial rock reefs can provide enhanced habitat for juvenile lobsters if placed on substrates (i.e., sand/fine gravel mix) that they can readily excavate for shelters. Interstitial spaces would be optimized through the use of 30 cm to 70 cm rip rap rock. Arrays of rock piles characterized by irregular patch sizes and heights ranging from 0.5 m to 0.75 m off the seabed could be used along with continuous, thin artificial rock reefs that are approximately 1 m high. The reefs could be laid parallel to bathymetric contours to maintain stability of the reefs.

One of the first artificial reefs created as lobster habitat was built in 1965 in the Northumberland Strait (Macdonald 2004). This reef was created from sandstone rocks quarried from the area, with the rocks ranging in size from 5 to 100 cm in diameter and were 15 cm thick. The reef that was created measured 100 m in length and 50 m in width and was placed in the marine environment 400 m away from minor lobster habitat and 2.5 km from major concentrations of lobster (Scarratt 1968, 1973 in Macdonald 2004). Colonization of the artificial reefs began with large lobsters which are generally the most motile and were searching for new larger shelters (Scarratt 1973). Six years after construction (1971) the artificial reef was surveyed using divers and was shown to support approximately 400 lobsters of which only 10 percent were legal size (Scarratt 1973). The population distribution observed indicates that the artificial reef was providing habitat for younger, smaller lobsters.

Scarratt (1973) noted that artificial reefs could also condense populations to an area and therefore make them more vulnerable to fishing mortality. This is especially important during the first couple of years when the large lobsters are colonizing the reef, and if these large lobsters

are removed via fishing, then a large portion of the spawning stock is eliminated reducing the potential to enrich abundance.

A more recent artificial reef project occurred in proximity of Sambro Harbour. This project involved the creation of an artificial reef system through the placement of cobble piles on sandy substrate. A study on the productivity of artificial reefs compared to nearby natural reefs was conducted for two year after the creation of the artificial reefs. Limited information pertaining to the study could be garnered as the report is not yet public but the following conclusions were obtained from DFO with respect to their research (DFO 2009).

The study concluded that the artificial reefs were successful in increasing productivity with the artificial reefs having higher primary productivity and vertebrate production than natural habitats. The natural reefs were determined to have higher production of invertebrates, this was due to the more complex habitat provided by the red algae present in the natural habitats. It was noted that the two year monitoring timeframe was insufficient to allow the red algae community to develop on the artificial reefs and may be a reason for the lower production of invertebrates as compared to the natural reefs. The duration of the monitoring was noted as a limitation of the study and monitoring artificial reefs later in their development would be preferred. The authors of the study also include two recommendations for the creation of artificial reefs:

- In the study it was noted that a variety of habitats support greater biodiversity and as such an optimal artificial reef design would utilize a matrix of patch reefs instead of one continuous reef.

- The study used cobble in the 10-15 cm size range, the authors recommend larger rock in the range of 20 – 100 cm to match the size of rock observed in the natural reefs.

DFO guidelines are also available for the construction and monitoring of artificial rock reefs in the marine environment (DFO n.d.).

4.1.2 Enhancement of Black Brook

Beach improvement near Black Brook in Morien Bay, as noted by DFO during discussions on the current Donkin Project, may be considered an option for habitat improvement. This may include reinforcing eroding shorelines in the Black Brook area and to clean the shore area and restore habitat.

4.1.3 Ghost Trap and Net Retrieval

Morien Bay and coastal areas are used by local lobster fishermen. It is not uncommon to lose traps during routine fishing activity. However these traps can continue to “fish” after being lost, commonly known as ghost fishing gear. Since the advent of metal and plastic traps this has become a more critical problem resulting in unnecessary mortality of shellfish. Methods are available to recover these “ghost” traps and prevent further unnecessary losses of shellfish.

4.1.4 Restoration of Orphaned/Abandoned Sites

Restoration of fish habitat at an orphaned site(s) for which there is no known responsible party or owner to be held accountable for the remediation and/or restoration could be considered for habitat compensation. Orphaned sites to be considered, for example, may include intertidal and subtidal areas to improve success of some fisheries thereby increasing net productivity of the fishery resource. The selection of an orphaned site would be based on consultation with DFO and engagement of local fishermen.

4.1.5 Improving Fish Passage for Marine Migratory Fish Species

There are several rivers and streams near the Project area. The downstream reaches of these watercourses could be surveyed to determine if any barriers to fish passage exist that could be removed or modified.

4.1.6 Other Compensation Project Options Potentially Identified through the Stakeholder Engagement Program

As discussed earlier in the document, stakeholder engagement will be conducted to seek input on potential habitat compensation projects. Viable and feasible options obtained from this process will be considered for use in the habitat compensation plan for the Project.

4.2 Freshwater Environment

4.2.1 Habitat Creation within a Diversion Channel for Stream 2

The Phase III coal waste disposal pile is currently proposed to interact with Stream 2, an unnamed tributary to Schooner Pond. The diversion of this watercourse, if feasible, to the north into Stream A would maintain the connection between Schooner Pond and the headwaters of both Stream A and Stream 2. This diversion channel would be developed in such a way to simulate the natural features of watercourses in the area. This may involve native plantings and the cultivation of riparian vegetation which would provide overhead cover, food sources and organic instream cover through deposition. The geophysical characteristics of the diversion channel would be developed in such a way to recreate the width, depth, sinuosity and slope of surrounding natural watercourses. Utilizing locally sourced substrate adequately sized to handle the requirements for both flow regimes and fish habitat. These design elements in addition to development of pool/riffle sequencing will replace habitat for fish species lost from the lower reaches of Stream 2. The creation of habitat within the diversion channel would be conducted through consultation with DFO and NSE and would follow the guidance of DFO's manual on Ecological Restoration of Degraded Aquatic Habitats: A Watershed Approach (2006). An approach at this scale has been utilized for the Granite Canal Hydroelectric Facility in Bay D'Espoir in Newfoundland where Nalcor and DFO created 1.6 km of salmonid spawning habitat in an anthropogenic channel diverting water around the hydroelectric generating station.

4.2.2 Habitat Restoration in Local Watersheds

Local watercourses may benefit from habitat restoration techniques. This restoration may occur through creation of instream cover, bank stabilization, pool-riffle creation, channel narrowing or removal of obstructions or debris. Specific sites will be chosen through discussion with stakeholders and DFO.

4.2.3 Improving Fish Passage for Freshwater Migratory Fish Species

There are several rivers and streams near the Donkin Peninsula. The downstream reaches of these watercourses could be surveyed to determine if any barriers to fish passage exist that could be removed or modified. The removal of these barriers would allow migratory species such as Atlantic salmon and American eel to access the upper reaches of the watercourses, thus improving their habitat range.

4.2.4 Other Compensation Project Options Potentially Identified through the Stakeholder Engagement Program

As discussed earlier in the document, stakeholder engagement will be conducted to seek input on potential habitat compensation projects. Viable and feasible options obtained from this process will be considered for use in the habitat compensation plan for the Project.

5.0 MONITORING

A mandatory HADD compensation monitoring program, which will be designed in consultation with DFO, will be implemented to verify the anticipated enhancement in fish habitat and productivity. This program will build on the habitat surveys that provided recent baseline information for the Project.

6.0 REFERENCES

DFO (Fisheries and Oceans Canada). 1986. Policy for the Management of Fish Habitat.

DFO. 2006. Ecological Restoration of Aquatic Habitats: A Watershed Approach.

DFO. 2009. Artificial Reef Studies: Sambro Harbour and Environs March 2009 Report. Draft Technical Report. Authors: Glyn Sharp, Bob Semple, Megan Wilson, Herb Vandermeulen. Draft Technical Report. 50 pages

DFO. n.d. Marine Fish Habitat Compensation: Rock Reefs. Marine Environment and Habitat Division, St. John's. NL.

Jacques Whitford. 2009. Environmental Assessment for Sydney Harbour Access Channel Deepening and Sydport Container Terminal. Final Report for Laurentian Energy Corporation, Project No. 1041307, March 2009. 231 pp.

Macdonald, C. 2004. Artificial Reefs for Lobsters. Hook, Line and Thinker Issue: 2004-3 Summer 2004.

Miller, R.J., G.J. Sharp, and E.M. O'Brien. 2006. Laboratory experiments on artificial reefs for American lobsters. J. of Crustacean Biology, 26 (4): 621-627.

Pister, B. 2009. Urban marine ecology in southern California: the ability of riprap structures to serve as rocky intertidal habitat. Marine Biology 156: 861 – 873.

Scarratt, D. J. 1973. Lobster populations on a man-made rocky reef. ICES (Conseil international pour l'Exporation de la Mer) Research Document C.M.1973/K:47, 3 pp.

APPENDIX H
Atmospheric Environment Assessment Methods and Results

Emissions Inventory

Mine Operation

Criteria Air Contaminants (CACs)

Mining Equipment

Emissions from diesel fuel combustion in mining equipment were estimated based on annual fuel consumption and emission factors from the European Environment Agency (EEA) (2009) air pollutant emissions inventory guideline, with the exception of SO_2. Stantec estimated annual fuel consumption from the equipment based on the quantity of each type of equipment and the energy output of each equipment type, and assuming 37 percent engine efficiency.

Sulphur dioxide emissions were estimated assuming a sulphur content of 0.5 wt% and complete conversion of fuel sulphur to SO_2.

The estimated annual CAC emissions for the various pieces of mining equipment are provided in Table 1.

Table 1 CAC Emissions from Mining Equipment

Equipment	SO_2 (t/y)	NO_2 (t/y)	CO (t/y)	PM (t/y)	PM_{10} (t/y)	$PM_{2.5}$ (t/y)
LHDs (Scoops)	0.028	30.98	10.1	1.97	1.97	1.97
Man Transport	0.038	41.60	13.6	2.65	2.65	2.65
Utility Man Trips	0.012	13.14	4.30	0.84	0.84	0.84
Grader	0.009	9.79	3.20	0.62	0.62	0.62
LHDs (Utility)	0.028	30.98	10.1	1.97	1.97	1.97
Stoneduster	0.002	2.06	0.67	0.13	0.13	0.13
Bobcat	0.006	6.78	2.22	0.43	0.43	0.43
Total	**0.124**	**135.33**	**44.2**	**8.61**	**8.61**	**8.61**

Note: All table values are approximate and subject to refinement

Fugitive Emissions from Stockpiles

The emissions resulting from wind erosion of the stockpiles were calculated using guidance provided by the US EPA (US EPA 2006). The estimated annual emissions from each stockpile due to wind erosion are presented in Table 2. These emission inventory estimates do not incorporate the mitigation that is planned, including "rain bird" type wet suppression and progressive reclamation. However the dust dispersion modelling that was conducted for this Project, as described below, does incorporate mitigation.

Table 2 Estimated Annual Airborne Particulate Emissions from Stockpiles (unmitigated)

Stockpile	TPM (t/y)	PM_{10} (t/y)	$PM_{2.5}$ (t/y)
Raw Coal	0.659	0.658	0.099
Product Coal	4.45	2.22	0.333
Rejects Disposal	29.7	29.7	4.45
Rejects	0.158	0.158	0.024

Note: All table values are approximate and subject to refinement

Marine Transportation

Emissions from marine transportation of product coal were estimated based on the fuel consumption details provided in the Marine Transport Option Study (CBCL 2012). Stantec determined that the scenario where 70,000 DWT bulk carriers were used resulted in greater annual fuel consumption than a scenario using 200,000 DWT bulk carriers. This was due to the fact that the 70,000 DWT bulk carriers will make more frequent calls to the transshipment site than the 200,000 DWT bulk carriers and is thus is considered more conservative with respect to the calculation of air emissions.

The annual fuel consumption by marine vessels was multiplied by emission factors from Environment Canada (2011b) to estimate CAC emissions. The resulting estimated emissions from marine transportation are presented in Table 3.

Table 3 CAC Emissions from Marine Transportation (70,000 DWT Vessels)

Vessel	NO_X (t/y)	SO_2 (t/y)	CO (t/y)	PM_{10} (t/y)
Floating Crane	20.9	0.0073	4.50	0.67
Transit Tug	95.3	0.0333	20.5	3.04
Helper Tug	11.2	0.0039	2.41	0.36
Total	127.4	0.0446	27.4	4.07

Note: All table values are approximate and subject to refinement

Totals

The total estimated CAC emissions during the Operation of the Project are presented in Table 4.

Table 4 Total CAC Emissions from Project Operation

Source type	NO_X (t/y)	SO_2 (t/y)	CO (t/y)	TPM (t/y)	PM_{10} (t/y)	$PM_{2.5}$ (t/y)
Mining Equipment	135.33	0.124	44.2	8.61	8.61	8.61
Fugitive Emissions Coal Handling	NA	NA	NA	127	96.1	2.58
Fugitive Emissions – Wind Erosion Stockpiles	NA	NA	NA	33.1	30.1	4.51
Marine Transportation	127.4	0.0446	27.4	9,094	4.07	4.07
Total	**262.73**	**0.1686**	**71.6**	**9,263**	**138.9**	**19.8**

Note: All table values are approximate and subject to refinement

Greenhouse Gases (GHGs)

Combustion in Mobile Mining Equipment

Stantec estimated GHG emissions from the combustion of diesel fuel in mobile equipment using the energy output of the equipment, an assumed engine efficiency, and emission factors from Environment Canada (2011b). Power requirements of the main and support equipment were estimated using manufacturer's specification sheets for industry models (IME 2011; Damascus 2011; Howe 2009; Berlet 2008; BPAI 2011; BCSI 2007; Morley 2010). Assumptions include that an underground mining diesel generator was employed with a 300 KVA Power Center; mobile roof supports were based on electro-hydraulic units with a 55 kW motor driving a piston hydraulic pump; and auxiliary fans are 25 HP free-standing vane-axial fans with diameters of 0.9 metres.

The analysis assumes 361 days of operation and 24 hours per day. The equipment considered to release direct GHG emissions and the energy output of the equipment is provided in Table 5.

Table 5 Diesel Operated Mining Equipment, Quantity and Energy Output

Main Equipment	No. Units	kW/unit
LHDs (Scoops)	4	126.6
Support Equipment		
Man Transport	8	85.0
Utility Man Trips	6	35.8
Grader	1	160.0
LHDs (Utility)	4	126.6
Stoneduster	1	33.6
Bobcat	2	55.4

Assuming an engine efficiency of 37 percent, Stantec estimated the annual volume of diesel fuel consumed by the above equipment and then applied emission factors for CO_2, CH_4, and N_2O to estimate annual emissions of GHGs. Diesel consumption figures were estimated using data from manufacturer's specification sheets for industry models of mining equipment (Caterpillar 2011; MECA 2009; Damascus 2011; AJM 2011; ALLC 2011; Krog & Grau 2008). At this early stage of Project planning, all equipment specifications are for "typical" equipment and the equipment selected in project implementation may differ. The estimated annual GHG emissions from mobile mining equipment are provided in Table 6.

Table 6 GHG Emissions from Mining Equipment

Equipment	Diesel Consumption (gallons/day)	CO_2 (t/y)	CH_4 (t/y)	N_2O (t/y)	GHGs (tonnes CO_{2e}/year
LHDs (Scoops)	819	2,979	0.17	1.23	3,364
Man Transport	1,099	3,999	0.23	1.65	4,516
Utility Man Trips	347	1,263	0.07	0.52	1,427
Grader	259	941	0.05	0.39	1,063
LHDs (Utility)	819	2,979	0.17	1.23	3,364
Stoneduster	54	198	0.01	0.08	223
Bobcat	179	652	0.04	0.27	736
Total	**3,576**	**13,011**	**0.74**	**5.37**	**14,693**

Note: All table values are approximate and subject to refinement

The total GHG emissions emitted from mobile mining equipment per year during the operation of the Project is estimated to be 14,693 t CO_{2e}.

Marine Transportation

The transportation of product coal from the barge load-out facility to the transshipment location is conducted using marine vessels. These vessels and diesel fuel use were discussed in the report Marine Transportation Option Study (CBCL 2012). Stantec estimated combustion emissions from the operation of the vessels and the floating crane using the following method.

Two bulk carrier vessel size classes were identified for the transportation of coal from the transshipment site to ports worldwide: the Cape Size (200,000 DWT); and the Panamax size (70,000 DWT). The vessel operating plan to load each type of bulk carrier involves a 500 hp helper tug, a 5,000 hp transit tug, and a floating crane. The maximum annual fuel consumption by these marine vessels occurs if the Panamax size vessels are the only ones used for the transportation of coal to markets. In this scenario, the two tugs and the floating crane are used for 39 calls per year, in comparison to the 14 calls per year with the Cape Size bulk carrier. The annual fuel consumption by each vessel, assuming only Panamax size bulk carriers (the more conservative scenario for the purpose of calculating air emissions), is provided in Table 7.

Table 7 Fuel Consumption by Vessel Type

Vessel	Fuel Volume (L)
Floating Crane	288,444
Transit Tug	1,315,119
Helper Tug	154,128
Total	**1,757,691**

Stantec estimated GHG emissions from the operation of these vessels using emission factors from Environment Canada (2011b) for marine diesel fuel use. The estimated emissions are presented in Table 8.

Table 8 GHG Emissions from Marine Transportation

Vessel	CO_2 (t/y)	CH_4 (t/y)	N_2O (t/y)	CO_{2e} (t/y)
Floating Crane	768	0.04	0.32	867
Transit Tug	3,502	0.20	1.45	3,955
Helper Tug	410	0.02	0.17	463
Total	**4,681**	**0.26**	**1.93**	**5,286**

Note: All table values are approximate and subject to refinement

The total annual GHG emissions emitted from the operation of marine vessels were estimated to be 5,286 t CO_{2e} per year.

Fugitive Methane Emissions

The cumulative emission points for underground coal mines encompass either individual ventilation wells and shafts or degasification system wells or shafts installed at any stage of mining operations (US EPA 2010).

Frequent sampling and continuous monitoring of volumetric flow rate and methane concentration from shafts and degasification systems is critical to determining amounts liberated. Collecting accurate measurements for ventilation air is not feasible when methane concentrations are below detectable levels; when using methanometers, this includes levels less than 0.1 percent (Irving 1997). Once destruction efficiencies are applied to the flow rate and concentration parameters for CH_4 destroyed, CO_2 emissions can be estimated using a GHG conversion factor (WCI 2010).

Potential fugitive methane emissions have been estimated at 1,095,967 tCO2-e/year or one megatonne, approximately, of carbon dioxide-equivalent per year if uncontrolled.

Indirect Emissions from Electricity Use

Some equipment associated with the Project operation use electricity imported from the local power grid. Indirect GHG emissions associated with this electricity use were estimated based on the energy required by the equipment and a GHG emission intensity provided by Nova Scotia

Power. A summary of the energy use for various equipment types imported from the power grid is provided in Table 9.

Table 9 Energy Use by Activity

Activity	kW
Main Equipment	5,189
Connected Power Requirements (*e.g.*, fans, pumps, belts, drills, *etc.*)	29,498
Raw Coal Handling	760
Coal Preparation Plant	3,543
Product Handling	170
Loadout	300
Reject Handling	167
General	400

The GHG intensity calculated by Nova Scotia Power for 2010 is 828 g CO2e/kWh (NSPI 2010). Greenhouse gas emissions were estimated assuming that the equipment operates for 361 days per year and 24 hours per day. Estimated annual indirect GHG emissions from the project are provided in Table 10.

Table 10 Indirect Project Emissions of GHGs

Facility	t CO_{2e}/year
Main Equipment	37,223
Connected Power Requirements (*e.g.*, fans, pumps, belts, drills, *etc.*)	211,613
Raw Coal Handling	5,453
Coal Preparation Plant	25,414
Product Handling	1,220
Loadout	2,150
Reject Handling	1,194
General	2,870
Total	**287,136**

Note: All table values are approximate and subject to refinement

Indirect GHG emissions from the operation of the Project are anticipated to be 287,136 tonnes CO_{2e} per year.

Totals

The estimated total GHG emissions emitted from Project operation are summarized in Table 11.

Table 11 Total Project Operation GHG Emissions (Without Mitigation)

Project Activity	CO_{2e} (t/y)
Mining Equipment	14,693
Marine Transportation	5,286
Fugitive Emissions	1,095,967

Table 11 Total Project Operation GHG Emissions (Without Mitigation)

Project Activity	CO_{2e} (t/y)
Total Direct Emissions	1,115,946
Total Indirect Emissions	287,136
Total Project Emissions (direct + indirect)	1,403,082

*All table values are approximate and subject to refinement

Dispersion Modelling

Stantec conducted dispersion modeling to estimate the ambient concentrations of total particulate matter, PM_{10}, and $PM_{2.5}$ as a result of Project operation.

Specifics pertaining to the model selection and all model input parameters, including meteorological data, terrain data, receptors, and sources, are described in detail in the following sub-sections.

Model Selection

There is no one specified dispersion model required for use by Nova Scotia Environment or Environment Canada. In the past, these agencies have, for the most part, accepted submissions based on:

- SCREEN3;
- ISCST3, ISCLT3;
- AERMOD;
- CALPUFF; and
- Others on a case by case basis.

SCREEN3 is not applicable to either long term averages or multiple sources; ISC variants have been superceded by AERMOD and CALPUFF; CALPUFF is generally used in studies with a greater spatial range. The plume dispersion model AERMOD was selected for this modelling study. AERMOD is the US EPA preferred model for regulatory air dispersion modelling of industrial sources, replacing the previously endorsed ISC model. AERMOD is applicable to rural and urban areas, flat and complex terrain, surface and elevated releases and multiple sources (including, point, area and volume sources).

Meteorological Data

Five years (2007-2011) of MM5 processed (TRC, 2012) meteorological data representing the location of the coal preparation and handling plant was used in this study. This AERMET ready meteorological data file was than processed by AERMET to make the dataset that is read directly by AERMOD.

A joint wind direction and speed frequency diagram, or wind rose, of the MM5 processed meteorological data is presented in Figure 1 in Attachment 1.

Terrain Data

The terrain elevations used in this modelling study were acquired from online topographic data. Terrain elevation spacings are at 0.75 arc second spacing.

Receptor Grid

The receptor grid array for the dispersion modelling consisted of a 4 km by 4 km Cartesian receptor grid with grid spacings of 50 m in the northing and eastings.

Six discrete receptors were also included in each modelling computation representing the nearest resident locations. These are listed in Table 12 and are shown on Figure 3 in Attachment 1.

Table 12 Discrete Receptor Locations

Receptor No.	UTM Coordinates		Distance to Nearest Project Component (Phase III Waste Pile) (km)
	Easting (m)	Northing (m)	
1	280238	5117672	0.16
2	280035	5117510	0.15
3	279916	5117499	0.23
4	279994	5117562	0.15
5	279872	5117358	0.16
6	279578	5116069	0.93

Assessment Scenarios & Source Information

As discussed above particulate matter modelling was conducted for TPM, PM_{10} and $PM_{2.5}$ for the operation of the Project. The modelling also incorporated the currently planned mitigation measures previously identified to reduce dust emissions from Project operations.

The emission sources, currently planned mitigation and resulting emission factors used in the dispersion modelling are presented in Table 13.

Table 13 Sources of Fugitive Particulate Emissions and Planned Mitigation

Source Description	Uncontrolled TPM Emission Rate (g/s)	Planned Mitigation	% Control Efficiency (CE)	Controlled TPM Emission Rate (g/s)	Controlled PM_{10} Emission Rate (g/s)	Controlled $PM_{2.5}$ Emission Rate (g/s)
Raw Coal Unloading to Raw Coal Stockpile	4.19	Misting Spray on Head Chute	75	1.05	0.788	0.022
Wind Erosion of the Raw Coal Stockpile	0.0209	Rain-bird Type Dust Suppression - High Volume Spray	75	0.005	0.005	0.00078
Raw Coal Load out to Reclaim Conveyor	5.24	Enclosed Transfer Point	99	0.0524	0.039	0.001

Table 13 Sources of Fugitive Particulate Emissions and Planned Mitigation

Source Description	Uncontrolled TPM Emission Rate (g/s)	Planned Mitigation	% Control Efficiency (CE)	Controlled TPM Emission Rate (g/s)	Controlled PM_{10} Emission Rate (g/s)	Controlled $PM_{2.5}$ Emission Rate (g/s)
Raw Coal Conveying Via Reclaim Conveyor	10.50	Enclosed Conveyor	99	0.105	0.079	0.002
Primary Crushing	1.05	Enclosed with Dust Collection	90	0.105	0.079	0.002
Secondary Crushing	8.38	Enclosed with Dust Collection	90	0.838	0.629	0.017
Raw Coal Load-out to Plant Feed Conveyor	10.50	Enclosed Transfer Point/Dust Suppression Spray	99	0.105	0.079	0.002
Raw Coal Conveying to CHPP	10.50	Enclosed Conveyor	99	0.105	0.079	0.002
Reject Transfer to Reject Conveyor	2.47	Enclosed Transfer Point	99	0.0247	0.019	0.0005
Reject Conveying to Reject Stockpile	2.47	Enclosed Conveyor	99	0.0247	0.019	0.0005
Reject Unloading to Reject Stockpile	0.99	Handling of Moist Material	75	0.248	0.186	0.005
Wind Erosion Reject Stockpile	0.005	Rain-bird Type Dust Suppression - High Volume Spray	75	0.001	0.001	0.0002
Haul Truck Loading of Reject Material	0.25	Handling of Moist Material	75	0.0625	0.047	0.0013
Haul Truck Unloading to Reject Disposal Site	0.25	Handling of Moist Material	75	0.0625	0.047	0.0013
Wind Erosion Reject Disposal Site (east)[1]	0.941	-	-	0.941	0.941	0.141
Product Transfer to Product Conveyor	8.00	Enclosed Transfer Point	99	0.08	0.06	0.0016
Product Conveying to Product Stockpile	8.00	Enclosed Conveyor	99	0.08	0.06	0.0016
Product Unloading Via Radial Stacker	3.20	Handling of Moist Material	75	0.80	0.6	0.016
Wind Erosion Product Stockpile	0.141	Rain-bird Type Dust Suppression - High Volume Spray	75	0.035	0.018	0.00265
Product Loading to Overland Conveyor	4.00	Enclosed Transfer Point	99	0.04	0.03	0.00082
Product Conveying to Barge Load-out	8.00	Enclosed Conveyor	99	0.08	0.06	0.0016
Product Transfer from Overland Conveyor to Barge Load-out	8.00	Enclosed Transfer Point with Dust Hood[2]	99	0.08	0.06	0.0016

Table 13 Sources of Fugitive Particulate Emissions and Planned Mitigation

Source Description	Uncontrolled TPM Emission Rate (g/s)	Planned Mitigation	% Control Efficiency (CE)	Controlled TPM Emission Rate (g/s)	Controlled PM_{10} Emission Rate (g/s)	Controlled $PM_{2.5}$ Emission Rate (g/s)
Barge Loading – Radial Stacker	16.00	Banana Peel Flexible Telescopic Chute with Dust Hood[3]	99	0.16	0.12	0.003

Davis. W.T (ed.). 2000; US EPA 1998; Professional Experience

[1] Dust modelling was conducted for year 10 of operation, which represents the worst case scenario in terms of the highest uncovered disposal pile and prior to reclamation. Natural precipitation suppresses dust approximately one third of the time; Frozen ground conditions are also likely present one third of the year.

[2] Assumes venting to collection system.

[3] 75 % CE can be achieved with use of a telescopic chute, however the project description states there will be no free fall of coal therefore have assumed a 95 % CE.

Results

The maximum predicted 24-hour and annual ground-level concentrations of TPM at each discrete receptor are presented in Table 14.

Table 14 Maximum Predicted Ground Level Concentrations (GLCs) for TPM

Receptor No.	Predicted 24-Hour GLC (µg/m^3)	Predicted Annual GLC (µg/m^3)
1	70	2.14
2	82	1.86
3	56	1.36
4	64	1.64
5	55	1.40
6	28	0.70
Regulatory Criteria	120	70

The maximum predicted 24-hour and annual ground-level concentrations of PM_{10} at each discrete receptor are presented in Table 15.

Table 15 Maximum Predicted Ground Level Concentrations (GLCs) for PM_{10}.

Receptor No.	Predicted 24-Hour GLC (µg/m^3)	Predicted Annual GLC (µg/m^3)
1	53	1.36
2	62	1.26
3	42	0.92
4	48	1.10
5	41	0.94
6	16	0.44
Regulatory Criteria	-	-

The maximum predicted 24-hour and annual ground-level concentrations of $PM_{2.5}$ at each discrete receptor are presented in Table 16.

Table 16 Maximum Predicted Ground Level Concentrations (GLCs) for $PM_{2.5}$

Receptor No.	Predicted 24-Hour GLC (µg/m3)	Predicted Annual GLC (µg/m3)
1	1.50	0.042
2	1.70	0.039
3	1.16	0.029
4	1.33	0.034
5	1.12	0.030
6	0.51	0.015
Regulatory Criteria	30	-

Based on the modelling results, which are presented in the above three tables, there were no exceedances of the provincial Air Quality Regulations or National Ambient Air Quality (NAAQ) Objectives.

The maximum predicted ground level concentrations have been graphically illustrated and included in Figures 4 to 6 in Attachment 1. for those contaminants and time periods that are regulated by either the provincial Air Quality Regulations or the NAAQ Objectives.

Acoustic Modelling

Model Description

There are numerous software packages available for modeling sound transmission in the atmosphere. Some use proprietary algorithms, and some are based on published methods that have international recognition. Cadna (Computer Aided Noise Abatement, version 4.0), produced by Datakustik in Germany, is a software program that is based on the propagation models in ISO 9613. This ISO standard is in two parts. ISO 9613-1 is concerned with the attenuation of sound by the constituents of air. ISO 9613-2 incorporates the atmospheric absorption component into a framework that models the attenuation of sound by the geometric spreading of sound in the free atmosphere.

CadnaA was used in this study to predict sound pressure levels resulting from the operation of the Project.

This computerized model is capable of predicting sound levels at specified receiver positions originating from a variety of sound sources. Applicable national or international standards can also be included in its analysis.

CadnaA can also account for such factors as:

- Distance attenuation (*i.e.*, geometrical dispersion of sound with distance);
- Geometrical characteristics of the source and receivers;
- Atmospheric attenuation (*i.e.*, the rate of sound absorption by atmospheric gases in the air between sound sources and receptors);

- Ground attenuation (*i.e.*, effect of sound absorption by the ground as sound passes over various terrain and vegetation types between source and receptor);

- Screening effects of surrounding terrain; and

- Meteorological conditions and effects.

The application of the sound model requires a number of input variables. The most important variables are those that indicate the relative geometric position of the source and receiver. Both the receiver and source coordinates are input as an x, y, and z value. The x value is the "easting" horizontal coordinate, and the y is the "northing" horizontal coordinate. The z value is the height above ground of the receiver. A height of 4 m, just over 13 feet, is used to represent the height of second story windows where sound levels are slightly higher than those at ground level.

Conservative modeling assumptions have been applied when analyzing the sound impacts of the Project.

The influences of meteorology and terrain and vegetation on sound attenuation in the LAA are described in the following sub-sections.

Information pertaining to basic noise concepts has been attached to this Appendix.

Meteorological Factors

Meteorological factors, such as temperature, humidity, wind speed and direction, influence sound propagation. The effects of wind on outdoor sound propagation during different weather conditions could cause variations in Project-related sound levels measured at a receptor. If the receptor is upwind of the facility, the wind could cause greater sound attenuation, and lower sound levels at the residence. However, if the residence is downwind of the facility, the opposite effect could occur, resulting in higher sound levels at the residence. Crosswinds have less effect on outdoor sound propagation. The ISO algorithms in Cadna were designed to reflect a situation where there is a modest wind direct from the source to the receiver; that is, the receiver is always downwind.

The following meteorological elements that represent low air absorption of sound are customarily used and were assumed for the sound assessment:

- Temperature = 10°C (50 °F);

- Relative humidity = 70 percent; and

- Wind conditions = variable.

These meteorological parameters can be considered typical of night-time conditions in the spring and summer (when outdoor activities are more likely) and representative of the sound effects during these seasons.

Terrain and Vegetation

Factors such as terrain conditions, types of vegetation and ground cover can all affect the absorption that takes place when sound waves travel over land. For example, if the ground is moist or covered in fresh snow or vegetation, it will be absorptive and aid in sound attenuation. In contrast, if the ground is hard-packed or frozen, it will be reflective and will not aid in sound attenuation. There are no water bodies of significant size between the sources and potentially affected receptors in this Project. Psychologically, trees and thick brush are beneficial in isolating the sound source and receiver; however, the actual degree of sound attenuation is limited. A thick growth of trees and brush about 30 m (100 ft) deep will achieve a noise reduction of 3 to 4 dBA. If the vegetation is deciduous, the loss of the leaves means a loss in the attenuation properties, and the vegetation must be in the line of sight to achieve a reduction. Note also that some part of the sound energy will refract over the bush, just as it can refract over hills, and doubling the depth of the forest will not necessarily double the reduction in sound transmission.

The ground in the Project area is generally vegetated, or a soil surface that may be overlain with snow in the winter season yielding surface absorption of about that could approach 80 percent. However, this study takes a conservative approach, assuming that there is no intervening vegetation between the sources and receivers to reduce sound levels, and using an assumed absorption factor of 50 percent.

Assessment Scenarios

The construction and operation assessment scenarios carried out as a component of this Study include:

- Project Construction, Site Preparation.
- Project Operation Scenario 1 – Mine Site and Barge Load-out Facility (East Disposal Site)
- Project Operation Scenario 2 – Mine Site and Barge Load-out Facility (West Disposal Site)
- Project Operation Scenario 3 – Transshipment

The input parameters used in each of these scenarios are provided below, under Project Noise Sources and Sound Power Levels.

Receptors

The receptor grid array for the modelling consisted of a 2.5 km by 2.0 km grid with grid spacing of 10 m by 10 m. The six discrete receptors used in the dust modelling, as presented in Table 12, were also incorporated into the acoustic modelling.

Project Noise Sources and Sound Power Levels

As detailed engineering of the Project has not yet been completed the exact types and quantities of construction equipment to be in used during site preparation is currently unknown. To assess the potential effects resulting from site preparation activities a representative number

and type of construction equipment typically used during site preparation activities was incorporated into Cadna. The list of equipment used and their associated sound power levels are presented in Table 17.

Table 17 Typical Site Preparation Construction Equipment and Associated Sound Power Levels

Noise Generating Equipment - Construction	Overall Sound Power Level (Lw) (dBA)
Backhoe	113
Chain Saw	119
Grader	120
Compactor	118
Dozer	117
Dump Truck	111
Loader	114
Excavator	116
Tractor	119

To assess the noise generated by other site preparation activities, including that of dredging, Cadna was used to estimate sound levels at varying distances from a typical dredging activity. As this activity is a source of impulsive or variable noise a 5 dBA penalty was added the sound power level associated with the activity. Therefore the total sound power level used within Cadna to represent typical dredging was 123 dBA (118 dBA + 5 dBA).

It was assumed, for modelling purposes that Project construction, including dredging, would occur during day time hours only.

To predict the sound pressure levels resulting from the operation of the land based activities, including the barge load-out facility, three operational scenarios were modeled, as listed above (Scenarios 2, 3 and 4).

Operation of the Project was assumed to occur twenty-four hours and day seven days a week, with the exception of the bull dozers operating in the reject disposal piles, as these pieces of equipment are not intended to operate during the night time period.

A list of operation equipment and associated sound power levels (including octave band analysis, where available) used to predict Project operation (Scenario’s 1 and 2) sound pressure levels are provided in Table 18.

Table 18 Operational Noise Generating Equipment and Associated Sound Power Levels

Major Noise Generating Equipment - Operation	Quantity	Octave Band Analysis									Overall Sound Power Level (Lw) (dBA) at Source
		31	63	125	250	500	1000	2000	4000	8000	
Mine Site and Barge Load-out											
Raw Coal Drift Conveyor[1]	1	-	-	-	-	-	-	-	-	-	91
Raw Coal Stockpile Dozer	2	-	83	84	80	77	79	76	86	75	119
Raw Coal Stockpile Reclaim	1	110	111	107	104	105	101	97	96	87	106
Coal Crusher	1	121	121	121	117	115	112	110	106	97	118
CHPP Plant Feeder Conveyor[1]	1	-	-	-	-	-	-	-	-	-	91
CHPP Building	1	-	-	-	-	-	-	-	-	-	111
Rejects Fixed Stacking Conveyor[1]	1	-	-	-	-	-	-	-	-	-	91
Rejects Stockpile Stacker	1	110	111	107	104	105	101	97	96	87	106
Rejects Stockpile Dozers	2	-	83	84	80	77	79	76	86	75	119
Haulage Route to Disposal Site	1	-	-	-	-	-	-	-	-	-	104
Production Collection Conveyor[1]	1	-	-	-	-	-	-	-	-	-	91
Radial Stack - Product Stockpile	1	110	111	107	104	105	101	97	96	87	106
Product Stockpile Dozers	2	-	83	84	80	77	79	76	86	75	119
Product Stockpile Reclaim	1	110	111	107	104	105	101	97	96	87	106
Product Overland Conveyor[1]	1	-	-	-	-	-	-	-	-	-	91
Radial Stacker - Barge	1	110	111	107	104	105	101	97	96	87	106
Pick-up Truck	1	-	-	-	-	-	-	-	-	-	98.6
Substation Transformer	1	-	-	-	-	-	-	-	-	-	82
Raw Coal Storage Transformer	1	-	-	-	-	-	-	-	-	-	50
Raw Water Transformer	1	-	-	-	-	-	-	-	-	-	50
Stockpile Reclaim Transformer	1	-	-	-	-	-	-	-	-	-	50
CHPP Transformer	1	-	-	-	-	-	-	-	-	-	50
Water Services Transformer	1	-	-	-	-	-	-	-	-	-	50
Tug Boat	1	-	-	-	-	-	-	-	-	-	110
Helper Tug Boat	1	-	-	-	-	-	-	-	-	-	110

Assumptions:
Reclaim feeder motors were assumed to be located underground
Two dozers per stockpile
References:
Hoover & Keith Inc. 1981; Bridges *et al.* 1999; BSI 2008; Environmental Protection Department 1998

As the operation of the Project also involves the transfer of coal from a barge to larger ocean going vessels via a floating crane, at the transshipment location, these activities were also modelled. A list of operation equipment and associated sound power levels used to predict Project operation sound pressure levels for Scenario 3 (Transshipment Site) are provided in Table 19.

Table 19 Noise Generating Equipment and Associated Sound Power Levels (Scenario 3) – Transshipment Location

Noise Generating Equipment	Quantity	Sound Power Level (dBA)
Tug Boat	1	110
Helper Tug Boat	1	110
Moored Vessel	1	107
Crane Barge	1	118

Witte 2010; Environmental Protection Department 1998

Results

Construction

The predicted sound pressure levels by distance from the Project site based on the operation of a number of "typical" pieces of construction equipment within the PDA are presented in Table 20.

Table 20 Predicted Sound Pressure Levels (dBA) by Distance for Project Construction

Distance (m)	Predicted Sound Pressure Level (dBA)
200	64
400	56
600	53
800	51
1000	49
1500	47

During the construction of the barge load-out facility dredging will be required to ensure appropriate depths for marine infrastructure and vessels. Table 21 below provides estimated sound pressure levels at varying distances from dredging.

Table 21 Predicted Sound Pressure Levels from Dredging

Distance from Dredging (m)	Sound Pressure Level (dBA)
200	67
400	61
600	58
800	55
1000	53
1500	48

Operation

The baseline sound pressure levels, predicted sound pressure levels resulting from the operation of the Project (Scenario 1) during the day and nighttime periods, and the cumulative Project sound pressure levels are presented in Table 22. As baseline noise data was only collected at Receptor 1, the same data was assumed to represent the existing locations at Receptors 2, 3, 4, 5 and 6.

Table 22 Cumulative Predicted Sound Pressure Levels Associated with Project Operation (Scenario 1)

Receptor No.	Background Sound Levels (dBA)		Predicted Operation Sound Levels (dBA)		Cumulative Project Operation Sound Pressure Levels (dBA)	
	Day	Night	Day	Night	Day	Night
1	48	43	51	51	53	52
2	48	43	51	51	53	52
3	48	43	47	46	51	48
4	48	43	51	51	53	52
5	48	43	47	46	51	48
6	48	43	41	39	49	44

The L_{dn} and percent HA for cumulative Project operation (Scenario 2) for each receptor is presented in Table 23.

Table 23 L_{dn} and % HA for the Cumulative Operation of the Project (Scenario 1)

Receptor No.	L_{dn} (dBA)	% HA
1	59	6.5
2	59	6.5
3	55	4.1
4	59	6.5
5	55	4.1
6	52	2.7

The baseline sound pressure levels, predicted sound pressure levels resulting from the operation of the Project (Scenario 3) during the day and nighttime periods, and the L_{dn} and the cumulative sound pressure levels are presented in Table 24. As baseline noise data was only collected at Receptor 1, the same data was assumed to represent the existing locations at Receptors 2, 3, 4, 5 and 6.

Table 24 Cumulative Predicted Sound Pressure Levels Associated with Project Operation (Scenario 2)

Receptor No.	Background Sound Levels (dBA)		Predicted Operation Sound Levels (dBA)		Cumulative Project Operation Sound Pressure Levels (dBA)	
	Day	Night	Day	Night	Day	Night
1	48	43	55	51	56	52
2	48	43	58	51	58	52

Table 24 Cumulative Predicted Sound Pressure Levels Associated with Project Operation (Scenario 2)

Receptor No.	Background Sound Levels (dBA)		Predicted Operation Sound Levels (dBA)		Cumulative Project Operation Sound Pressure Levels (dBA)	
	Day	Night	Day	Night	Day	Night
3	48	43	55	47	56	48
4	48	43	58	51	58	52
5	48	43	58	47	58	48
6	48	43	43	39	49	44

The L_{dn} and percent HA for cumulative Project operation (scenario 2) for each receptor is presented in Table 25.

Table 25 L_{dn} and % HA for the Cumulative Operation of the Project (Scenario 2)

Receptor No.	L_{dn} (dBA)	% HA
1	59	7.1
2	60	7.7
3	57	5.2
4	60	7.7
5	58	6.0
6	52	2.7

The predicted sound pressure levels resulting from Project operation are graphically displayed in Figures 7 to 10 in Attachment 1.

As there are no receptors located within 2.3 km of the Transshipment location, an assessment using Health Canada guidance, as presented above, was not conducted for the operation of the Project at the Transshipment site (Scenario 3). However, the predicted sound pressure levels resulting from the operation of the Transshipment site results in a sound pressure level of approximately 48 dBA at the nearest section of land to the site.

REFERENCES

Australian Journal of Mining (AJM). 2011. Bobcat S650 Skid Steer Loader. Australian Journal of Mining.

A.L. Lee Corporation (ALLC). 2011. Underground Mining Diesel Generator Set: http://www.directindustry.com (Accessed November 3, 2011).

BCS Incorporated. 2007. Mining Industry Energy Bandwidth Study. BCS Incorporated; United States Department of Energy, Industrial Technologies Program.

Berlet Electronics Ltd. 2008. Load Haul Dump Equipment. Available online: http://www.berlet.com (Accessed November 1, 2011).

Berglund and Lindvall. 1995. Community Noise. Published by the World Health Organization (WHO).

BPAI. 2011. Feeder Breaker Products. Available online: http://www.hpainternational.tradeindia.com (Accessed November 1, 2011).

Bridges, M., C. Titter, and D. Hoffmann. 1999. Noise Reduction in Coal Handling and Preparation Plants.

British Standards Institution (BSI). 2008. Code of Practice for Noise and Vibration Control on Construction and Open Sites, Part 1: Noise, BS 5228-1:2009.

Caterpillar. 2011. Caterpillar Motor Graders from Finning for Mining. Available online: http://www.caterpillar.com (Accessed November 2, 2011).

CBCL Limited (CBCL). 2012. Marine Transport Option. Additional Engineering Requirement for Input to Environment Impact Study. Prepared for Xstrata Coal Donkin Management.

Damascus Corporation. 2011. Underground Mining Vehicles: Diesel Transporters and Personnel Carriers.

Davis, W.T (ed.). 2000. Air Pollution Engineering Manual. John Wiley & Sons, Inc.

Environment Canada. 2011b. National Inventory Report, 1990–2009.

Environmental Protection Department, Noise Control Authority. 1998. Technical Memorandum on Noise from Construction Work other than Percussive Piling.

European Environment Agency (EEA). 2009. EMEP/EEA Air Pollutant Emission Inventory Guidebook. Available online: http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009 (Accessed February 22, 2012).

Health and Safety Executive (HSE). N.d. Advice for Employers. Available online: http://www.hse.gov.uk/noise/advice.htm.

Hoover & Keith Inc. 1981. Noise Control for Buildings and Manufacturing Plants.

Howe, L. 2009. Two Decades of Mobile Roof Support Applications. Huntington: J. H. Fletcher & Co.

Industrea Mining Equipment (IME). 2011. Primary Products: Carriers, Dozers, Grazers and Vehicles. Thornton, Australia: Industrea Mining Equipment.

Irving, W. 1997. CH4 Emissions: Coal Mining and Handling. International Panel on Climate Change (IPCC).

Krog, R., & Grau, R. 2008. Fan selection for large-opening mines: vane-axial or propeller fans. Pittsburgh: U.S. Department of Health and Human Services, Pittsburgh Research Laboratory.

Manufacturers of Emission Controls Association (MECA). 2009. Case Studies of Mining Equipment Diesel Retrofit Projects. Washington: Manufacturers of Emission Controls Association.

Morley, L. A. 2010. Mine Power Systems. Washington: United States Department of the Interior, Bureau of Mines.

Nova Scotia Power Inc. (NSPI). 2011. Total System Emissions. Available online: http://www.nspower.ca/en/home/environment/emissions/archived/totals.aspx (Accessed February 22, 2012).

TRC Companies, Inc. 2012. MM5 Data. Available online: http://www.src.com/mm5/MM5_Main_Page.html

United States Environmental Protection Agency (US EPA). 1998. Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors – Western Surface Coal Mining.

United States Environmental Protection Agency (US EPA). 2006. Industrial Wind Erosion, Chapter 13.2.5.

United States Environmental Protection Agency (US EPA). 2010. Underground Coal Mines: Greenhouse Gas Reporting Program. United States Environmental Protection Agency.

Western Climate Initiative (WCI). 2010. Underground Coal Mines.

Witte, J. (Rob). 2010. Noise from Moored Ships, Inter Noise 2010, Noise and Sustainability.

ATTACHMENT 1

SUPPLEMENTARY INFORMATION

Basic Noise Concepts

As noise is a complex subject, some general introductory information is thought to be useful for those who do not have a background in acoustics. A complete description of acoustics is beyond the scope of this document, however, it is hoped that enough information is provided to give a general understanding.

Sound is produced by any vibrating body and is transmitted in air as a longitudinal wave motion. It is, therefore, a form of mechanical energy and is typically measured in energy-related units. For humans, sound is defined as acoustic energy in the frequency range that can be heard by the human ear – from 20 to 20,000 Hz. Noise is generally defined as “unwanted sound” and is thus subjective in nature. One of the most basic descriptors of sound is the sound pressure level (SPL). The SPL of a sound reflects only its magnitude and does not refer to the source of the sound or the character of the sound. Sound pressure levels are most commonly measured and described in decibels (Denoted dB) or A-weighted decibels (Denoted dBA). A-weighted decibels more closely correlate with the subjective loudness of a sound, as discerned by the human ear.

Typical sound pressure levels range from about 20 dBA in an extremely quiet wilderness area to between 50 and 70 dBA in towns during the day time, 90 dBA or more in industrial settings to well over 120 dBA near to a jet-aircraft at take-off (Berglund, Lindvall 1995). The sound pressure levels of some familiar sounds are compared in Figure A.

Figure A Comparison of decibel levels (http://www.hse.gov.uk/noise/advice.htm)

Another basic descriptor of sound is the Sound Power Level (PWL). This is a basic quantity which describes the amount of acoustic power radiated by a source (*i.e.*, motor, generator). It is the fundamental quantity which produces a sound pressure level (SPL) at a certain distance from a source. It is used to define the source for assessment purposes and to calculate the SPL at a receptor. The PWL is also usually described in decibels or A-weighted decibels.

Understanding the nature of sound travel in the outdoor environment is also important. Sound measured at a certain distance from a point source is reduced by about 6 dBA at twice that distance. For example, if the sound from a source at a distance of 1 metre is 75 dBA then at 2 metres it will be approximately 69 dBA and at 4 metres 63 dBA and so on. When more than one source is involved, the reduction of noise with distance may vary depending on the arrangement of the sources with respect to the receptor. Other factors such as complex topography, obstructions between the noise source and the receptor as well as atmospheric conditions, especially wind direction can also complicate the attenuation (reduction effect) of distance. These issues are dealt with through the use of computer modelling programs based on atmospheric physics.

A widely used "rule of thumb" for the loudness of a particular sound is that the sound must be increased in intensity by 10 dBA for the sound to be perceived as twice as loud. For example it takes ten violins to sound twice as loud as one violin. Although this rule is widely used, it must be emphasized that it is an approximate general statement based upon a great deal of investigation of average human hearing but it is not to be taken as a hard and fast rule (Georgia State University 2005). Another rule of thumb is that differences of 3 dB are just perceptible, especially in a fluctuating sound, but 5 dB is distinctly perceptible.

DEFINITIONS

Attenuation

The reduction of sound intensity by various means (*e.g.*, air, humidity and porous materials).

Audibility

Audibility is the detectability of sound by animals with normal hearing, including humans. Audibility is affected by the hearing ability of the animal, other simultaneous interfering sounds or stimuli, and by the frequency content and amplitude of the sound.

A-Weighting

The weighting network used to account for changes in level sensitivity as a function of frequency. The A-weighting network de-emphasizes the high (6.3 kHz and above) and low (below 1 kHz) frequencies, and emphasizes the frequencies between 1 kHz and 6.3 kHz, in an established standard to simulate the relative response of the human ear. The A-weighting system is the most common network in use in environmental sound assessments and criteria.

Ambient Noise

All-encompassing sound that is associated with a given environment, usually a composite of sounds from many sources near and far.

Background Noise

All-encompassing sound of a given environment without the sound source of interest.

Day Night Average Sound Level (L_{dn})

Twenty-four hour average sound level, obtained after the addition of 10 decibels to sound levels in the night, from 10 pm to 7 am.

$L_{dn} = 10 \log (1/24 (15 (10L_d/10) + 9 (10(L_n + 10)/10)))$

Where,

L_{dn} = day-night sound level (dB)

L_d = daytime equivalent sound level (dB)

L_n = nighttime equivalent sound level (dB)

Decibel

A logarithmic measure of any measured physical quantity and commonly used in the measurement of sound. The decibel provides the possibility of representing a large span of signal levels in a simple manner as

Decibel Addition

Decibels are logarithmic quantities and therefore do not follow normal algebraic rules, instead they are converted to energy equivalents, the energy equivalents are then added algebraically and the total energy equivalents is then converted back to a decibel value. The decibel sum of several sound levels can be obtained by the following equation:

$L_s = 10 \log (10\text{^}L_1/10 + 10\text{^}L_2/10 + 10\text{^}L_3/10 + \ldots\ldots)$

Where,

Ls = decibel sum

L_1, L2, L_3… = sound levels

A simplified method for obtaining the sum of two decibels (to an accuracy of 1 dB) is provided below:

When two decibel values differ by:	Add the following number to the higher value:
0 or 1 dB	3 dB
2 or 3 dB	2 dB
4 to 9 dB	1 dB
10 dB or more	0 dB

Energy Equivalent Sound Level (L_{eq})

The L_{eq} is the level of a constant sound over a specific time period that has the same sound energy as the actual (varying) sound over the same period. L_{eq} is strongly influenced by intrusive sounds and will typically be higher than the steady state sound level. It is the metric most often used in regulatory applications, sound emission rating for turbines or other machinery, and environmental monitoring. L_{eq} should be used carefully in quantifying natural ambient sound levels because occasional loud sound levels (gusts of wind, birds, insects) may heavily influence (increase) its value, even though the typical sound levels are lower.

Existing Ambient

All sounds in a given area (includes all natural sounds as well as all mechanical, electrical and other human-caused sounds).

Hearing Range (human)

An average healthy young person can hear frequencies from approximately 20 Hz to 20,000 Hz, and sound pressure levels from 0 dB to 130 dB or more (threshold of pain). Adults hear a significantly reduced range of frequencies, often less than 10,000 Hz at the high end, and the threshold of hearing also increases with age. In terms of hearing differences in sound levels, the smallest perceptible change is 1 dB, but this would only be possible in controlled environments. Change of 3 dBA may be perceived, depending on how variable the sound is; changes of this magnitude in average levels during gusty wind conditions, for example, would generally not be noticeable, but changes in the fairly constant hum of an operating appliance would be perceived. In natural environmental sounds changes of 5 dBA would be detectible.

Human perception of noise is on a logarithmic scale, and that means that there is a non-linear relationship between the energy content of a sound level and the human perceived volume. A doubling of the energy content is measured as a 3 dB increase, but to humans this is a just perceptible difference in sound. In the normal fluctuations of outdoor sound, this might not even be perceptible. For humans to perceive a doubling in the volume of the sound, the energy must increase by 10 dB.

Percent Highly Annoyed

The preferred measurement scale for noise annoyance used by Health Canada is the "percent highly annoyed", or percent HA, a metric that is based on some pioneering work of the US EPA in measuring noise annoyance to the public in the 1970's. The scale is based on an equation (see below) that is derived by statistical linear regression methods that fit a response line to the graph of community annoyance versus day-night sound level, L_{dn} (see L_{dn}).

$\% HA = 100 / [1 + \exp(10.4 – 0.132 L_{dn})]$

Natural Ambient

Natural ambient sound is defined as all natural sounds in a given area, excluding all non-natural sounds. "Natural ambient" is considered synonymous with the term "natural quiet," although natural ambient is more appropriate because nature is often not quiet.

Noise

Traditionally, noise has been defined as unwanted, undesired, or unpleasant sound. This makes noise a subjective term. Sounds that may be unwanted and undesired by some may be wanted and desirable by others.

Octave

An octave is the interval between two frequencies having a ratio of 2 to 1. For acoustic measurements, the octaves start at 1000 Hz center frequency and go up or down from that point, at the 2:1 ratio. From 1000 Hz, the next filter's center frequency is 2000 Hz, the next is 4000 Hz, *etc.*, or 500 Hz, 250 Hz, *etc.* Octave filtering is used in measurement and analysis, and can be full octave, one-third octave or greater subdivisions. The division of sound into frequency bands is done in analysis because the different frequencies behave differently in the atmosphere, higher frequency sound being absorbed more readily than low frequency sound.

Sound

Sound is a pressure fluctuation due to a wave motion in air, water, or other media that has the potential to be heard through the auditory mechanisms of humans or animals.

Sound Power Level (L_W)

The sound power level is the total sound energy radiated by a source per unit time. The unit of measurement is the decibel representing a ratio of acoustic watts to a reference level of watts. The acoustic power radiated from a given sound source as related to a reference power level (typically 10^{-12} watts) and expressed as decibels. A sound power level of 1 watt = 120 dB. Conventionally, the reference level = 10^{-12} watts.

Sound Pressure Level (SPL)

Sound levels are represented by the energy in the sound pressure level as defined as ten times the base-10 logarithm of the square of the ratio of the mean-square sound pressure, in a stated frequency band (often weighted), and the reference mean-square sound pressure of 20 µPa, the threshold of human hearing.

$SPL = 10*\log_{10}(p^2 / p_{ref}^2)$ (dB)

where:

p = mean-square sound pressure; and

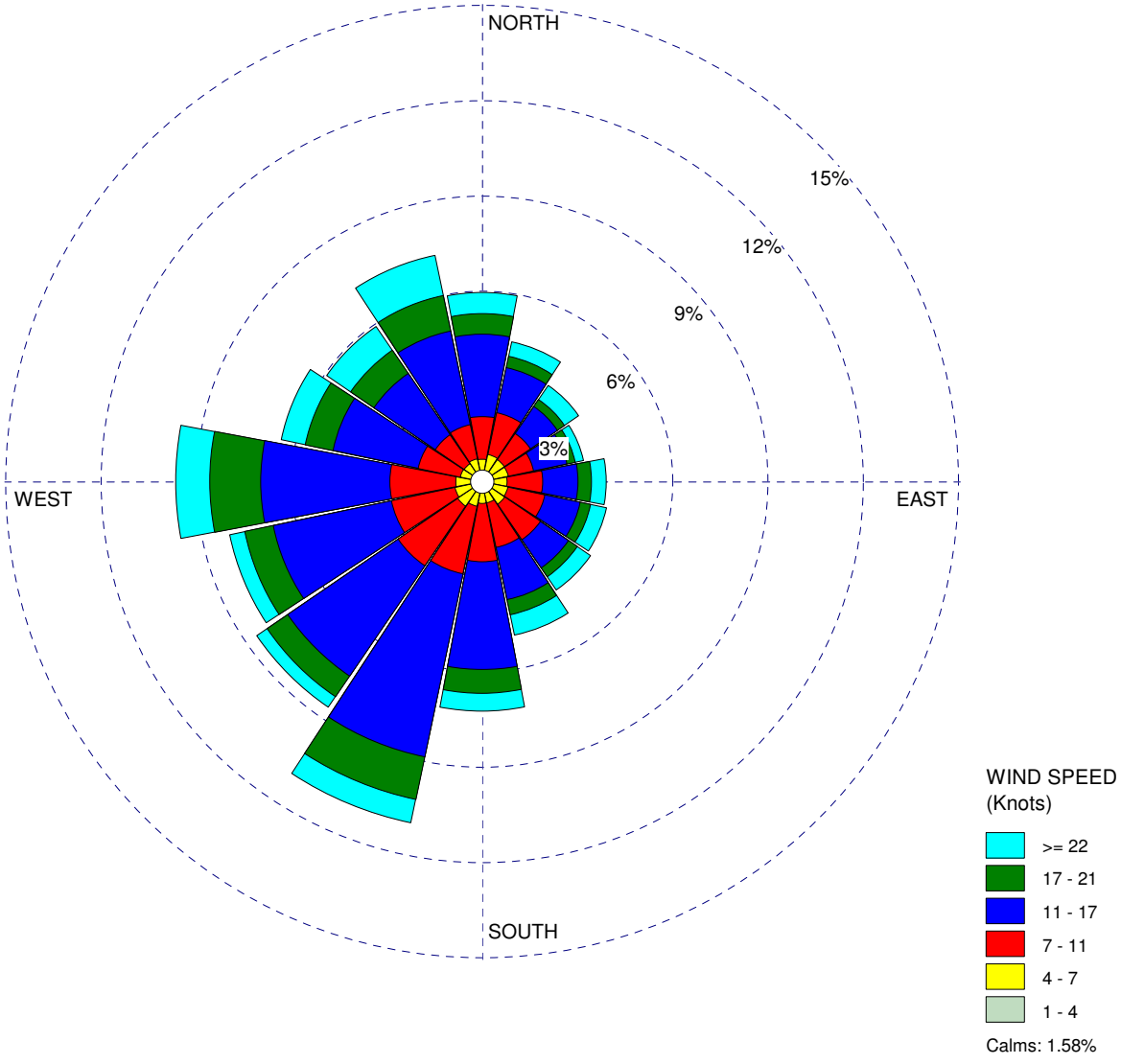
p_{ref} = reference mean-square sound pressure of 20 µPa.

WIND ROSE PLOT:

Figure 1 Joint Wind Direction and Speed Frequency Diagram
Surface Meteorological Data Surface Meteorological Data

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD: **Start Date: 1/1/2007 - 00:00** **End Date: 12/31/2011 - 23:00**	COMPANY NAME: **Stantec Consulting Ltd.**	
		MODELER:	Stantec
	CALM WINDS: **1.58%**	TOTAL COUNT: **43824 hrs.**	
	AVG. WIND SPEED: **13.01 Knots**	DATE: **3/26/2012**	PROJECT NO.: **121510478**

Donkin

Former Donkin Reservoir

Schooner Pond Cove

Schooner Pond Head

Devco Settling Pond

Schooner Pond

Wreck Point

Atlantic Ocean

Northern Head

Morien Bay

Project Components
- Project Infrastructure
- Future Tunnel
- Tunnel
- Access Road
- Coal Waste Pile

Study Features
- CBCL Air Noise Monitoring
- Stantec Noise Monitoring

Map Features
- Current Building
- Watercourse
- Road
- Road, other

SOURCE:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB).
Project Data: Client
Imagery: ESRI basemap service

ST NS-121510478-029

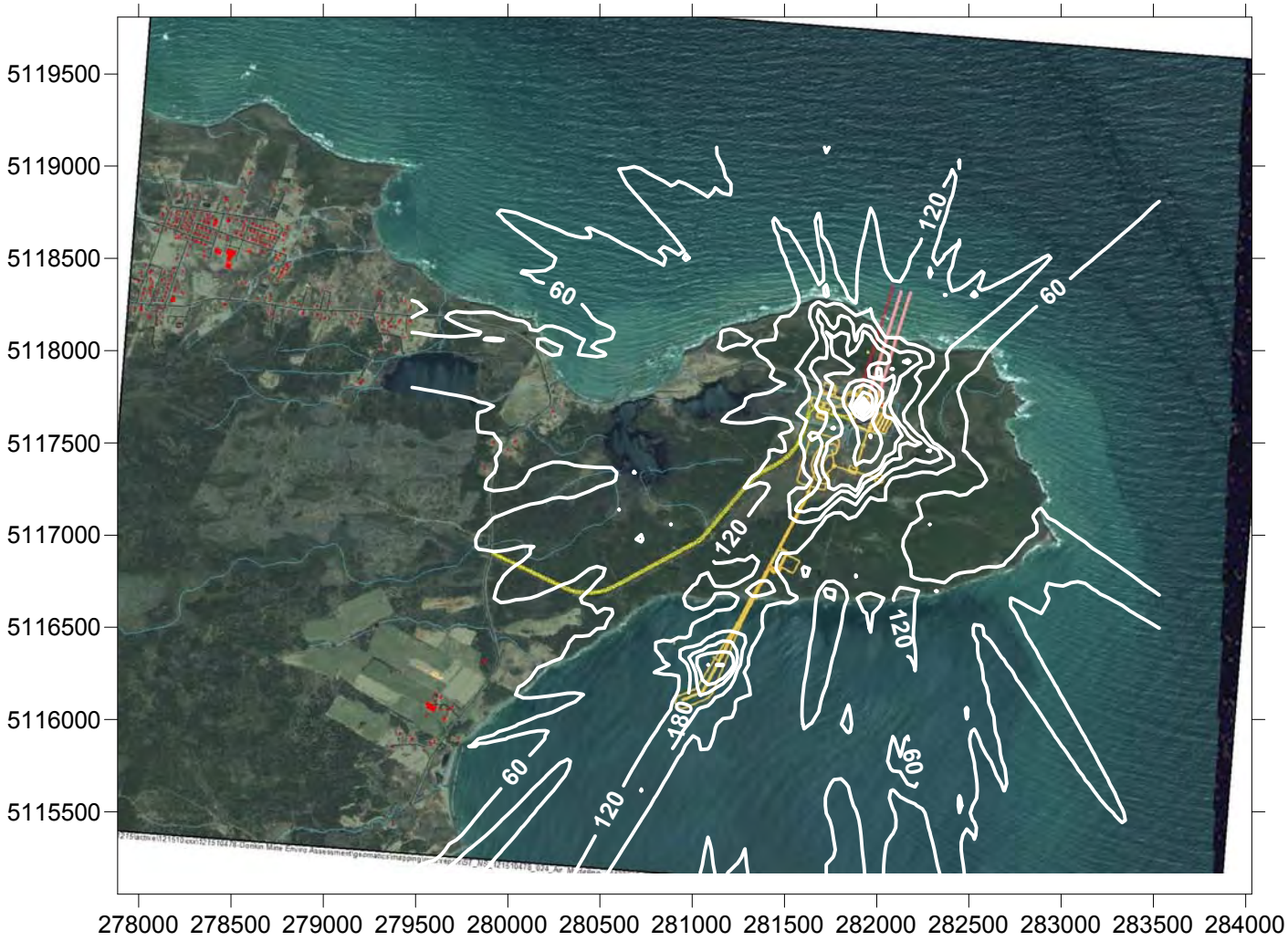
0 200 400 600
Meters

PREPARED BY: K Keizer	Donkin Export Coking Coal Project
REVIEWED BY: G Asche	**Baseline Air and Noise Monitoring Locations**
CLIENT: xstrata coal	FIGURE NO.: 2
	DATE: Apr 26, 2012
	Stantec

File Path: V:\1215\active\121510xxx\121510478-Donkin Mine Enviro Assessment\geomatics\mapping\mxd\EA_Final\ST_NS_121510478_029_Baseline_Air_Noise_20120227.mxd

PREPARED BY: K Keizer	Donkin Export Coking Coal Project	FIGURE NO.: 3
REVIEWED BY: G Asche	**Discrete Receptor Locations Used in Acoustic and Dust Modelling**	DATE: Jun 21, 2012
CLIENT: xstrata coal		Stantec

Figure 4
Maximum Predicted 24-hr
Total Particulate Matter Concentrations
(with mitigation)

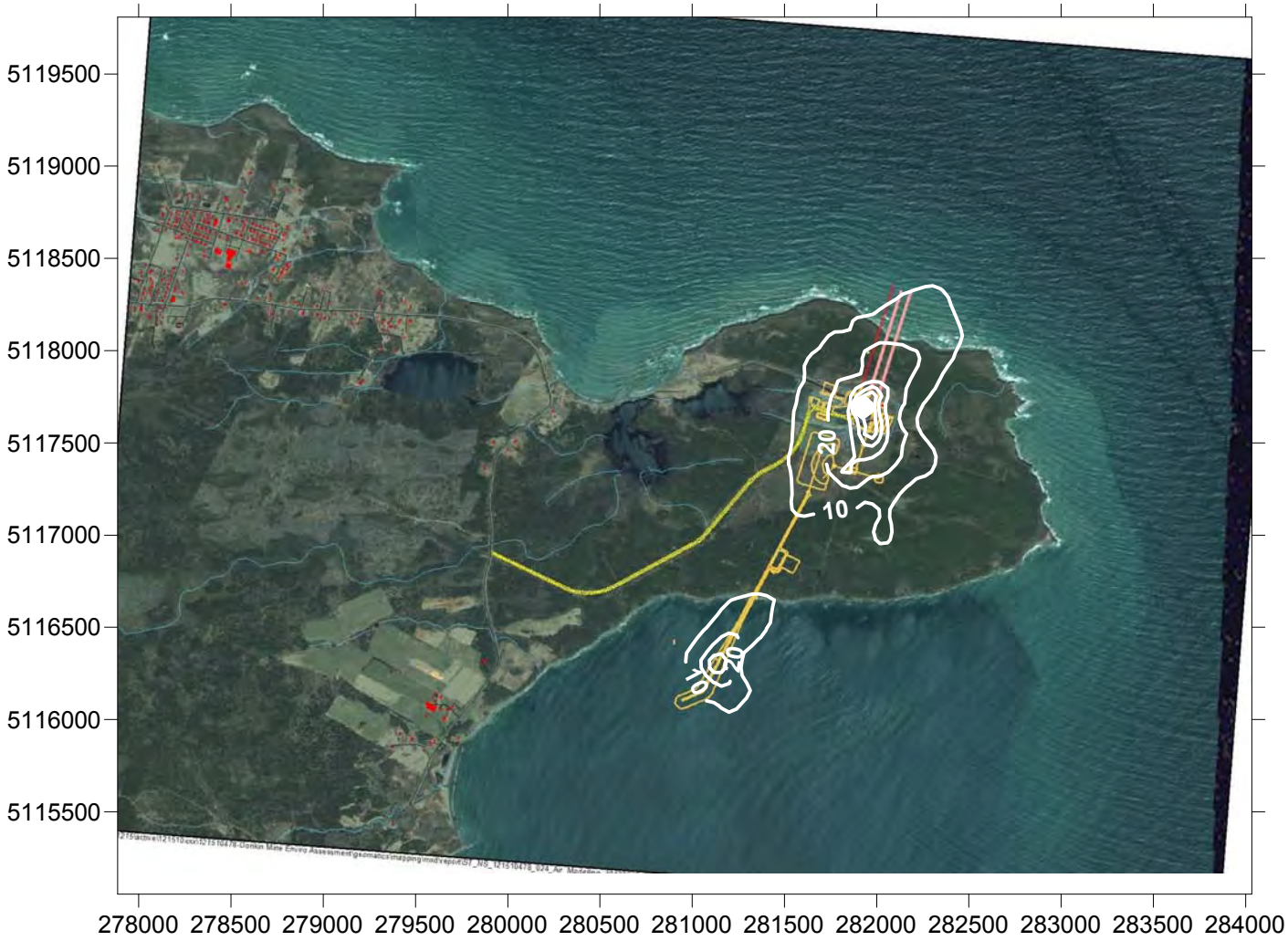


LEGEND

5 Concentration Contour, µg/m³

120 Ambient Air Quality Standard, µg/m³

Figure 5
Maximum Predicted Annual
Total Particulate Matter Concentrations
(with mitigation)

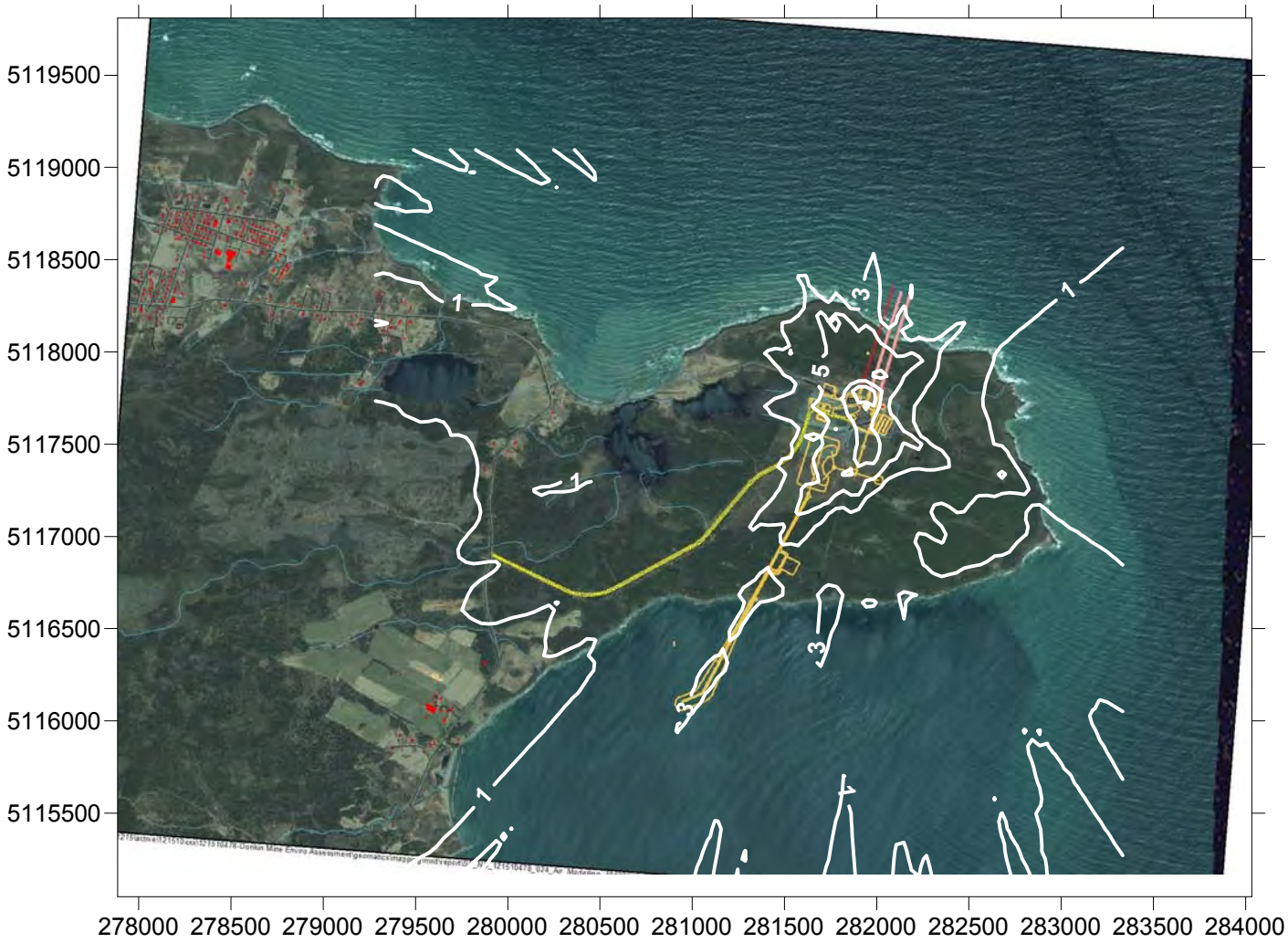


LEGEND

5 Concentration Contour, µg/m³

60 Ambient Air Quality Standard, µg/m³

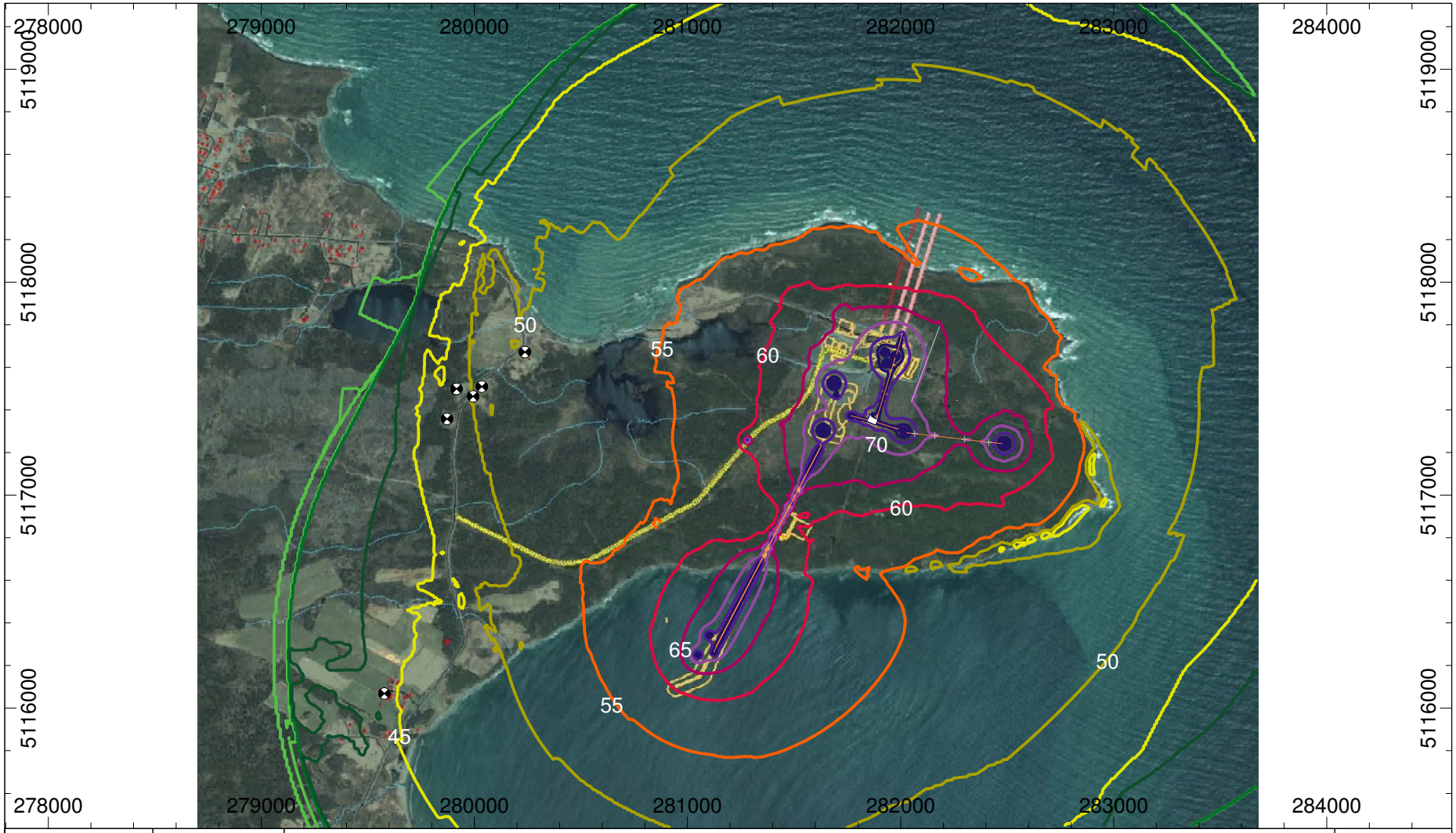
Figure 6
Maximum Predicted 24-hr
Particulate Matter Less Than 2.5 Microns Concentrations
(with mitigation)



LEGEND

5 Concentration Contour, µg/m³

30 Ambient Air Quality Standard, µg/m³

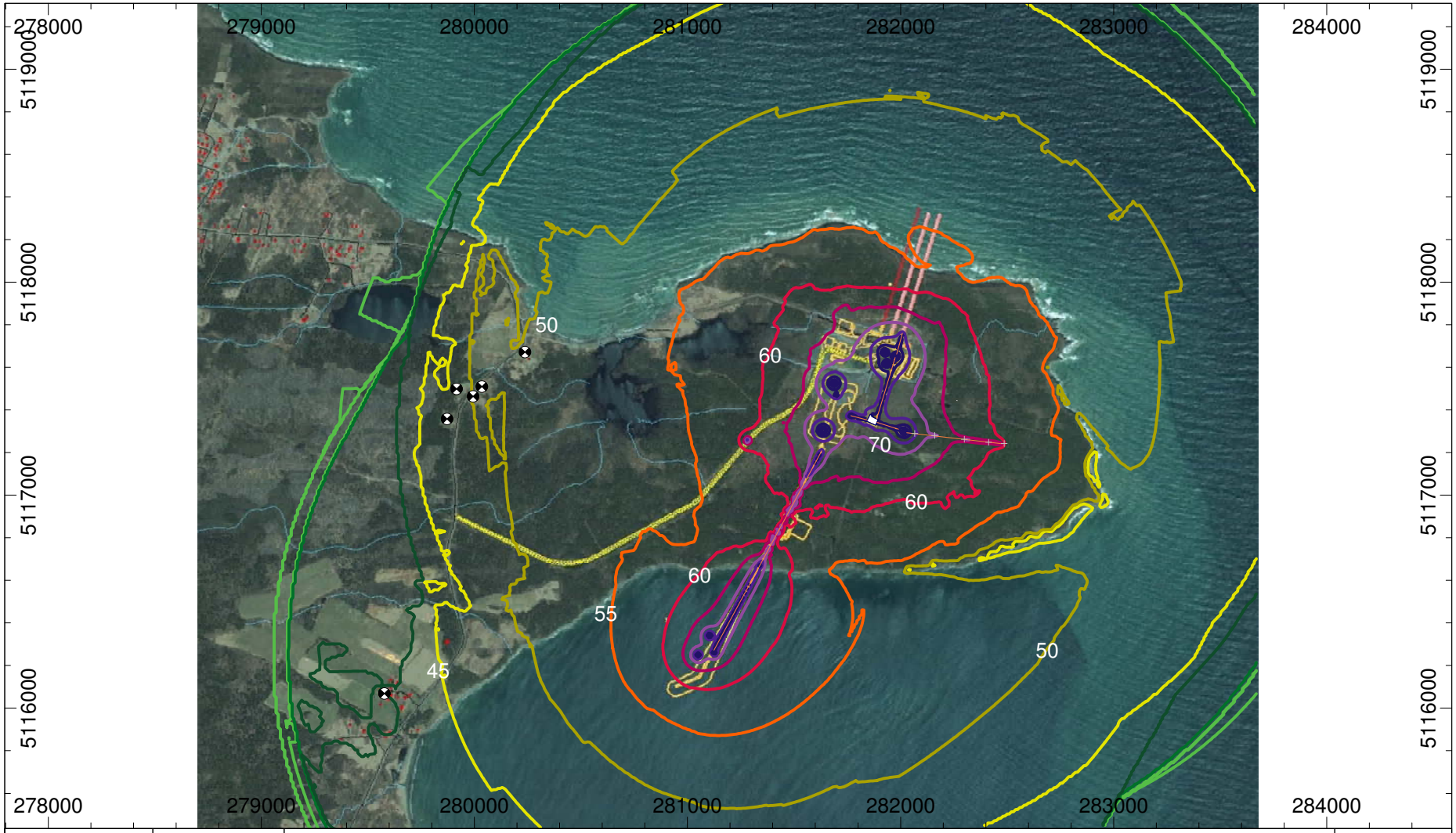


Stantec

N

Daytime Predicted Sound Pressure Levels Project Operation (Scenario 1)

Figure 7

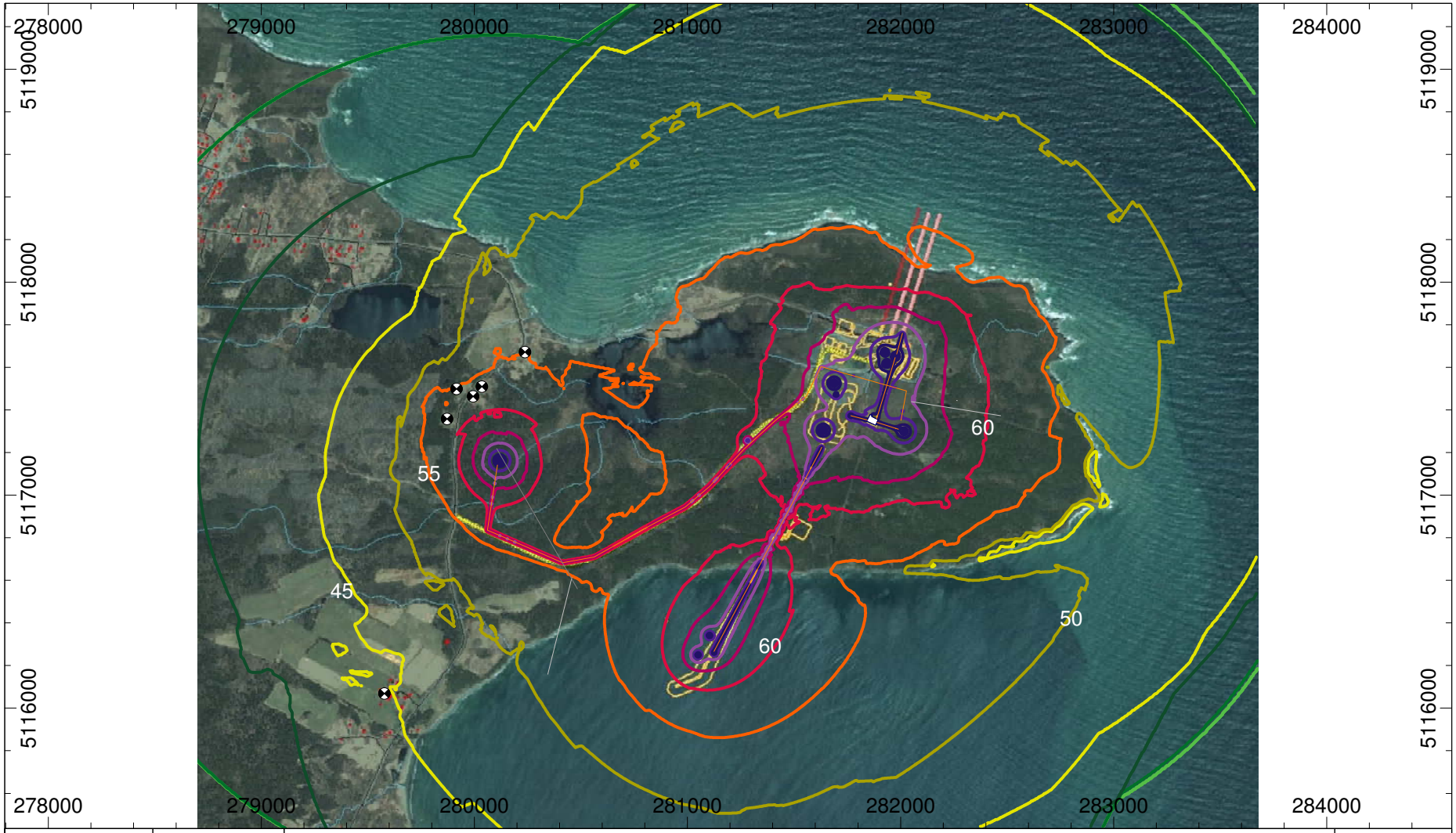


Stantec

N

Nighttime Predicted Sound Pressure Levels Project Operation (Scenario 1)

Figure 8

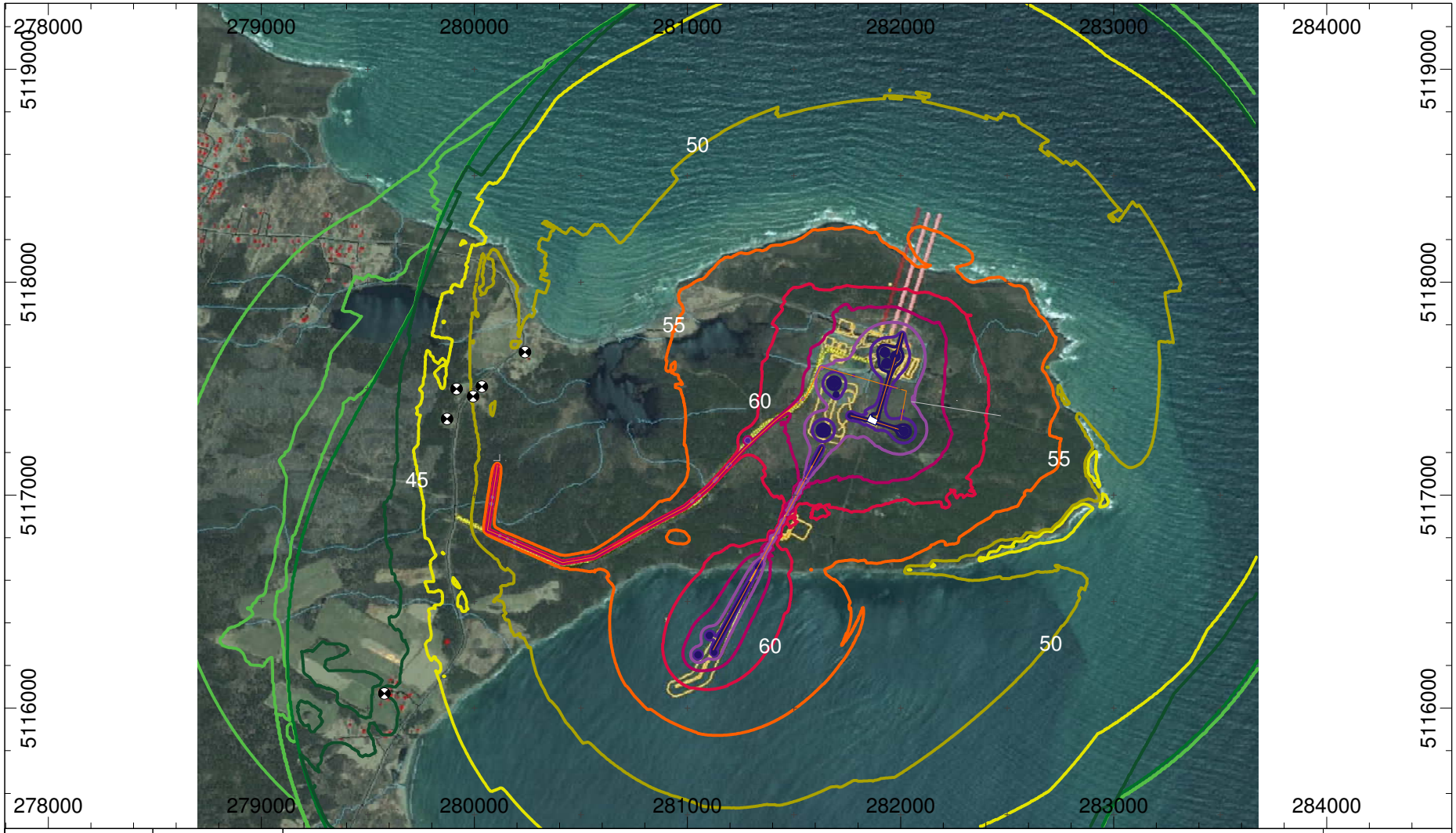


Stantec

N

Daytime Predicted Sound Pressure Levels Project Operation (Scenario 2)

Figure 9



N

Nighttime Predicted Sound Pressure Levels Project Operation (Scenario 2)

Figure 10

APPENDIX I
Water Resources

Water Balance Assessment

A hydrologic water balance assessment was conducted using the Thornthwaite and Mather (1957) method. The computational procedure outlined in the water balance method was computerized in a model developed by Black (1996) referred to as THORNPRO and used to develop water balance estimates for all four watersheds within the PDA; (the watersheds also encompass the RAA).

The general equation that describes the long term water balance estimation is:

$P = ET + R + I$

Where: P = precipitation

ET = evapotranspiration

R = surface runoff

I = infiltration and storage

Thornthwaite and Mather's method relies on the amount of energy available to evaporate water from free water-surfaces such as streams, wetlands, ponds, lakes, oceans, and the intercepting surfaces on which it falls as precipitation. Water loss can also take place in vegetation at the openings of stomates normally on the lower surface of leaves. Energy also vaporizes water drops present in the atmosphere.

In the THORNPRO model, the change of state of water is a function of the amount of energy that is available at any given time. That, in turn, is governed by the latitude, length of day and season which combine to control the amount of energy received at the earth's surface. Infiltration factors and vegetation type then control the fraction of excess water that infiltrates into the ground versus the fraction that runs off to nearby streams.

To adequately describe the amount of both energy and water within a given system, the Thornthwaite and Mather method requires the input of average monthly or daily temperature and precipitation, hemisphere, latitude, elevation, vegetation type, land use, soil storage characteristics, size of the watershed, average slope, and relative location of the atmospheric station within the governing watershed.

Water balance calculations also require the input of climate normal information included in Table 8.2.1, local land use, geographical and environmental characteristics to further identify site specific conditions. Using aerial photography, GIS applications and regional soil data, parameters best representing the four watersheds surrounding the proposed PDA were chosen for three scenarios which include the existing condition, the operation of the Project and after decommissioning is completed.

After analyzing all scenarios it was concluded that for the existing condition the water balance is defined by the components already present with no other major modifications to land use or any other parameters. During the operating phase of the Project two coal waste piles with a total

extension of approximately 0.9 km^2 (which represents 17 percent of the total catchment areas) will be gradually added as more waste material becomes available. It is assumed that the precipitation that falls on the coal waste piles will be conveyed for treatment and discharged separately from the remaining catchment areas, and therefore there will be a reduction in area contributing to runoff to 4.5 km^2. This represents the worst case condition assuming that the coal waste piles are hydraulically disconnected from the catchment areas; however, it is recognized that the precipitation that falls on the waste piles will be collected, treated and sent to a passive system for discharge or for reuse within the site. Since the contribution from the waste piles to the receiving catchment areas cannot be quantified at this time, the analysis included a full reduction in watershed area.

For the decommissioning condition, the coal waste piles will be capped with an impermeable layer to prevent precipitation to infiltrate into the rock waste and produce seepage to nearby receptors. Therefore, for this scenario an increase in surface runoff is expected with a reduction in infiltration amounts.

Table 1 lists the input parameters used to derive water balance for all three scenarios under consideration.

Table 1 Site Specific Water Balance Input Parameters

	Latitude	Longitude	Elevation (m.a.s.l)
Climate Station	46°10'00"	60°02'53"	61.9
Project Area	46°10'40"	59°49'31"	15.0
Slope (m/m)	0.7%	Average slope	
Other Descriptors	Wetlands and Lakes	Identified in the PDA	
Existing Condition			
Parameter	Value	Note	
Soil Storage (mm)	-350	Assuming a predominant GW discharge area	
Drainage Area (km^2)	5.4	Sum of all four sub-watersheds	
Operating Condition			
Parameter	Value	Note	
Soil Storage (mm)	-250	Assuming a reduction in catchment area	
Drainage Area (km^2)	4.5	Reduction of rock waste piles	
Decommissioning Condition			
Parameter	Value	Note	
Soil Storage (mm)	-500	Increase in runoff and reduction in infiltration	
Drainage Area (km^2)	5.4	Sum of all four sub-watersheds	

The monthly and annual water balance results for the PDA for all three scenarios are shown in Table 2. Based on the THORNPRO model, for the existing condition a total annual precipitation of 1504.9 mm, 32 percent (481 mm) is lost to evapotranspiration, 17 percent to infiltration and storage (249.9 mm) and 51 percent (774 mm) leaves the watershed as surface runoff.

For the operating condition and a total annual precipitation of 1504.9 mm, 32 percent (481 mm) is lost to evapotranspiration, 23 percent to infiltration and storage (348.9 mm) and 45 percent (676 mm) leaves the watershed as surface runoff, which is a reduction of 13 percent from the existing condition.

And for the decommissioning condition and a total annual precipitation of 1504.9 mm, 32 percent (481 mm) is lost to evapotranspiration, 7 percent to infiltration and storage (100.9 mm) and 61 percent (924 mm) leaves the watershed as surface runoff which corresponds to a 19 percent increase from the existing condition.

Table 2 Water Balance Results

Existing Condition													
Parameter (mm)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Precipitation	151.5	132.1	138.9	130.4	102.9	92.6	86.8	93.1	113.4	146	149.7	167.5	1504.9
Evapotranspiration	0	0	0	15	57	91	86	94	78	43	16	0	481
Infiltration	127.5	120.1	132.9	23.4	-164.1	-103.4	-51.2	-26.9	4.4	36	33.7	118.5	249.9
Runoff	24	12	6	92	210	105	52	26	31	67	100	49	774
Operating Condition													
Precipitation	151.5	132.1	138.9	130.4	102.9	92.6	86.8	93.1	113.4	146	149.7	167.5	1504.9
Evapotranspiration	0	0	0	15	57	91	86	94	78	43	16	0	481
Infiltration	127.5	120.1	132.9	33.4	-119.1	-80.4	-40.2	-21.9	6.4	38	33.7	118.5	348.9
Runoff	24	12	6	82	165	82	41	21	29	65	100	49	676
Decommissioning Condition													
Precipitation	151.5	132.1	138.9	130.4	102.9	92.6	86.8	93.1	113.4	146	149.7	167.5	1504.9
Evapotranspiration	0	0	0	15	57	91	86	94	78	43	16	0	481
Infiltration	127.5	120.1	132.9	8.4	-231.1	-137.4	-68.2	-35.9	-0.6	34	32.7	118.5	100.9
Runoff	24	12	6	107	277	139	69	35	36	69	101	49	924

The water balance results indicate that a large portion of available surface water leaves as surface runoff with a lower infiltration amount. The mean annual flow rates for each sub-watershed within the PDA are included in Table 3 and these were compared with the mean annual flow rates from the prorated flows for Station 01FJ002 (Macaskills Brook near Birch Grove) available from the Water Survey of Canada National Information Archive online.

Table 3 Mean Annual Flow Rates for all Sub-watersheds within the PDA

Station	**Mean Annual Flow (m^3/s) from water balance results**			**Mean Annual Flow (m^3/s) from prorated flows**
	Exisiting	**Operation**	**Decommissioning**	
SW1	0.082	0.062	0.097	0.12
SW2	0.019	0.014	0.023	0.028
SW3	0.020	0.011	0.024	0.030
SW4	0.010	0.008	0.012	0.015

Even when both techniques yield different results for both cases the estimated mean annual runoff flow rates are within the same order of magnitude. The main effect includes a decrease

in average runoff amounts during the operation of the Project that will be eventually be replenished after decommissioning with higher runoff amounts. However, during the operations phase, it may be necessary to direct collected and treated flow back to the watersheds, especially SW1 which discharges through Baileys Wetland.

Stream Flow Proration

According to the Water Survey of Canada National Information Archive online, Station 01FJ002 (Macaskills Brook near Birch Grove) is the closest station with available average daily flow rates between the years 1978 to 2010. The surface area of the watershed that is directly upstream of Station 01FJ002 is 17.2 km^2. Although this is larger than the area of sub-watersheds SW1 to SW4, based on its proximity to the PDA a flow proration by area is applicable assuming that all watersheds have similar hydrologic inputs, topography, land use and hydrologic regime.

Therefore, the average daily data from Station 01FJ002 was used to estimate the flows at the exit of sub-watersheds SW1, SW2, and SW3. Flows at sub-watershed SW4 were not estimated because there are no identified streams within this sub-watershed.

The entire flow hydrographs for all available data for sub-watersheds SW1, SW2 and SW3 are shown in Figures 1 to 3, respectively.

Figure 1 Flow Hydrograph for the Exit of Sub-watershed SW1

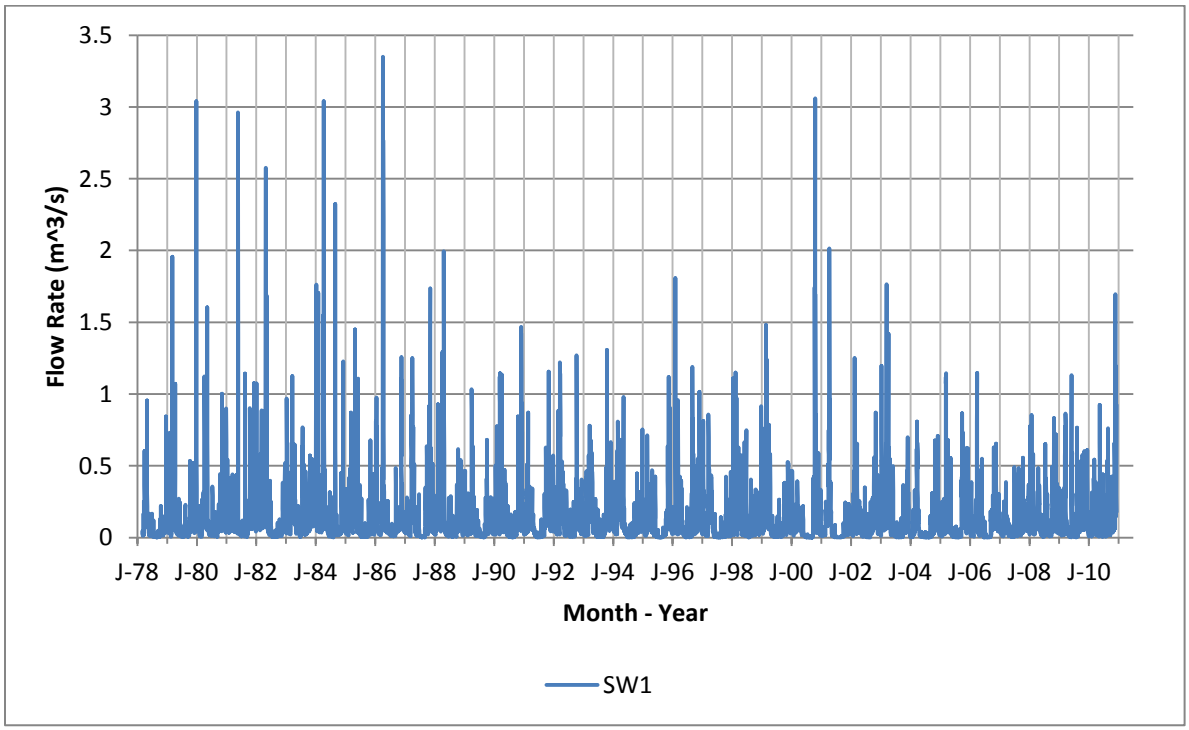


Figure 2 Flow Hydrograph for the Exit of Sub-watershed SW2

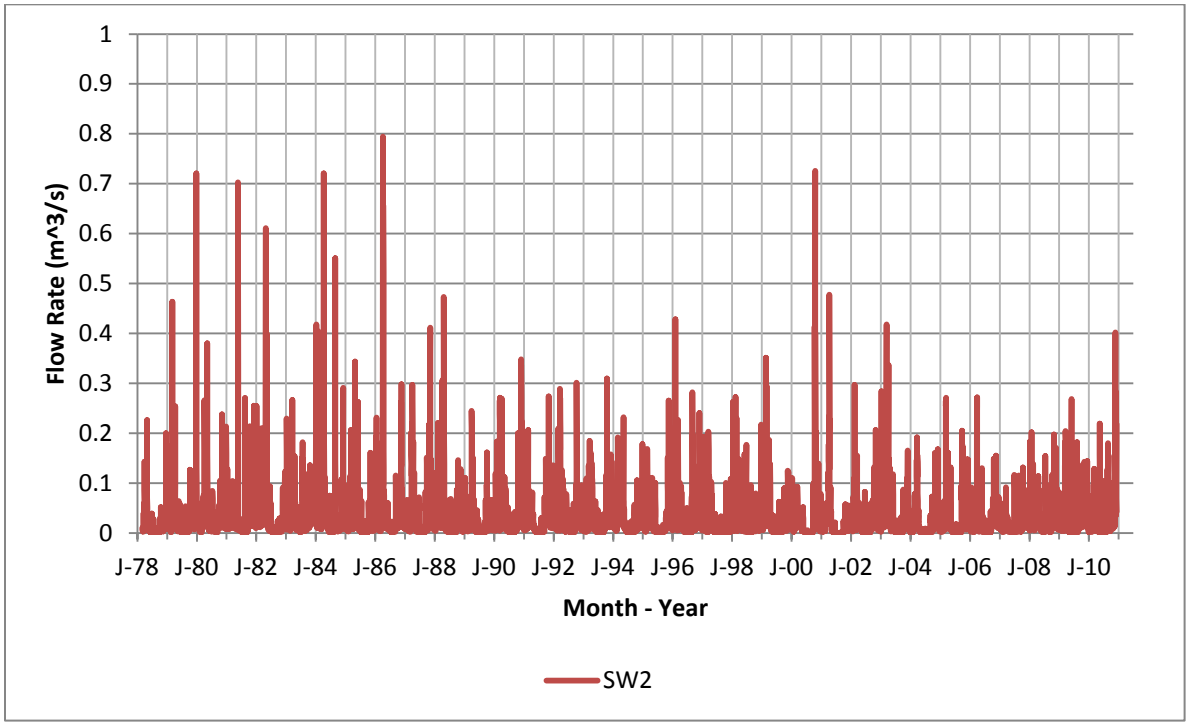
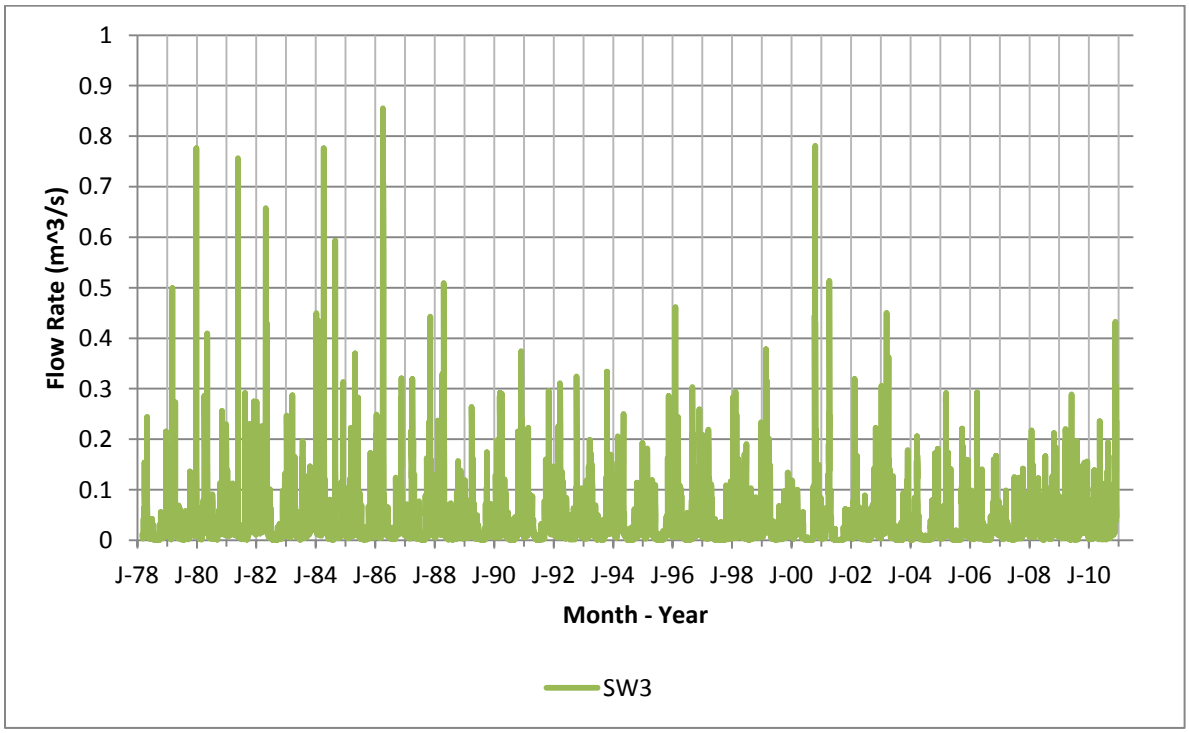
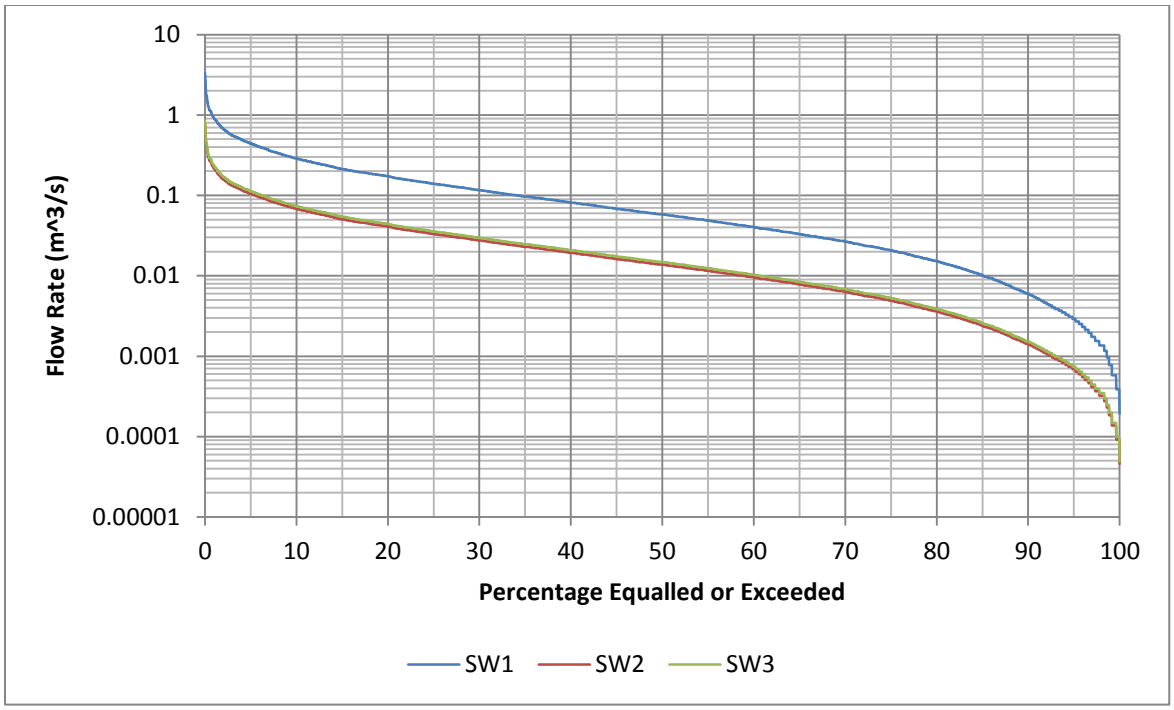


Figure 3 Flow Hydrograph for the Exit of Sub-watershed SW3



Flow duration curves were also developed for sub-watersheds SW1, SW2 and SW3 and are shown in Figure 4. The flow duration curves show the percentage of time during the available record (32 years) that any given flow was equalled or exceeded; although this analysis does not take into account the distribution of the flow rates with respect to time, it is a useful tool to visualize for which percentage of the entire record a flow was equalled or exceeded.

Figure 4 Flow Duration Curve for Sub-watersheds SW1, SW2 and SW3



Based on the flow duration curve, the 10th, 50th and 90th percentiles for all sub-watersheds are included in Table 4. Both sub-watersheds SW2 and SW3 have very similar surface areas and therefore have similar flow statistics due to the flow proration method that was used.

Table 4 Different Flow Percentiles for Sub-watersheds SW1, SW2 and SW3

Sub-watershed	Flow Statistics (m^3/s)					
	Minimum	Maximum	Average	P_{10}	P_{50}	P_{90}
SW1	0.000194	3.34	0.119	0.3	0.06	0.006
SW2	0.000046	0.79	0.028	0.065	0.014	0.0015
SW3	0.000049	0.85	0.030	0.07	0.016	0.0017

Table 4 shows that the highest flow rates during the available record occurred at sub-watershed SW1 with a maximum peak of 3.34 m^3/s; this was estimated during the 1986 spring freshet (April 10, 1986). Likely, most peak flows during the available record occurred during the spring freshet as well as during the fall which is normally associated with larger precipitation amounts based on the Climate Normals.

Minimum flows for all sub-watersheds range between 0.194 L/s for SW1 to 0.04 L/s for SW2 and SW3, respectively.

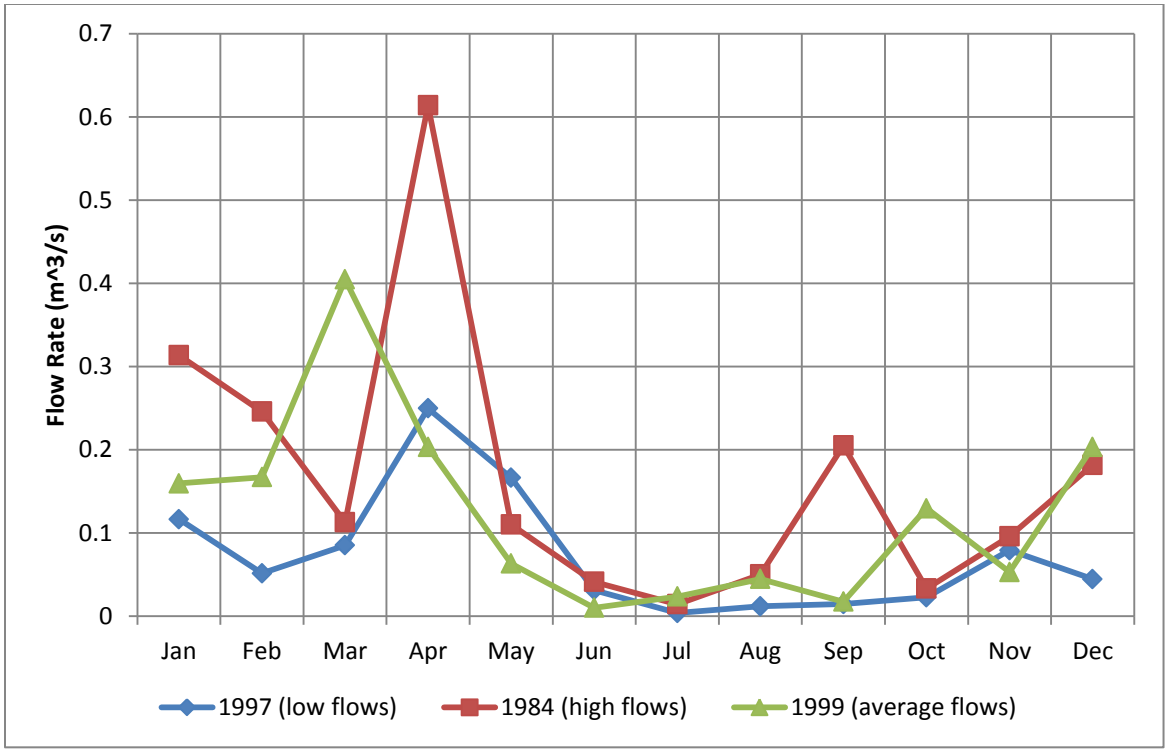
The estimated average flow rates based on the water balance calculations and included in Table 3 are similar and within the same order of magnitude than the average flow rates included in Table 4, which are based on a duration curve method.

Hydrologic Regimes

The available climate and flow rate data can be used to describe the hydrologic regimes in the streams that are located within the PDA. Several wetlands are directly connected to the streams and affect the hydrologic regime by providing flow attenuation and storage.

Prorated monthly average flows from Station 01FJ002 at sub-watershed SW1 were used to evaluate the variability of flows during the year. For this purpose, rather than showing all years, three years with representative low, high and average flows were chosen. These correspond to the years 1997, 1984 and 1999, respectively, and are shown in Figure 5.

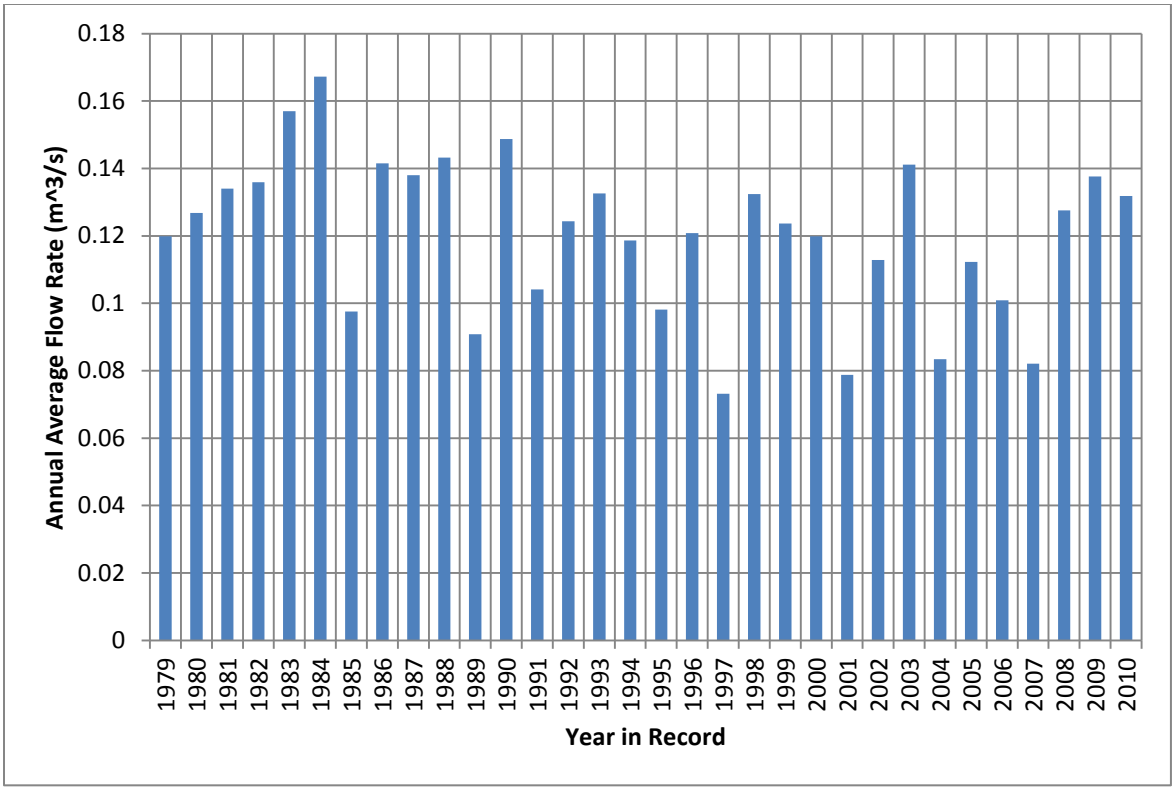
Figure 5 Average Prorated Monthly Flows for Sub-watershed SW1



The flow regime for the area can be characterized with intervals of medium to low flows during the winter, increasing during the spring freshet. Once the spring freshet passes, there is a gradual transition to low flows associated with the summer months where high evapotranspiration rates and lower precipitation amounts occur; during this time baseflow becomes a significant contributor to stream flow. Normally large rainfall events increase flow rate amounts during the fall and finally a transition starts to the winter months where most of the available water is frozen in the form of snow and ice and is eventually released during the next spring freshet.

The average annual flow for the years 1979 to 2010 was prorated to sub-watershed SW1 and is shown in Figure 6.

Figure 6 Average Annual Flow Rate Prorated to Sub-watershed SW1



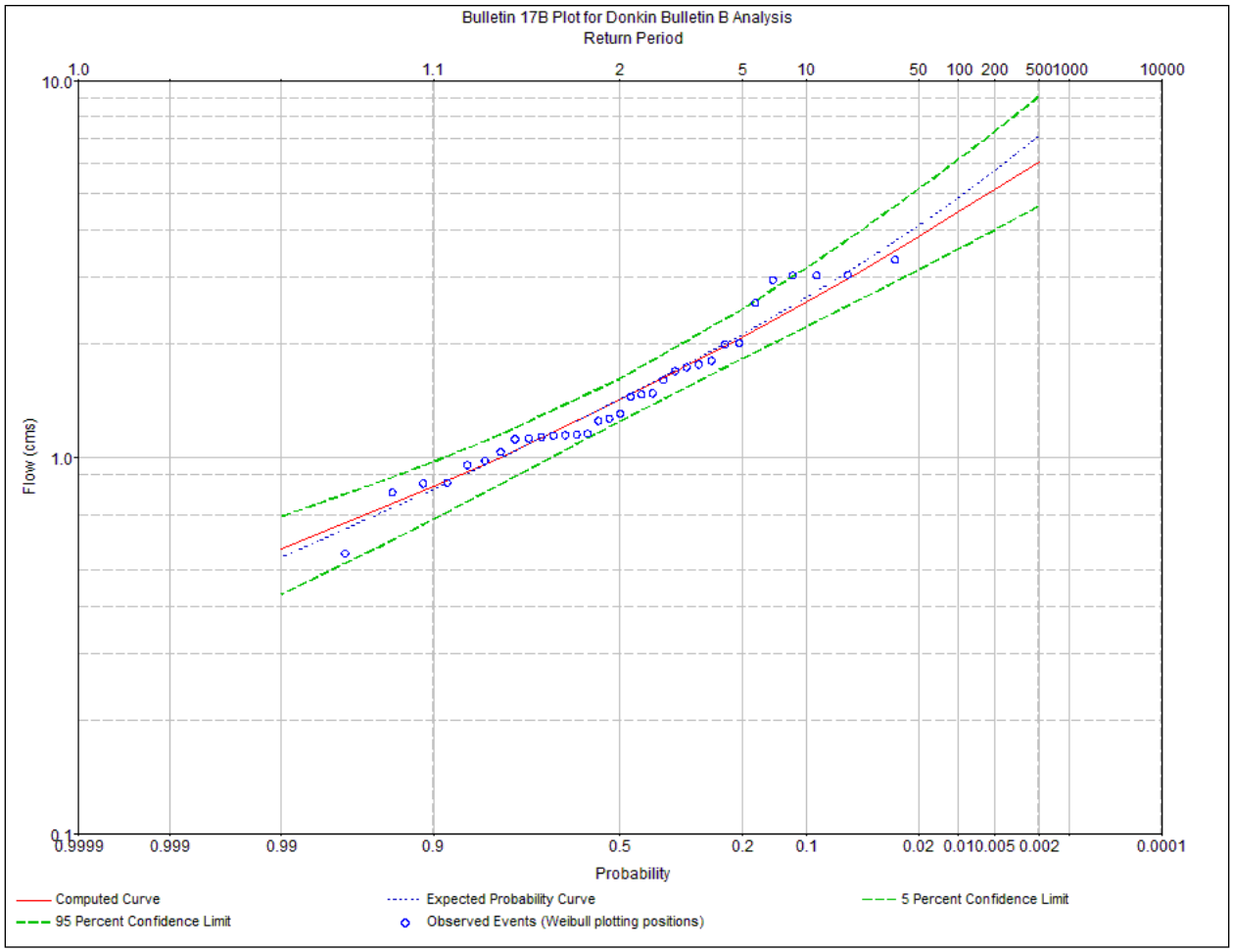
The annual variability of average yearly flow rates shown in Figure 6 consists of a pattern of medium to high average flows followed by a year of low average flows. This pattern repeats throughout the record with an increasing frequency of low average flows in recent years. The annual average flow rates range from approximately 73 L/s in 1997 to 167 L/s in 1984. These correspond to total yearly precipitation amounts of 1275.2 mm in 1997 and 1458.3 mm in 1984, respectively.

A basic assessment of low and high flow conditions (*i.e.* floods and droughts) for the PDA was conducted for sub-watershed SW1, since it is the largest of the four and it contains the highest number of streams as well as Baileys Wetland.

The high flow assessment was conducted using the software HEC-SSP, which was used to determine the flow magnitudes associated with different return periods by adjusting the available flow data to a frequency distribution. The HEC-SSP software package was developed by the U.S. Army Corps of Engineers and follows the guidelines of Bulletin 17B, Guidelines for Determining Flood Frequency (USGS 1982).

The flow data was adjusted using a Log-Pearson type III distribution and confidence limits of 0.05 and 0.95. The resultant graphical plot is included in Figure 7 and shows the magnitude of different flood events with their associated probability and return period.

Figure 7 Flood Probability Curve for Sub-watershed SW1



The data shown in Figure 7 is summarized on Table 5 for different flows and associated probabilities and return periods.

Table 5 Summary of Flood Probability Results for Sub-watershed SW1

Probability (%)	Return Period (years)	Flow Rate (m^3/s)
50	2	1.5
20	5	2.1
10	10	2.5
2	50	3.8
1	100	4.5

A low flow or drought analysis was conducted with historical flow data from Station 01FJ002 prorated to sub-watershed SW1 and the software package DFLOW.

For assessment purposes, the 7Q50 and 60Q50 flow parameters were calculated, which are often used in Nova Scotia to represent low flow and drought conditions in streams for the assessment of water intakes and maintenance of aquatic habitat. Each parameter represents

the minimum flow that is sustained for a given number of days with a specified return period (*i.e.* the 60Q50 is the lowest flow that is maintained for 60 days with an associated return period of 1:50 years), this would simulate a drought condition.

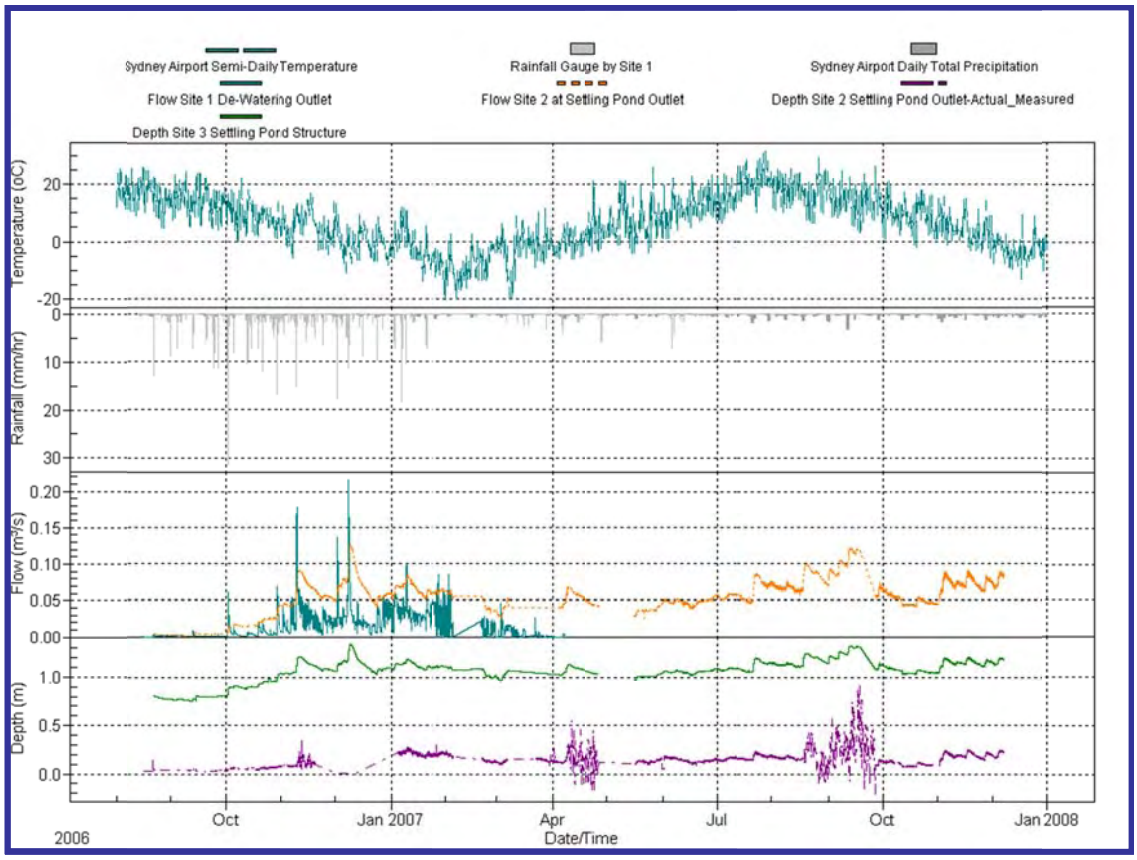
Both parameters were calculated using the statistical software DFLOW (version 3.1) developed by the U.S. Environmental Protection Agency. DFLOW is capable to adjust long term flow records to a frequency distribution in order to estimate user-selected low flows. For this case in particular, because the available record has a duration of 32 years and the required return period is 50 years, an extrapolation method was required. The analysis indicated that the 7Q50 is 0.0002 m^3/s (0.2 L/s) and the 60Q50 is 0.0012 m^3/s (1.2 L/s). The probability of occurrence of these events each year is two percent.

Rainfall amounts from IDF curves-Station 8205700 (Sydney Airport) are included in Table 6.

On-site Hydrologic Monitoring

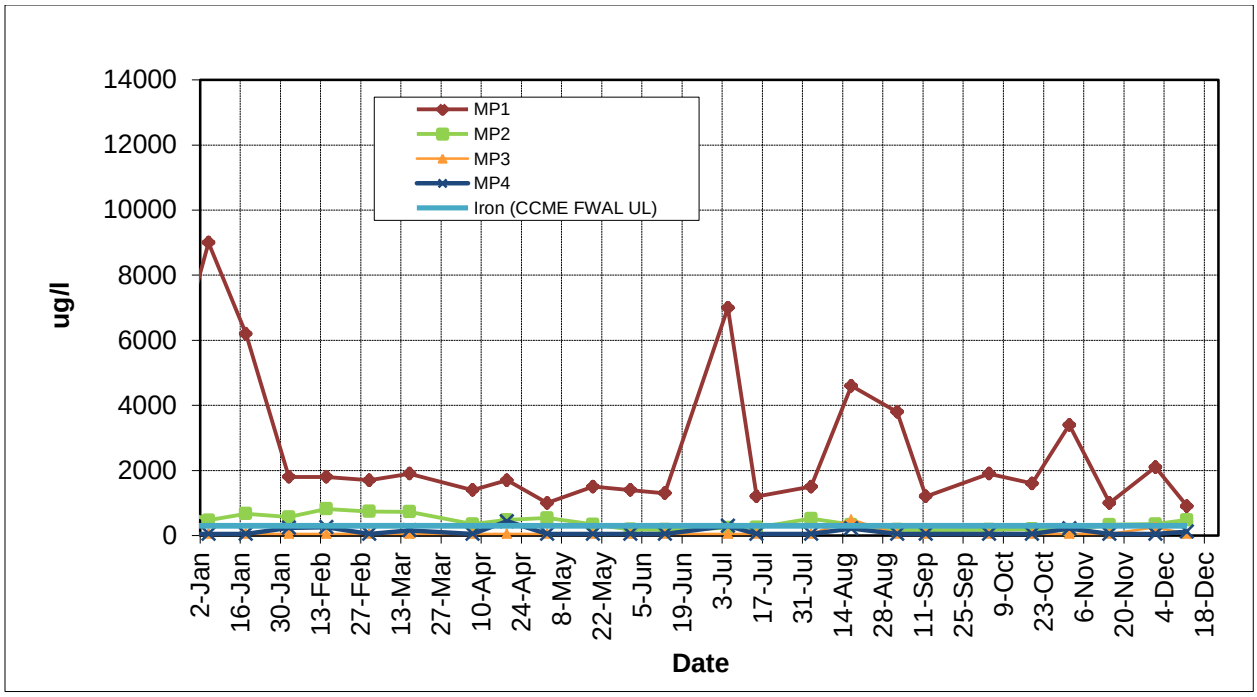
Flows and pond levels in the LAA were measured by CBCL from the fall of 2006 to the fall of 2007. Flows along the drainage ditch (which formerly took the tunnel water to the DEVCO settling pond) generally remained below 0.05 m^3/s, while flows at the outlet of the DEVCO settling pond were generally above 0.05 m^3/s, and, on occasion, surpassed 0.10 m^3/s. This is consistent with the annual average flow rates calculated for SW2 (Tables 3 and 4), considering that the mean annual flows were calculated using a long term data set and they are compared to one year of data measured by CBCL.

Figure 8 On-site Hydrologic Monitoring (CBCL 2008)



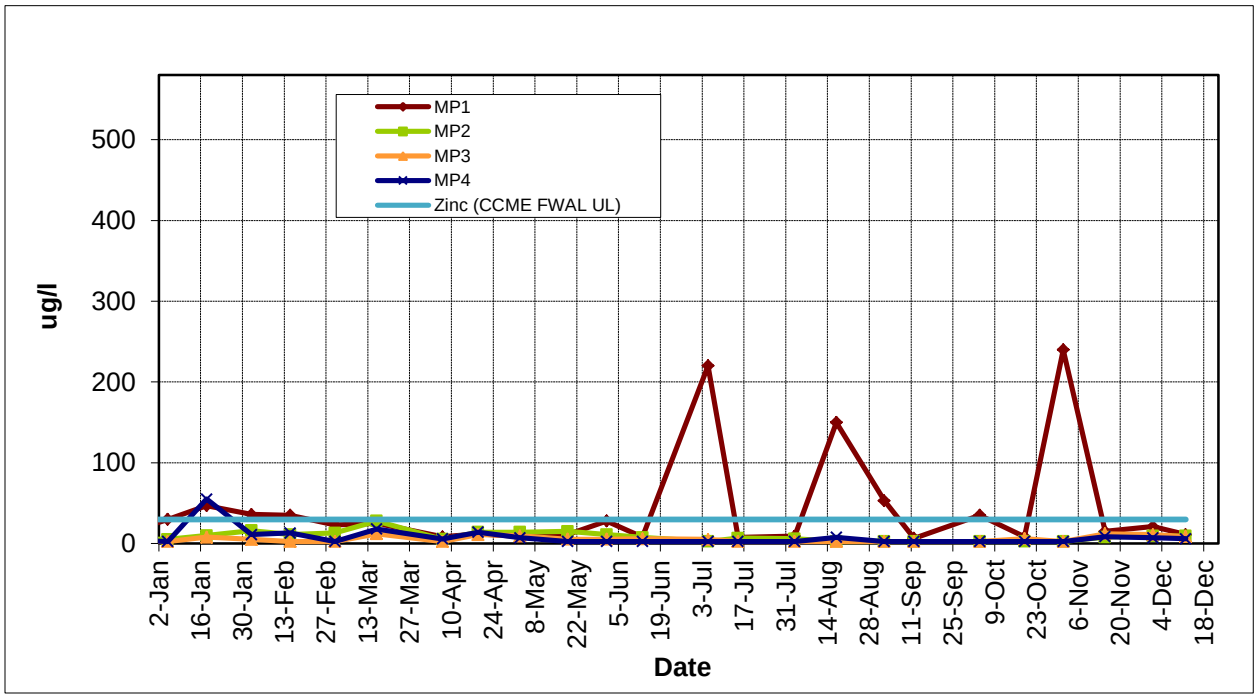
Trends observed in the key indicator parameters have continued to demonstrate that the tunnel water treatment process (based on a comparison of inlet and outlet concentrations) is effective in decreasing the concentrations of iron, zinc, TSS, and conductivity from the tunnel water (see Figures 9 to 13.

Figure 9 Iron Change Over Time at Each Monitoring Location January to December 2011



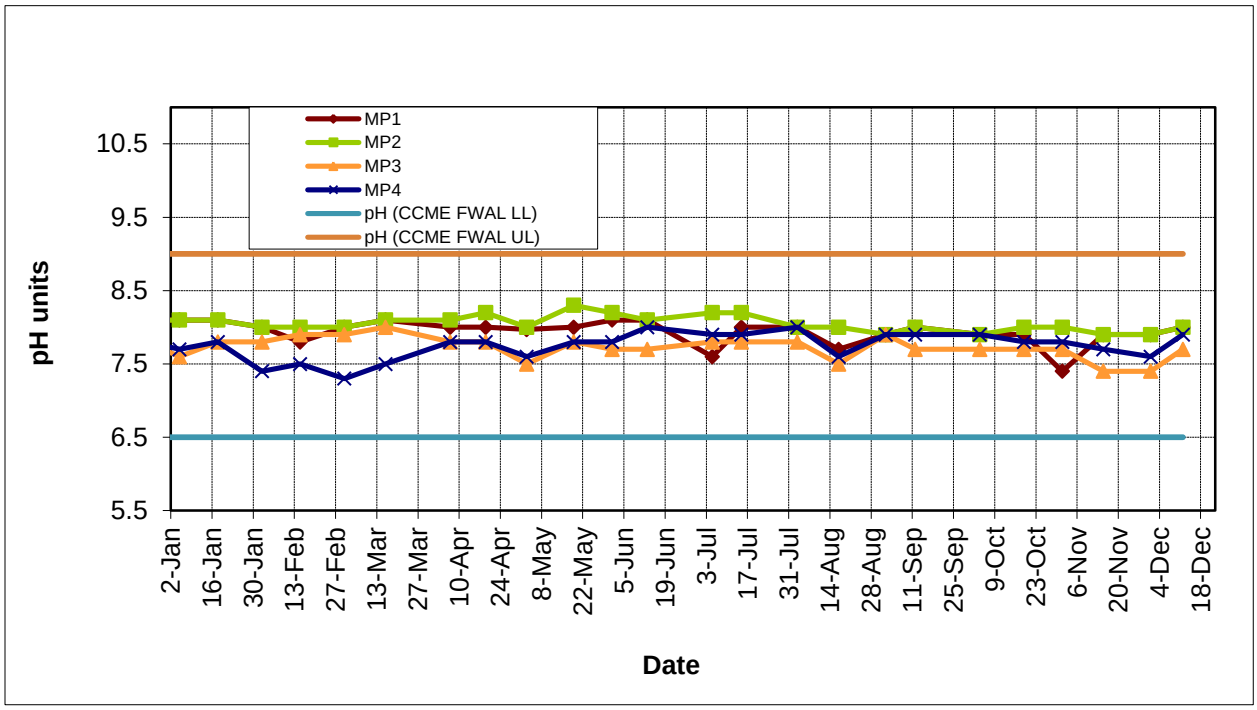
CCME FWAL UL = Canadian Council for the Ministers of the Environment Guidelines for the Protection of Aquatic Life - upper limit

Figure 10 Zinc Change Over Time at Each Monitoring Location January to December 2011



CCME FWAL UL = Canadian Council for the Ministers of the Environment Guidelines for the Protection of Aquatic Life - upper limit

Figure 11 pH Change Over Time at Each Monitoring Location January to December 2011



CCME FWAL UL/LL = Canadian Council for the Ministers of the Environment Guidelines for the Protection of Aquatic Life - upper limit/lower limit

Figure 12 **TSS Change Over Time at Each Monitoring Location January to December 2011**

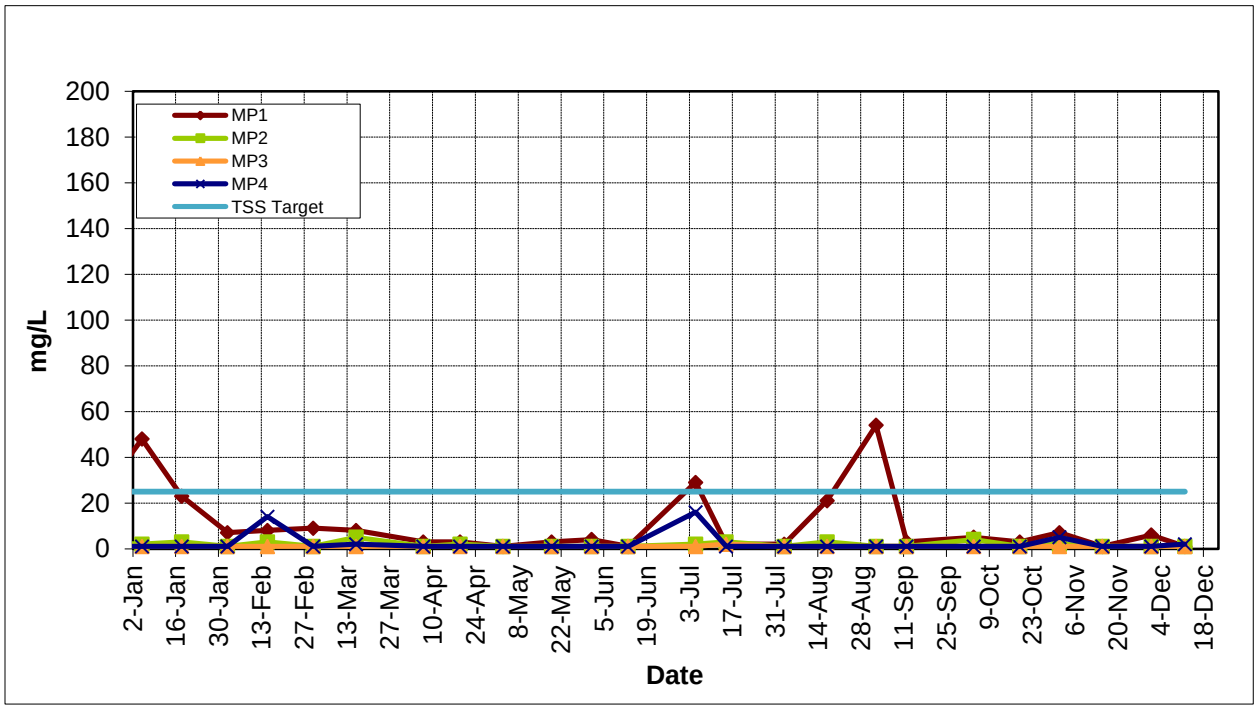


Figure 13 **Conductivity Change Over Time at Each Monitoring Location January to December 2011**

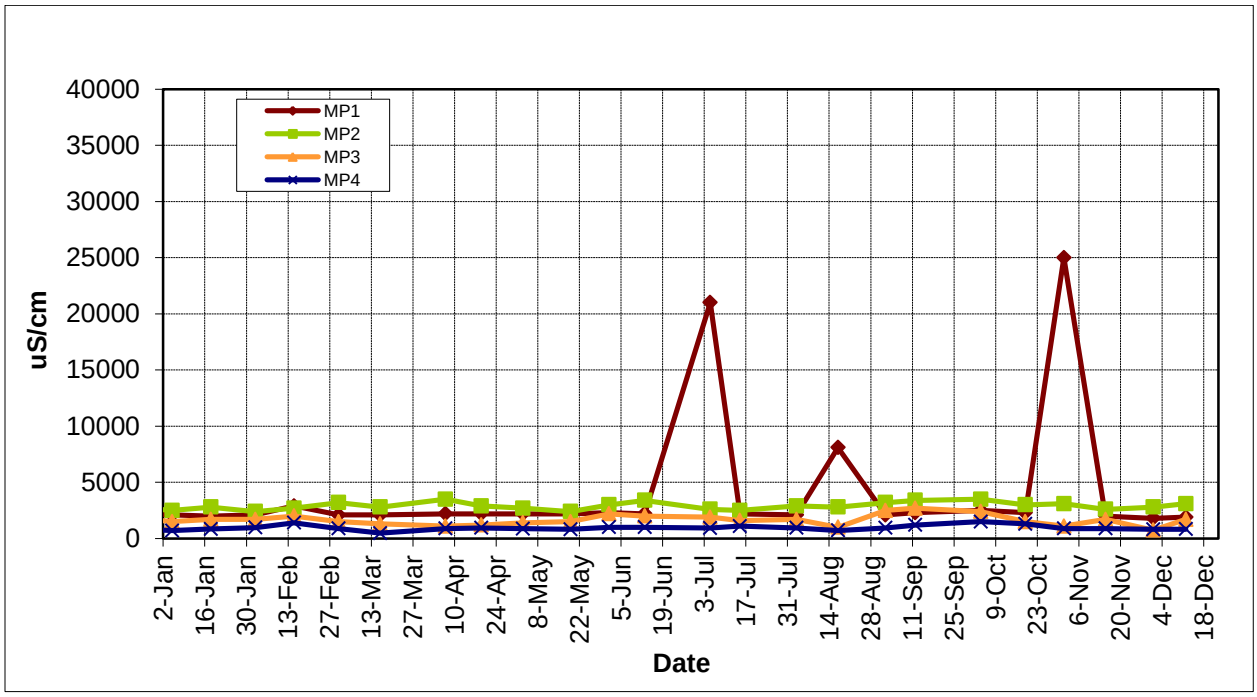


Table 6 Rainfall Amounts from IDF Curves – Station 8205700 (Sydney Airport)

Duration		Return Period (years)					
		2	5	10	25	50	100
5	min	5.3	6.8	7.9	9.2	10.2	11.1
10	min	7.7	9.8	11.3	13.1	14.4	15.7
15	min	9.6	12.5	14.5	17	18.8	20.6
30	min	13.2	17.9	21	25	27.9	30.8
1	h	18.1	24.5	28.8	34.1	38.1	42.1
2	h	26.1	34.1	39.4	46.1	51.1	56
6	h	44.7	57.4	65.9	76.5	84.5	92.3
12	h	56.6	70.5	79.7	91.4	100	108.6
24	h	67.7	82.9	92.9	105.5	114.9	124.2

REFERENCES

Black. 1996. Thornthwaite Water Budget, Software Manual, Professional Version.

Thornthwaite and Mather. 1957. The Water Balance, Publications in Climatology, Vol. X, No. 3, Drexel Institute of Technology, Centerton, NJ.

United States Geological Survey (USGS). 1982. Guidelines for Determining Flood Flow Frequency. Bulletin #17B of the Hydrology Subcommittee. U.S. Department of the Interior, U.S. Geological Survey.Reston Virginia, U.S.A

APPENDIX J
Birds and Wildlife

Table 1 Bird Species Recorded on the Donkin Peninsula Including Seasonal Occurrence and Breeding Status (Data Derived from Field and Existing Sources)

Common Name	Scientific Name	Recorded During Breeding Season		Recorded During Migration	Recorded During Late Winter / Early Spring
		Breed Code 2010 Survey	Breed Code 2002 Survey		
Red-throated Loon	*Gavia stellata*			Yes	Yes
Common Loon	*Gavia immer*		No indication of Breeding	Yes	Yes
Pied-billed Grebe	*Podilymbus podiceps*		Probable Breeder	Yes	
Horned Grebe	*Podiceps auritus*			Yes	Yes
Red-necked Grebe	*Podiceps grisegena*			Yes	Yes
Northern Fulmar	*Fulmarus glacialis*			Yes	
Cory's Shearwater	*Calonectris diomedea*			Yes	
Greater Shearwater	*Puffinus gravis*			Yes	
Sooty Shearwater	*Puffinus griseus*			Yes	
Manx Shearwater	*Puffinus puffinus*			Yes	
Wilson's Storm-Petrel	*Oceanites oceanicus*			Yes	
Leach's Storm-Petrel	*Oceanodroma leucorhoa*			Yes	
Northern Gannet	*Morus bassanus*	No indication of Breeding	No indication of Breeding	Yes	
Great Cormorant	*Phalacrocorax carbo*	Confirmed Breeder	Confirmed Breeder	Yes	Yes
Double-crested Cormorant	*Phalacrocorax auritus*	Confirmed Breeder	Confirmed Breeder	Yes	Yes
American Bittern	*Botaurus lentiginosus*		Possible Breeder	Yes	
Great Blue Heron	*Ardea herodias*	Possible Breeder		Yes	
Great Egret	*Ardea alba*			Yes	
Little Blue Heron	*Egretta caerulea*			Yes	
Tricolored Heron	*Egretta tricolor*			Yes	
Western Reef-Heron	*Egretta gularis*			Yes	
Green Heron	*Butorides virescens*			Yes	
Glossy Ibis	*Plegadis falcinellus*			Yes	
Snow Goose	*Chen caerulescens*			Yes	
Brant	*Branta bernicla*			Yes	
Canada Goose	*Branta canadensis*			Yes	Yes

Table 1 Bird Species Recorded on the Donkin Peninsula Including Seasonal Occurrence and Breeding Status (Data Derived from Field and Existing Sources)

Common Name	Scientific Name	Recorded During Breeding Season		Recorded During Migration	Recorded During Late Winter / Early Spring
		Breed Code 2010 Survey	Breed Code 2002 Survey		
Wood Duck	*Aix sponsa*	Possible Breeder	Possible Breeder	Yes	
Green-winged Teal	*Anas crecca*		Possible Breeder	Yes	
American Black Duck	*Anas rubripes*	Confirmed Breeder	Confirmed Breeder	Yes	Yes
Mallard x American Black Duck Hybrid	*N/A*	No indication of Breeding			
Mallard	*Anas platyrhynchos*	Confirmed Breeder	Confirmed Breeder	Yes	Yes
Northern Pintail	*Anas acuta*			Yes	Yes
Blue-winged Teal	*Anas discors*			Yes	
American Wigeon	*Anas americana*			Yes	Yes
Ring-necked Duck	*Aythya collaris*	Probable Breeder	Possible Breeder	Yes	
Greater Scaup	*Aythya marila*			Yes	Yes
Lesser Scaup	*Aythya affinis*			Yes	Yes
Common Eider	*Somateria mollissima*		No indication of Breeding	Yes	Yes
Harlequin Duck - Eastern pop.	*Histrionicus histrionicus pop. 1*			Yes	Yes
Long-tailed Duck	*Clangula hyemalis*			Yes	Yes
Black Scoter	*Melanitta nigra*			Yes	Yes
Surf Scoter	*Melanitta perspicillata*			Yes	Yes
White-winged Scoter	*Melanitta fusca*			Yes	Yes
Common Goldeneye	*Bucephala clangula*			Yes	Yes
Bufflehead	*Bucephala albeola*			Yes	
Hooded Merganser	*Lophodytes cucullatus*			Yes	
Common Merganser	*Mergus merganser*				Yes
Red-breasted Merganser	*Mergus serrator*			Yes	Yes
Ruddy Duck	*Oxyura jamaicensis*			Yes	
Black Vulture	*Coragyps atratus*			Yes	
Turkey Vulture	*Cathartes aura*			Yes	Yes
Osprey	*Pandion haliaetus*			Yes	

Table 1 Bird Species Recorded on the Donkin Peninsula Including Seasonal Occurrence and Breeding Status (Data Derived from Field and Existing Sources)

Common Name	Scientific Name	Recorded During Breeding Season		Recorded During Migration	Recorded During Late Winter / Early Spring
		Breed Code 2010 Survey	Breed Code 2002 Survey		
Bald Eagle	*Haliaeetus leucocephalus*	No indication of Breeding	No indication of Breeding	Yes	Yes
Northern Harrier	*Circus cyaneus*	No indication of Breeding		Yes	
Sharp-shinned Hawk	*Accipiter striatus*			Yes	Yes
Northern Goshawk	*Accipiter gentilis*			Yes	Yes
Broad-winged Hawk	*Buteo platypterus*			Yes	
Swainson's Hawk	*Buteo swainsoni*			Yes	
Red-tailed Hawk	*Buteo jamaicensis*			Yes	Yes
Rough-legged Hawk	*Buteo lagopus*			Yes	Yes
American Kestrel	*Falco sparverius*		Possible Breeder	Yes	Yes
Merlin	*Falco columbarius*	Possible Breeder		Yes	Yes
Peregrine Falcon - anatum/tundrius Population	*Falco peregrinus pop. 1*	Possible Breeder		Yes	
Spruce Grouse	*Falcipennis canadensis*				Yes
Ruffed Grouse	*Bonasa umbellus*	Possible Breeder			Yes
Virginia Rail	*Rallus limicola*				
Clapper Rail	*Rallus longirostris*			Yes	
Sora	*Porzana carolina*		Probable Breeder	Yes	
Common Moorhen	*Gallinula chloropus*			Yes	
American Coot	*Fulica americana*			Yes	
Sandhill Crane	*Grus canadensis*			Yes	
Black-bellied Plover	*Pluvialis squatarola*			Yes	
American Golden-Plover	*Pluvialis dominica*			Yes	
Semipalmated Plover	*Charadrius semipalmatus*		No indication of Breeding	Yes	
Killdeer	*Charadrius vociferus*		Probable Breeder	Yes	
Greater Yellowlegs	*Tringa melanoleuca*		No indication of Breeding	Yes	
Lesser Yellowlegs	*Tringa flavipes*	No indication of Breeding		Yes	
Solitary Sandpiper	*Tringa solitaria*			Yes	

Table 1 Bird Species Recorded on the Donkin Peninsula Including Seasonal Occurrence and Breeding Status (Data Derived from Field and Existing Sources)

Common Name	Scientific Name	Recorded During Breeding Season		Recorded During Migration	Recorded During Late Winter / Early Spring
		Breed Code 2010 Survey	Breed Code 2002 Survey		
Willet	*Tringa semipalmata*			Yes	
Spotted Sandpiper	*Actitis macularius*	Possible Breeder		Yes	
Upland Sandpiper	*Bartramia longicauda*			Yes	
Whimbrel	*Numenius phaeopus*			Yes	
Hudsonian Godwit	*Limosa haemastica*			Yes	
Ruddy Turnstone	*Arenaria interpres*			Yes	
Red Knot rufa ssp	*Calidris canutus rufa*			Yes	
Sanderling	*Calidris alba*			Yes	
Semipalmated Sandpiper	*Calidris pusilla*			Yes	
Western Sandpiper	*Calidris mauri*			Yes	
Least Sandpiper	*Calidris minutilla*		No indication of Breeding	Yes	
White-rumped Sandpiper	*Calidris fuscicollis*			Yes	
Baird's Sandpiper	*Calidris bairdii*			Yes	
Pectoral Sandpiper	*Calidris melanotos*			Yes	
Purple Sandpiper	*Calidris maritima*			Yes	Yes
Dunlin	*Calidris alpina*			Yes	
Curlew Sandpiper	*Calidris ferruginea*			Yes	
Buff-breasted Sandpiper	*Tryngites subruficollis*			Yes	
Ruff	*Philomachus pugnax*			Yes	
Short-billed Dowitcher	*Limnodromus griseus*			Yes	
Wilson's Snipe	*Gallinago delicata*		Probable Breeder	Yes	Yes
American Woodcock	*Scolopax minor*			Yes	
Red-necked Phalarope	*Phalaropus lobatus*			Yes	
Red Phalarope	*Phalaropus fulicaria*			Yes	
Pomarine Jaeger	*Stercorarius pomarinus*			Yes	
Parasitic Jaeger	*Stercorarius parasiticus*			Yes	

Table 1 Bird Species Recorded on the Donkin Peninsula Including Seasonal Occurrence and Breeding Status (Data Derived from Field and Existing Sources)

Common Name	Scientific Name	Recorded During Breeding Season		Recorded During Migration	Recorded During Late Winter / Early Spring
		Breed Code 2010 Survey	Breed Code 2002 Survey		
Laughing Gull	*Larus atricilla*			Yes	
Franklin's Gull	*Larus pipixcan*			Yes	
Black-headed Gull	*Larus ridibundus*			Yes	Yes
Ring-billed Gull	*Larus delawarensis*	No indication of Breeding	No indication of Breeding	Yes	Yes
Bonaparte's Gull	*Larus philadelphia*				Yes
Herring Gull	*Larus argentatus smithsonianus*	Confirmed Breeder[1]	Confirmed Breeder	Yes	Yes
Iceland Gull	*Larus glaucoides*			Yes	
Lesser Black-backed Gull	*Larus fuscus*			Yes	Yes
Glaucous Gull	*Larus hyperboreus*			Yes	Yes
Great Black-backed Gull	*Larus marinus*	No indication of Breeding	No indication of Breeding	Yes	Yes
Black-legged Kittiwake	*Rissa tridactyla*	Confirmed Breeder	Confirmed Breeder	Yes	
Gull-billed Tern	*Gelochelidon nilotica*			Yes	
Caspian Tern	*Sterna caspia*			Yes	
Common Tern	*Sterna hirundo*			Yes	
Arctic Tern	*Sterna paradisaea*			Yes	
Dovekie	*Alle alle*			Yes	Yes
Common Murre	*Uria aalge*			Yes	Yes
Thick-billed Murre	*Uria lomvia*			Yes	Yes
Razorbill	*Alca torda*	Possible Breeder	Possible Breeder	Yes	Yes
Black Guillemot	*Cepphus grylle*	Probable Breeder	Confirmed Breeder	Yes	Yes
Atlantic Puffin	*Fratercula arctica*			Yes	Yes
Rock Dove	*Columba livia*	Possible Breeder	Possible Breeder	Yes	Yes
Mourning Dove	*Zenaida macroura*	Possible Breeder	Possible Breeder	Yes	Yes
Black-billed Cuckoo	*Coccyzus erythropthalmus*			Yes	
Yellow-billed Cuckoo	*Coccyzus americanus*			Yes	
Great Horned Owl	*Bubo virginianus*			Yes	Yes

Table 1 Bird Species Recorded on the Donkin Peninsula Including Seasonal Occurrence and Breeding Status (Data Derived from Field and Existing Sources)

Common Name	Scientific Name	Recorded During Breeding Season		Recorded During Migration	Recorded During Late Winter / Early Spring
		Breed Code 2010 Survey	Breed Code 2002 Survey		
Snowy Owl	*Bubo scandiacus*			Yes	Yes
Barred Owl	*Strix varia*			Yes	Yes
Long-eared Owl	*Asio otus*			Yes	
Short-eared Owl	*Asio flammeus*			Yes	Yes
Northern Saw-whet Owl	*Aegolius acadicus*			Yes	Yes
Common Nighthawk	*Chordeiles minor*			Yes	
Chimney Swift	*Chaetura pelagica*			Yes	
Ruby-throated Hummingbird	*Archilochus colubris*			Yes	
Belted Kingfisher	*Megaceryle alcyon*	No indication of Breeding	Confirmed Breeder	Yes	
Yellow-bellied Sapsucker	*Sphyrapicus varius*			Yes	
Downy Woodpecker	*Picoides pubescens*		Probable Breeder	Yes	Yes
Hairy Woodpecker	*Picoides villosus*			Yes	Yes
Black-backed Woodpecker	*Picoides arcticus*	No indication of Breeding		Yes	Yes
Northern Flicker	*Colaptes auratus*	Possible Breeder	Probable Breeder	Yes	Yes
Olive-sided Flycatcher	*Contopus cooperi*			Yes	
Eastern Wood-Pewee	*Contopus virens*			Yes	
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Possible Breeder	Probable Breeder	Yes	
Least Flycatcher	*Empidonax minimus*			Yes	
Alder Flycatcher	*Empidonax alnorum*	Possible Breeder	Probable Breeder		
Eastern Phoebe	*Sayornis phoebe*			Yes	
Say's Phoebe	*Sayornis saya*			Yes	
Great Crested Flycatcher	*Myiarchus crinitus*			Yes	
Western Kingbird	*Tyrannus verticalis*			Yes	
Eastern Kingbird	*Tyrannus tyrannus*			Yes	
Horned Lark	*Eremophila alpestris*			Yes	Yes
Purple Martin	*Progne subis*			Yes	

Table 1 Bird Species Recorded on the Donkin Peninsula Including Seasonal Occurrence and Breeding Status (Data Derived from Field and Existing Sources)

Common Name	Scientific Name	Recorded During Breeding Season		Recorded During Migration	Recorded During Late Winter / Early Spring
		Breed Code 2010 Survey	Breed Code 2002 Survey		
Tree Swallow	*Tachycineta bicolor*	No indication of Breeding	Possible Breeder	Yes	
Bank Swallow	*Riparia riparia*	No indication of Breeding	Confirmed Breeder	Yes	
Cliff Swallow	*Petrochelidon pyrrhonota*			Yes	
Barn Swallow	*Hirundo rustica*		Confirmed Breeder	Yes	
Gray Jay	*Perisoreus canadensis*	Probable Breeder	Confirmed Breeder	Yes	Yes
Blue Jay	*Cyanocitta cristata*	Probable Breeder	Possible Breeder	Yes	Yes
American Crow	*Corvus brachyrhynchos*	No indication of Breeding	Confirmed Breeder	Yes	Yes
Common Raven	*Corvus corax*	Confirmed Breeder	Confirmed Breeder	Yes	Yes
Black-capped Chickadee	*Poecile atricapilla*	Probable Breeder	Probable Breeder	Yes	Yes
Boreal Chickadee	*Poecile hudsonica*	Possible Breeder	Probable Breeder	Yes	Yes
Red-breasted Nuthatch	*Sitta canadensis*	Confirmed Breeder		Yes	Yes
Brown Creeper	*Certhia americana*	Confirmed Breeder		Yes	Yes
Carolina Wren	*Thryothorus ludovicianus*			Yes	
Winter Wren	*Troglodytes troglodytes*	Possible Breeder		Yes	
Golden-crowned Kinglet	*Regulus satrapa*	Confirmed Breeder	Confirmed Breeder	Yes	Yes
Ruby-crowned Kinglet	*Regulus calendula*	Possible Breeder	Probable Breeder	Yes	
Blue-gray Gnatcatcher	*Polioptila caerulea*			Yes	
Northern Wheatear	*Oenanthe oenanthe*			Yes	
Eastern Bluebird	*Sialia sialis*			Yes	
Veery	*Catharus fuscescens*			Yes	
Gray-cheeked Thrush	*Catharus minimus*			Yes	
Swainson's Thrush	*Catharus ustulatus*	Possible Breeder	Probable Breeder	Yes	
Hermit Thrush	*Catharus guttatus*	Possible Breeder	Probable Breeder	Yes	
Bicknell's Thrush	*Catharus bicknelli*			Yes	
American Robin	*Turdus migratorius*	Possible Breeder	Confirmed Breeder	Yes	Yes
Gray Catbird	*Dumetella carolinensis*		Probable Breeder	Yes	

Table 1 Bird Species Recorded on the Donkin Peninsula Including Seasonal Occurrence and Breeding Status (Data Derived from Field and Existing Sources)

Common Name	Scientific Name	Recorded During Breeding Season		Recorded During Migration	Recorded During Late Winter / Early Spring
		Breed Code 2010 Survey	Breed Code 2002 Survey		
Northern Mockingbird	*Mimus polyglottos*			Yes	
Brown Thrasher	*Toxostoma rufum*			Yes	
American Pipit	*Anthus rubescens*			Yes	
Bohemian Waxwing	*Bombycilla garrulus*			Yes	Yes
Cedar Waxwing	*Bombycilla cedrorum*	Possible Breeder	Probable Breeder	Yes	Yes
Northern Shrike	*Lanius excubitor*			Yes	Yes
European Starling	*Sturnus vulgaris*		Confirmed Breeder	Yes	Yes
White-eyed Vireo	*Vireo griseus*			Yes	
Blue-headed Vireo	*Vireo solitarius*	Probable Breeder	Confirmed Breeder	Yes	
Yellow-throated Vireo	*Vireo flavifrons*			Yes	
Warbling Vireo	*Vireo gilvus*			Yes	
Philadelphia Vireo	*Vireo philadelphicus*			Yes	
Red-eyed Vireo	*Vireo olivaceus*	Possible Breeder	Confirmed Breeder	Yes	
Blue-winged Warbler	*Vermivora pinus*			Yes	
Golden-winged Warbler	*Vermivora chrysoptera*			Yes	
Tennessee Warbler	*Vermivora peregrina*			Yes	
Orange-crowned Warbler	*Vermivora celata*			Yes	
Nashville Warbler	*Vermivora ruficapilla*	Possible Breeder		Yes	
Northern Parula	*Parula americana*			Yes	
Yellow Warbler	*Dendroica petechia*	Probable Breeder	Confirmed Breeder	Yes	
Chestnut-sided Warbler	*Dendroica pensylvanica*	Possible Breeder		Yes	
Magnolia Warbler	*Dendroica magnolia*	Probable Breeder	Confirmed Breeder	Yes	
Cape May Warbler	*Dendroica tigrina*			Yes	
Black-throated Blue Warbler	*Dendroica caerulescens*			Yes	
Yellow-rumped Warbler	*Dendroica coronata*	Probable Breeder	Confirmed Breeder	Yes	Yes
Black-throated Green Warbler	*Dendroica virens*	Possible Breeder		Yes	

Table 1 Bird Species Recorded on the Donkin Peninsula Including Seasonal Occurrence and Breeding Status (Data Derived from Field and Existing Sources)

Common Name	Scientific Name	Recorded During Breeding Season		Recorded During Migration	Recorded During Late Winter / Early Spring
		Breed Code 2010 Survey	Breed Code 2002 Survey		
Blackburnian Warbler	*Dendroica fusca*	Possible Breeder		Yes	
Yellow-throated Warbler	*Dendroica dominica*			Yes	
Pine Warbler	*Dendroica pinus*			Yes	
Prairie Warbler	*Dendroica discolor*			Yes	
Palm Warbler	*Dendroica palmarum*	Possible Breeder		Yes	
Bay-breasted Warbler	*Dendroica castanea*			Yes	
Blackpoll Warbler	*Dendroica striata*	Possible Breeder		Yes	
Black-and-White Warbler	*Mniotilta varia*	Possible Breeder	Probable Breeder	Yes	
American Redstart	*Setophaga ruticilla*	Possible Breeder	Confirmed Breeder	Yes	
Prothonotary Warbler	*Protonotaria citrea*			Yes	
Worm-eating Warbler	*Helmitheros vermivorum*			Yes	
Ovenbird	*Seiurus aurocapillus*			Yes	
Northern Waterthrush	*Seiurus noveboracensis*			Yes	
Mourning Warbler	*Oporornis philadelphia*	Possible Breeder	Confirmed Breeder	Yes	
Common Yellowthroat	*Geothlypis trichas*	Probable Breeder	Confirmed Breeder	Yes	
Hooded Warbler	*Wilsonia citrina*			Yes	
Wilson's Warbler	*Wilsonia pusilla*			Yes	
Canada Warbler	*Wilsonia canadensis*			Yes	
Yellow-Breasted Chat	*Icteria virens*			Yes	
Scarlet Tanager	*Piranga olivacea*			Yes	
Rose-breasted Grosbeak	*Pheucticus ludovicianus*			Yes	
Blue Grosbeak	*Guiraca caerulea*			Yes	
Indigo Bunting	*Passerina cyanea*			Yes	
Dickcissel	*Spiza americana*			Yes	
Eastern Towhee	*Pipilo erythrophthalmus*			Yes	
American Tree Sparrow	*Spizella arborea*			Yes	Yes

Table 1 Bird Species Recorded on the Donkin Peninsula Including Seasonal Occurrence and Breeding Status (Data Derived from Field and Existing Sources)

Common Name	Scientific Name	Recorded During Breeding Season		Recorded During Migration	Recorded During Late Winter / Early Spring
		Breed Code 2010 Survey	Breed Code 2002 Survey		
Chipping Sparrow	*Spizella passerina*			Yes	
Clay-colored Sparrow	*Spizella pallida*			Yes	
Field Sparrow	*Spizella pusilla*			Yes	
Vesper Sparrow	*Pooecetes gramineus*			Yes	
Lark Sparrow	*Chondestes grammacus*			Yes	
Savannah Sparrow	*Passerculus sandwichensis*	Possible Breeder	Confirmed Breeder	Yes	Yes
Grasshopper Sparrow	*Ammodramus savannarum*			Yes	
Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*			Yes	
Fox Sparrow	*Passerella iliaca*			Yes	
Song Sparrow	*Melospiza melodia*	Probable Breeder	Confirmed Breeder	Yes	Yes
Lincoln's Sparrow	*Melospiza lincolnii*		Probable Breeder	Yes	
Swamp Sparrow	*Melospiza georgiana*	Possible Breeder	Probable Breeder	Yes	
White-throated Sparrow	*Zonotrichia albicollis*	Possible Breeder	Confirmed Breeder	Yes	
White-crowned Sparrow	*Zonotrichia leucophrys*			Yes	
Dark-eyed Junco	*Junco hyemalis*	Probable Breeder	Confirmed Breeder	Yes	Yes
Lapland Longspur	*Calcarius lapponicus*			Yes	Yes
Snow Bunting	*Plectrophenax nivalis*			Yes	Yes
Bobolink	*Dolichonyx oryzivorus*			Yes	
Red-winged Blackbird	*Agelaius phoeniceus*	Probable Breeder	Confirmed Breeder	Yes	
Eastern Meadowlark	*Sturnella magna*			Yes	
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*			Yes	
Rusty Blackbird	*Euphagus carolinus*	No indication of Breeding		Yes	
Common Grackle	*Quiscalus quiscula*	Possible Breeder	Probable Breeder	Yes	
Brown-headed Cowbird	*Molothrus ater*			Yes	
Baltimore Oriole	*Icterus galbula*			Yes	
Pine Grosbeak	*Pinicola enucleator*			Yes	Yes

Table 1 Bird Species Recorded on the Donkin Peninsula Including Seasonal Occurrence and Breeding Status (Data Derived from Field and Existing Sources)

Common Name	Scientific Name	Recorded During Breeding Season		Recorded During Migration	Recorded During Late Winter / Early Spring
		Breed Code 2010 Survey	Breed Code 2002 Survey		
Purple Finch	*Carpodacus purpureus*			Yes	Yes
Red Crossbill	*Loxia curvirostra*			Yes	Yes
White-winged Crossbill	*Loxia leucoptera*		Possible Breeder	Yes	Yes
Common Redpoll	*Carduelis flammea*			Yes	Yes
Pine Siskin	*Carduelis pinus*		Confirmed Breeder	Yes	Yes
American Goldfinch	*Carduelis tristis*	Probable Breeder	Confirmed Breeder	Yes	Yes
Evening Grosbeak	*Coccothraustes vespertinus*			Yes	Yes
House Sparrow	*Passer domesticus*			Yes	Yes

[1] Confirmed breeding status based on 2011 survey

Table 2 Bird Species of Conservation Concern Recorded in the Donkin Peninsula Study Area (All Sources)

Species		Population Status						Seasonal Presence			
Common Name	Scientific Name	IUCN	*SARA*	COSEWIC Rank	*NSESA* Rank	AC CDC Rank	NSDNR Rank	Breeding	Migration	Winter / Spring	Habitat
Common Loon	*Gavia immer*	Least Concern		Not at Risk		S3B,S4N	May Be At Risk	Present	Present	Present	Coastal waters
Pied-billed Grebe	*Podilymbus podiceps*	Least Concern				S3B	Sensitive	Present	Present		Productive shallow freshwater (Baileys Pond and Devco settling pond)
Great Cormorant	*Phalacrocorax carbo*	Least Concern				S3	Sensitive	Present	Present	Present	Nests on coastal cliffs, forages in coastal waters
American Bittern	*Botaurus lentiginosus*	Least Concern				S3S4B	Sensitive	Present	Present		Freshwater marshes (Baileys Pond and the Devco settling pond)
Brant	*Branta bernicla*	Least Concern				S3M	Sensitive		Present		Forages on eel grass beds. No preferred habitat on Donkin Peninsula
Northern Pintail	*Anas acuta*	Least Concern				S2B	May Be At Risk		Present	Present	Fertile freshwater wetlands with open water (Baileys Pond, DEVCO settling pond)
Blue-winged Teal	*Anas discors*	Least Concern				S3B	May Be At Risk	Present	Present		Fertile freshwater wetlands with open water (Baileys Pond, DEVCO settling pond)
Harlequin Duck - Eastern pop.	*Histrionicus histrionicus pop. 1*	Least Concern*	Special Concern	Special Concern	Endangered	S2N	At Risk		Present	Present	High energy, rocky coastlines
Turkey Vulture	*Cathartes aura*	Least Concern				S2S3B	Sensitive		Present	Present	Nests on cliffs, forages in a variety of habitats
American Peregrine Falcon	*Falco peregrinus anatum*	Least Concern*	Threatened	Special Concern	Vulnerable	S1B	At Risk	Present			Nests on coastal cliffs, forages along coastline
Peregrine Falcon - anatum/tundrius Population	*Falco peregrinus pop. 1*	Least Concern*		Special Concern		S1B	Sensitive		Present		Forages along coastline during migration
Common Moorhen	*Gallinula chloropus*	Least Concern				S1B	Undetermined		Present		Productive shallow freshwater (Baileys Pond, Devco settling pond)
American Coot	*Fulica americana*	Least Concern		Not at Risk		S1B	Undetermined		Present		Productive shallow freshwater (Baileys Pond and Devco settling pond)
American Golden-Plover	*Pluvialis dominica*	Least Concern				S3M	Sensitive		Present		Beaches and headlands during migration (Schooner Pond Beach)
Killdeer	*Charadrius vociferus*	Least Concern				S3S4B	Sensitive	Present	Present		Open disturbed habitat (mine site)
Greater Yellowlegs	*Tringa melanoleuca*	Least Concern				S3B,S5M	Sensitive	Present	Present		Beaches, mud flats and coastal ponds (Schooner Pond Beach)
Northern Pintail	*Tringa semipalmata*	na				S2S3B	May Be At Risk		Present		Salt marshes, beaches (Schooner Pond Beach)
Spotted Sandpiper	*Actitis macularius*	Least Concern				S3S4B	Sensitive	Present	Present		Coastal and freshwater shorelines
Whimbrel	*Numenius phaeopus*	Least Concern				S3M	Sensitive		Present		Coastal headlands and beaches (Schooner Pond Beach)
Hudsonian Godwit	*Limosa haemastica*	Least Concern				S3M	Sensitive		Present		Beaches (Schooner Pond Beach)
Red Knot rufa ssp	*Calidris canutus rufa*	Least Concern*		Endangered	Endangered	S2S3M	At Risk		Present		Beaches (Schooner Pond Beach)
Semipalmated Sandpiper	*Calidris pusilla*	Least Concern				S3M	Sensitive		Present		Beaches and mud flats (Schooner Pond Beach, intertidal ledges at Schooner Pond Head)
Purple Sandpiper	*Calidris maritima*	Least Concern				S3N	Sensitive		Present	Present	Rocky coastal shoreline
Wilson's Snipe	*Gallinago delicata*	na				S3S4B	Sensitive	Present	Present	Present	Wet meadows or brushy swamps (Baileys Pond and DEVCO settling pond)
Red-necked Phalarope	*Phalaropus lobatus*	Least Concern				S2S3M	Sensitive		Present		Offshore waters, occasionally found in nearshore waters following storms
Red Phalarope	*Phalaropus fulicaria*	Least Concern				S2S3M	Sensitive		Present		Offshore waters, occasionally found in nearshore waters following storms
Black-legged Kittiwake	*Rissa tridactyla*	Least Concern				S2B,S4S5N	Sensitive	Present	Present		Nests on coastal cliffs (Northern Head) Offshore waters outside of breeding season.
Common Tern	*Sterna hirundo*	Least Concern		Not at Risk		S3B	Sensitive		Present		No suitable nesting habitat present. Forages in coastal waters.
Arctic Tern	*Sterna paradisaea*	Least Concern				S3B	May Be At Risk		Present		No suitable nesting habitat present. Forages in coastal waters.
Razorbill	*Alca torda*	Least Concern				S1B,S4N	Sensitive	Present	Present	Present	Nests on coastal cliffs (Northern Head) Offshore waters outside of breeding season.
Atlantic Puffin	*Fratercula arctica*	Least Concern				S1B,S4S5N	Sensitive		Present	Present	Offshore waters, occasionally found in nearshore waters following storms
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Least Concern				S3?B	May Be At Risk		Present		Alder thickets (along access road to mine)
Long-eared Owl	*Asio otus*	Least Concern				S2	May Be At Risk		Present		Nests in dense conifer stands near open habitats. Forages in a wide range of habitats.
Short-eared Owl	*Asio flammeus*	Least Concern	Special Concern	Special Concern		S1S2	May Be At Risk		Present	Present	Coastal headlands and old fields provide foraging habitat.
Common Nighthawk	*Chordeiles minor*	Least Concern	Threatened	Threatened	Threatened	S3B	At Risk		Present		Forages on the wing. Nests and roosts in open habitat such as barrens, clear-cuts and disturbed habitat around mine site.
Chimney Swift	*Chaetura pelagica*	Near Threatened	Threatened	Threatened	Endangered	S2S3B	At Risk		Present		Forages on the wing. Nests and roosts in large chimneys or large hollow trees.
Black-backed Woodpecker	*Picoides arcticus*	Least Concern				S3S4	Sensitive	Present	Present	Present	Coniferous and mixedwood forest .
Olive-sided Flycatcher	*Contopus cooperi*	Near Threatened	Threatened	Threatened		S3B	At Risk	Present	Present		Wetlands with snags and open areas (Baileys Pond wetland and wetland surrounding DEVCO settling pond)
Eastern Wood-Pewee	*Contopus virens*	Least Concern				S3S4B	Sensitive		Present		Edges of clear-cuts and other openings
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Least Concern				S3S4B	Sensitive	Present	Present		Coniferous treed swamps
Eastern Phoebe	*Sayornis phoebe*	Least Concern				S3S4B	Sensitive		Present		Mixture of open and forested habitat such as around the mine site.
Great Crested Flycatcher	*Myiarchus crinitus*	Least Concern				S2B	May Be At Risk		Present		Usually associated with mature mixedwood or hardwood forest

Table 2 Bird Species of Conservation Concern Recorded in the Donkin Peninsula Study Area (All Sources)

Species		Population Status						Seasonal Presence			
Common Name	Scientific Name	IUCN	*SARA*	COSEWIC Rank	*NSESA* Rank	AC CDC Rank	NSDNR Rank	Breeding	Migration	Winter / Spring	Habitat
Eastern Kingbird	*Tyrannus tyrannus*	Least Concern				S3S4B	Sensitive	Present	Present		Typically forage around waterbodies (Baileys Pond and DEVCO settling pond)
Purple Martin	*Progne subis*	Least Concern				S1B	May Be At Risk	Present	Present		No nesting habitat. Forage around water bodies (Baileys Pond and DEVCO sttling pond)
Tree Swallow	*Tachycineta bicolor*	Least Concern				S4B	Sensitive	Present	Present		Nest in tree cavities usually near water bodies (Baileys Pond and DEVCO settling pond)
Bank Swallow	*Riparia riparia*	Least Concern				S3B	May Be At Risk	Present	Present		Nest colonially in eroding banks. Forage over water bodies (Baileys Pond, DEVCO settling pond, Schooner Pond Cove)
Cliff Swallow	*Petrochelidon pyrrhonota*	Least Concern				S3B	May Be At Risk		Present		Nest on buildings or bridges. Forage over water bodies (Baileys Pond, DEVCO settling pond)
Barn Swallow	*Hirundo rustica*	Least Concern				S3B	Sensitive	Present	Present		Nest on buildings or bridges. Forage over water bodies (Baileys Pond, DEVCO settling pond)
Gray Jay	*Perisoreus canadensis*	Least Concern				S3S4	Sensitive	Present	Present	Present	Coniferous or mixedwood forest
Boreal Chickadee	*Poecile hudsonica*	Least Concern				S3	Sensitive	Present	Present	Present	Coniferous or mixedwood forest
Golden-crowned Kinglet	*Regulus satrapa*	Least Concern				S4	Sensitive	Present	Present	Present	Coniferous or mixedwood forest
Ruby-crowned Kinglet	*Regulus calendula*	Least Concern				S4B	Sensitive	Present	Present		Coniferous or mixedwood forest
Eastern Bluebird	*Sialia sialis*	Least Concern		Not at Risk		S3B	Sensitive		Present		Open areas with scattered trees
Bicknell's Thrush	*Catharus bicknelli*	Vulnerable	Special Concern	Threatened	Vulnerable	S1S2B	At Risk		Present		Thick coniferous forest such as krumholtz on coastal headlands.
Gray Catbird	*Dumetella carolinensis*	Least Concern				S3B	May Be At Risk	Present	Present		Dense shrub thickets such as along the access road to the mine site.
Tennessee Warbler	*Vermivora peregrina*	Least Concern				S3S4B	Sensitive	Present	Present		Open woodland, brushy pasture or clearing
Cape May Warbler	*Dendroica tigrina*	Least Concern				S3?B	Sensitive	Present	Present		Coniferous forest
Bay-breasted Warbler	*Dendroica castanea*	Least Concern				S3S4B	Sensitive	Present	Present		Dense coniferous forest
Blackpoll Warbler	*Dendroica striata*	Least Concern				S3S4B	Sensitive	Present	Present		Thick coniferous forest such as krumholtz on coastal headlands.
Wilson's Warbler	*Wilsonia pusilla*	Least Concern				S3S4B	Sensitive	Present	Present		Tall shrub swamps and deciduous treed swamps
Canada Warbler	*Wilsonia canadensis*	Least Concern	Threatened	Threatened		S3B	At Risk	Present	Present		Forested wetland or upland sites with dense shrub understories and hummocky ground surface
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Least Concern				S3S4B	Sensitive		Present		Deciduous thickets
Vesper Sparrow	*Pooecetes gramineus*	Least Concern				S2S3B	May Be At Risk		Present		Usually nests in open pasture, fields or blueberry fields where vegetation alternates with bare patches.
Bobolink	*Dolichonyx oryzivorus*	Least Concern		Threatened		S3S4B	Sensitive	Present	Present		Pastures or fields with a dense cover of tall grass
Eastern Meadowlark	*Sturnella magna*	Least Concern				S1B	Sensitive		Present		Pastures or fields
Rusty Blackbird	*Euphagus carolinus*	Vulnerable	Special Concern	Special Concern		S2S3B	May Be At Risk	Present	Present		Forested wetlands with areas of grass and sedge cover and open water.
Brown-headed Cowbird	*Molothrus ater*	Least Concern				S2S3B	May Be At Risk		Present		Typically found in agricultural areas and areas of human habitation
Baltimore Oriole	*Icterus galbula*	Least Concern				S2S3B	May Be At Risk		Present		Usually found in near human habitation in gardens and thickets.
Pine Grosbeak	*Pinicola enucleator*	Least Concern				S3?B,S5N	May Be At Risk	Present	Present	Present	Coniferous forest
Pine Siskin	*Carduelis pinus*	Least Concern				S3S4B,S5N	Sensitive	Present	Present	Present	Coniferous and mixedwood forest .

* IUCN ranking based on overall species epithet independent of population, subspecies, or variety

Key:

S1 = extremely rare
S2 = very rare
S3 = rare/uncommon
S4 = common, some long-term concern
S5 = common and demonstrably secure
SNA = conservation status not available
S#S# = A range between two consecutive numeric ranks. Denotes the range of uncertainty about the exact rarity of the element (*e.g.*, S1S2).
S#? = denotes AC CDC uncertainty around the ranking

Qualifiers:

B: Breeding (migratory species).
N: Non-Breeding (migratory species).
C: Captive or Cultivated.

Table 3 Breeding Status and Population Status Ranks for Bird Species Encountered along the Transmission Line Corridor During the Field Surveys

Common Name	Scientific Name	COSEWIC Rank	NSESA Rank	AC CDC Rank	NSDNR Rank	Maximum Field Survey Breeding Status
Common Loon	*Gavia immer*			S3B,S4N	May be at Risk	Confirmed
American Bittern	*Botaurus lentiginosus*			S3S4B	Secure	Observed
Great Blue Heron	*Ardea herodias*			S4B	Secure	Observed
Black-crowned Night-heron	*Nycticorax nycticorax*			S1B	May be at Risk	Observed
American Black Duck	*Anas rubripes*			S5	Secure	Observed
Mallard	*Anas platyrhynchos*			S5	Secure	Confirmed
Ring-necked Duck	*Aythya collaris*			S5B	Secure	Probable
Bald Eagle	*Haliaeetus leucocephalus*			S4	Secure	Confirmed
Northern Harrier	*Circus cyaneus*			S5B	Secure	Confirmed
Sharp-shinned Hawk	*Accipiter striatus*			S4S5B	Secure	Confirmed
American Kestrel	*Falco sparverius*			S5B	Secure	Observed
Merlin	*Falco columbarius*			S5B	Secure	Possible
Ring-necked Pheasant	*Phasianus colchicus*			SNA	Exotic	Possible
Ruffed Grouse	*Bonasa umbellus*			S4S5	Secure	Confirmed
Spotted Sandpiper	*Actitis macularius*			S3S4B	Sensitive	Possible
Wilson's Snipe	*Gallinago delicata*			S3S4B	Sensitive	Possible
American Woodcock	*Scolopax minor*			S4S5B	Secure	Observed
Herring Gull	*Larus argentatus*			S4S5	Secure	Observed
Rock Dove	*Columba livia*			SNA	Exotic	Confirmed
Mourning Dove	*Zenaida macroura*			S5	Secure	Possible
Common Nighthawk	*Chordeiles minor*	Threatened	Threatened	S3B	At Risk	Confirmed
Ruby-throated Hummingbird	*Archilochus colubris*			S5B	Secure	Possible
Downy Woodpecker	*Picoides pubescens*			S5	Secure	Possible
Hairy Woodpecker	*Picoides villosus*			S5	Secure	Confirmed
Northern Flicker	*Colaptes auratus*			S5B	Secure	Confirmed
Pileated Woodpecker	*Dryocopus pileatus*			S5	Secure	Observed
Olive-sided Flycatcher	*Contopus cooperi*	Threatened		S3B	At Risk	Possible

Table 3 Breeding Status and Population Status Ranks for Bird Species Encountered along the Transmission Line Corridor During the Field Surveys

Common Name	Scientific Name	COSEWIC Rank	NSESA Rank	AC CDC Rank	NSDNR Rank	Maximum Field Survey Breeding Status
Eastern Wood-Pewee	*Contopus virens*			S3S4B	Sensitive	Possible
Yellow-bellied Flycatcher	*Empidonax flaviventris*			S3S4B	Sensitive	Possible
Alder Flycatcher	*Empidonax alnorum*			S5B	Secure	Probable
Tree Swallow	*Tachycineta bicolor*			S4B	Sensitive	Observed
Barn Swallow	*Hirundo rustica*			S3B	Sensitive	Observed
Gray Jay	*Perisoreus canadensis*			S3S4	Sensitive	Possible
Blue Jay	*Cyanocitta cristata*			S5	Secure	Confirmed
American Crow	*Corvus brachyrhynchos*			S5	Secure	Confirmed
Common Raven	*Corvus corax*			S5	Secure	Confirmed
Black-capped Chickadee	*Poecile atricapilla*			S5	Secure	Probable
Boreal Chickadee	*Poecile hudsonica*			S3	Sensitive	Probable
Red-breasted Nuthatch	*Sitta canadensis*			S4S5	Secure	Possible
Brown Creeper	*Certhia americana*			S5	Secure	Confirmed
Golden-crowned Kinglet	*Regulus satrapa*			S4	Sensitive	Probable
Ruby-crowned Kinglet	*Regulus calendula*			S4B	Sensitive	Possible
Veery	*Catharus fuscescens*			S4B	Secure	Probable
Swainson's Thrush	*Catharus ustulatus*			S4S5B	Secure	Probable
Hermit Thrush	*Catharus guttatus*			S5B	Secure	Confirmed
American Robin	*Turdus migratorius*			S5B	Secure	Confirmed
Cedar Waxwing	*Bombycilla cedrorum*			S5B	Secure	Probable
European Starling	*Sturnus vulgaris*			SNA	Exotic	Confirmed
Blue-headed Vireo	*Vireo solitarius*			S5B	Secure	Probable
Red-eyed Vireo	*Vireo olivaceus*			S5B	Secure	Confirmed
Nashville Warbler	*Vermivora ruficapilla*			S5B	Secure	Possible
Northern Parula	*Parula americana*			S5B	Secure	Possible
Yellow Warbler	*Dendroica petechia*			S5B	Secure	Probable
Chestnut-sided Warbler	*Dendroica pensylvanica*			S5B	Secure	Possible

Table 3 Breeding Status and Population Status Ranks for Bird Species Encountered along the Transmission Line Corridor During the Field Surveys

Common Name	Scientific Name	COSEWIC Rank	NSESA Rank	AC CDC Rank	NSDNR Rank	Maximum Field Survey Breeding Status
Magnolia Warbler	*Dendroica magnolia*			S5B	Secure	Confirmed
Black-throated Blue Warbler	*Dendroica caerulescens*			S5B	Secure	Possible
Yellow-rumped Warbler	*Dendroica coronata*			S5B	Secure	Confirmed
Black-throated Green Warbler	*Dendroica virens*			S4S5B	Secure	Probable
Blackburnian Warbler	*Dendroica fusca*			S4B	Secure	Possible
Palm Warbler	*Dendroica palmarum*			S5B	Secure	Possible
Bay-breasted Warbler	*Dendroica castanea*			S3S4B	Sensitive	Possible
Black-and-White Warbler	*Mniotilta varia*			S4S5B	Secure	Probable
American Redstart	*Setophaga ruticilla*			S5B	Secure	Probable
Ovenbird	*Seiurus aurocapillus*			S5B	Secure	Probable
Mourning Warbler	*Oporornis philadelphia*			S4B	Secure	Possible
Common Yellowthroat	*Geothlypis trichas*			S5B	Secure	Probable
Canada Warbler	*Wilsonia canadensis*	Threatened		S3B	At Risk	Possible
Savannah Sparrow	*Passerculus sandwichensis*			S4B	Secure	Possible
Song Sparrow	*Melospiza melodia*			S5B	Secure	Confirmed
Lincoln's Sparrow	*Melospiza lincolnii*			S4B	Secure	Possible
Swamp Sparrow	*Melospiza georgiana*			S5B	Secure	Confirmed
White-throated Sparrow	*Zonotrichia albicollis*			S5B	Secure	Confirmed
Dark-eyed Junco	*Junco hyemalis*			S4S5	Secure	Confirmed
Red-winged Blackbird	*Agelaius phoeniceus*			S4S5B	Secure	Probable
Common Grackle	*Quiscalus quiscula*			S5B	Secure	Confirmed
Purple Finch	*Carpodacus purpureus*			S4S5	Secure	Possible
American Goldfinch	*Carduelis tristis*			S5	Secure	Probable

Table 4 Numbers of Birds Recorded during the Transmission Line Corridor Field Surveys and the Habitats in which they were Found

Species	Mature Softwood	Immature Softwood	Mature Mixedwood	Immature Mixedwood	Mature Hardwood	Immature Hardwood	Clear-cut	Tall Shrub Thicket	Low Shrub Thicket	Disturbed Area	Residential Area	Abandoned Area	Pasture	Semi-Barrens	Tall Shrub Swamp	Low Shrub Swamp	Coniferous Treed Swamp	Deciduous Treed Swamp	Mixedwood Treed Swamp	Fresh Marsh	Brackish Marsh	Bog	Treed Bog	Wet Meadow	Open Water	Habitat Unknown	Flew Over	Total
Common Loon																1											2	**3**
American Bittern																											1	**1**
Great Blue Heron																											1	**1**
Black-crowned Night-heron																				2								**2**
American Black Duck																											2	**2**
Mallard																									5		2	**7**
Ring-necked Duck																									2			**2**
Bald Eagle	3			2											1												1	**7**
Northern Harrier																											4	**4**
Sharp-shinned Hawk																											2	**2**
American Kestrel										2																		**2**
Merlin																	1			1								**2**
Ring-necked Pheasant			1								1													1		1		**4**
Ruffed Grouse	1		5					4							1			1	2							1		**15**
Spotted Sandpiper																									1			**1**
Wilson's Snipe																2								45			2	**49**
American Woodcock										1					4													**5**
Herring Gull																											8	**8**
Rock Dove										1																	8	**9**
Mourning Dove				2		1																				2		**5**
Common Nighthawk																											5	**5**
Ruby-throated Hummingbird				1	1	1								1	2			1										**7**
Downy Woodpecker	3			1	1																							**5**
Hairy Woodpecker	1		1		1	2													1							1	1	**8**
Northern Flicker	1		1	2	3	2											1							1		1	2	**14**
Pileated Woodpecker																						1						**1**
Olive-sided				1																						2		**3**

Table 4 Numbers of Birds Recorded during the Transmission Line Corridor Field Surveys and the Habitats in which they were Found

Species	Mature Softwood	Immature Softwood	Mature Mixedwood	Immature Mixedwood	Mature Hardwood	Immature Hardwood	Clear-cut	Tall Shrub Thicket	Low Shrub Thicket	Disturbed Area	Residential Area	Abandoned Area	Pasture	Semi-Barrens	Tall Shrub Swamp	Low Shrub Swamp	Coniferous Treed Swamp	Deciduous Treed Swamp	Mixedwood Treed Swamp	Fresh Marsh	Brackish Marsh	Bog	Treed Bog	Wet Meadow	Open Water	Habitat Unknown	Flew Over	Total
Flycatcher																												
Eastern Wood-Pewee					1														1									**2**
Yellow-bellied Flycatcher			1														1											**2**
Alder Flycatcher				5		4		14							23		3		1			2				1		**53**
Tree Swallow																											7	**7**
Barn Swallow																											1	**1**
Gray Jay				1																								**1**
Blue Jay	3		1	4				3		1												1				8	2	**23**
American Crow			1	3	3										1	1										8	6	**23**
Common Raven					1					5																5	3	**14**
Black-capped Chickadee	16		11	6	2	5		10						1	15		1		10				2			1		**80**
Boreal Chickadee			2																2									**4**
Red-breasted Nuthatch				1																			1					**2**
Brown Creeper	3		1																1									**5**
Golden-crowned Kinglet	11	1	7	3														1					3					**26**
Ruby-crowned Kinglet	1		9	1	2														1							3		**17**
Veery				2	1	1																						**4**
Swainson's Thrush	1		1	4	1																					5		**12**
Hermit Thrush	2	1	8	6	3	4									1		1		2							9		**37**
American Robin	1		8	7	3	7		19		5			1		6		5									4	1	**67**
Cedar Waxwing	2			3		1		11																				**17**
European Starling						1		1		1							1										11	**15**
Blue-headed Vireo	2		6	1	2																					1		**12**
Red-eyed Vireo			15	6	30	25		5							1			1	1							2		**86**
Nashville Warbler	1	1	1	4		2											6		3							1		**19**

Table 4 Numbers of Birds Recorded during the Transmission Line Corridor Field Surveys and the Habitats in which they were Found

Species	Mature Softwood	Immature Softwood	Mature Mixedwood	Immature Mixedwood	Mature Hardwood	Immature Hardwood	Clear-cut	Tall Shrub Thicket	Low Shrub Thicket	Disturbed Area	Residential Area	Abandoned Area	Pasture	Semi-Barrens	Tall Shrub Swamp	Low Shrub Swamp	Coniferous Treed Swamp	Deciduous Treed Swamp	Mixedwood Treed Swamp	Fresh Marsh	Brackish Marsh	Bog	Treed Bog	Wet Meadow	Open Water	Habitat Unknown	Flew Over	Total
Northern Parula			2	1	4	1													1									**9**
Yellow Warbler				1		1		18							2													**22**
Chestnut-sided Warbler						2		2									1											**5**
Magnolia Warbler	3		5	9		1											2		4									**24**
Black-throated Blue Warbler						2																						**2**
Yellow-rumped Warbler	2		6	5	3			1											3							2		**22**
Black-throated Green Warbler	1		10		5									1					1							1		**19**
Blackburnian Warbler	2		4																									**6**
Palm Warbler				3				1						1	1	2							2					**10**
Bay-breasted Warbler			1																									**1**
Black-and-White Warbler			11	8	6	2		2							2				1							2		**34**
American Redstart				2	8	5		11							4													**30**
Ovenbird			14	4	41	2																						**61**
Mourning Warbler				2		2		2																				**6**
Common Yellowthroat				3		1		17		1				1	23	4	1		3	4		2	1	2		1		**64**
Canada Warbler		1			1									1	1			1	1									**6**
Savannah Sparrow												2																**2**
Song Sparrow				1	1	3		23	1	4		3			20						1			1		2		**60**
Lincoln's Sparrow		1		2																								**3**
Swamp Sparrow								2							27	3	1	2				1		1		1	1	**39**
White-throated Sparrow	2		3	17		8	1	11		4				2	5	1	1	2	3					1		8		**69**
Dark-eyed Junco	7	1	2	10	2					2					2			2	3									**31**
Red-winged Blackbird																				4	2						3	**9**

Table 4 Numbers of Birds Recorded during the Transmission Line Corridor Field Surveys and the Habitats in which they were Found

Species	Mature Softwood	Immature Softwood	Mature Mixedwood	Immature Mixedwood	Mature Hardwood	Immature Hardwood	Clear-cut	Tall Shrub Thicket	Low Shrub Thicket	Disturbed Area	Residential Area	Abandoned Area	Pasture	Semi-Barrens	Tall Shrub Swamp	Low Shrub Swamp	Coniferous Treed Swamp	Decidous Treed Swamp	Mixedwood Treed Swamp	Fresh Marsh	Brackish Marsh	Bog	Treed Bog	Wet Meadow	Open Water	Habitat Unknown	Flew Over	Total
Common Grackle	1							1							11							3					39	**55**
Purple Finch						2												2	3			1				1		**9**
American Goldfinch				1	1	4		17							11				1								28	**63**
Total	**70**	**6**	**138**	**135**	**127**	**92**	**1**	**175**	**1**	**27**	**1**	**5**	**1**	**8**	**164**	**14**	**26**	**13**	**49**	**11**	**3**	**11**	**9**	**52**	**8**	**74**	**143**	**1364**

Table 5 Bird Species of Conservation Concern Recorded during the Field Surveys

Common Name	Scientific Name	SARA Rank	NS ESA Rank	AC CDC General Status Rank	NSDNR General Status Rank	Number of Locations where Recorded	Breeding Status
Common Loon	*Gavia immer*			S3B,S4N	May Be At Risk	1	Confirmed
American Bittern	*Botaurus lentiginosus*			S3S4B	Sensitive	1	Observed
Black-crowned Night-heron	*Nycticorax nycticorax*			S1B	May Be At Risk	1	Observed
Spotted Sandpiper	*Actitis macularius*			S3S4B	Sensitive	1	Possible
Wilson's Snipe	*Gallinago delicata*			S3S4B	Sensitive	2	Possible
Common Nighthawk	*Chordeiles minor*	Threatened	Threatened	S3B	At Risk	3	Confirmed
Olive-sided Flycatcher	*Contopus cooperi*	Threatened		S3B	At Risk	3	Possible
Eastern Wood-Pewee	*Contopus virens*			S3S4B	Sensitive	2	Possible
Yellow-bellied Flycatcher	*Empidonax flaviventris*			S3S4B	Sensitive	2	Possible
Tree Swallow	*Tachycineta bicolor*			S4B	Sensitive	3	Observed
Barn Swallow	*Hirundo rustica*			S3B	Sensitive	1	Observed
Gray Jay	*Perisoreus canadensis*			S3S4	Sensitive	1	Possible
Boreal Chickadee	*Poecile hudsonica*			S3	Sensitive	2	Probable
Golden-crowned Kinglet	*Regulus satrapa*			S4	Sensitive	19	Probable
Ruby-crowned Kinglet	*Regulus calendula*			S4B	Sensitive	17	Possible
Bay-breasted Warbler	*Dendroica castanea*			S3S4B	Sensitive	1	Possible
Canada Warbler	*Wilsonia canadensis*	Threatened		S3B	At Risk	4	Possible

Table 6 Bird Species Recorded in the Breeding Bird Atlas Square on the Donkin Peninsula

Common Name	Scientific Name	COSEWIC Rank	NSESA Rank	AC CDC Rank	NSDNR Rank	Breeding Status
Wood Duck	*Aix sponsa*			S4S5B	Secure	Possible
American Black Duck	*Anas rubripes*			S5	Secure	Confirmed
Mallard	*Anas platyrhynchos*			S5	Secure	Confirmed
Green-winged Teal	*Anas crecca*			S4S5B	Secure	Probable
Ring-necked Duck	*Aythya collaris*			S5B	Secure	Probable
Ruffed Grouse	*Bonasa umbellus*			S4S5	Secure	Probable
Northern Gannet	*Morus bassanus*			SHB,S5M	Secure	
Double-crested Cormorant	*Phalacrocorax auritus*			S5B	Secure	Confirmed
Great Cormorant	*Phalacrocorax carbo*			S3	Sensitive	Confirmed
American Bittern	*Botaurus lentiginosus*			S3S4B	Sensitive	Possible
Bald Eagle	*Haliaeetus leucocephalus*			S4	Secure	Probable
Northern Harrier	*Circus cyaneus*			S5B	Secure	Possible
Northern Goshawk	*Accipiter gentilis*			S3S4	Secure	Possible
American Kestrel	*Falco sparverius*			S5B	Secure	Probable
Merlin	*Falco columbarius*			S5B	Secure	Possible
Sora	*Porzana carolina*			S4S5B	Secure	Possible
Killdeer	*Charadrius vociferus*			S3S4B	Sensitive	Possible
Spotted Sandpiper	*Actitis macularius*			S3S4B	Sensitive	Probable
Willet	*Tringa semipalmata inornatus*			SNA	Accidental	Possible
Black-legged Kittiwake	*Rissa tridactyla*			S2B,S4S5N	Sensitive	Confirmed
Ring-billed Gull	*Larus delawarensis*			S1?B,S5N	Secure	
Herring Gull	*Larus argentatus*			S4S5	Secure	Confirmed
Great Black-backed Gull	*Larus marinus*			S4	Secure	Confirmed
Razorbill	*Alca torda*			S1B,S4N	Sensitive	Confirmed
Black Guillemot	*Cepphus grylle*			S3S4	Secure	Confirmed
Rock Pigeon	*Columba livia*			SNA	Exotic	Confirmed
Mourning Dove	*Zenaida macroura*			S5	Secure	Possible

Table 6 Bird Species Recorded in the Breeding Bird Atlas Square on the Donkin Peninsula

Common Name	Scientific Name	COSEWIC Rank	NSESA Rank	AC CDC Rank	NSDNR Rank	Breeding Status
Short-eared Owl	*Asio flammeus*	Special Concern		S1S2	May Be At Risk	Possible
Ruby-throated Hummingbird	*Archilochus colubris*			S5B	Secure	Possible
Belted Kingfisher	*Megaceryle alcyon*			S5B	Secure	Probable
Downy Woodpecker	*Picoides pubescens*			S5	Secure	Probable
Hairy Woodpecker	*Picoides villosus*			S5	Secure	Possible
Northern Flicker	*Colaptes auratus*			S5B	Secure	Probable
Yellow-bellied Flycatcher	*Empidonax flaviventris*			S3S4B	Sensitive	Possible
Alder Flycatcher	*Empidonax alnorum*			S5B	Secure	Probable
Blue-headed Vireo	*Vireo solitarius*			S5B	Secure	Possible
Red-eyed Vireo	*Vireo olivaceus*			S5B	Secure	Possible
Gray Jay	*Perisoreus canadensis*			S3S4	Sensitive	Confirmed
Blue Jay	*Cyanocitta cristata*			S5	Secure	Confirmed
American Crow	*Corvus brachyrhynchos*			S5	Secure	Confirmed
Common Raven	*Corvus corax*			S5	Secure	Confirmed
Tree Swallow	*Tachycineta bicolor*			S4B	Sensitive	Possible
Bank Swallow	*Riparia riparia*			S3B	May Be At Risk	Possible
Barn Swallow	*Hirundo rustica*			S3B	Sensitive	Possible
Black-capped Chickadee	*Poecile atricapilla*			S5	Secure	Possible
Boreal Chickadee	*Poecile hudsonica*			S3	Sensitive	Possible
Red-breasted Nuthatch	*Sitta canadensis*			S4S5	Secure	Possible
Golden-crowned Kinglet	*Regulus satrapa*			S4	Sensitive	Possible
Ruby-crowned Kinglet	*Regulus calendula*			S4B	Sensitive	Possible
Swainson's Thrush	*Catharus ustulatus*			S4S5B	Secure	Possible
Hermit Thrush	*Catharus guttatus*			S5B	Secure	Possible
American Robin	*Turdus migratorius*			S5B	Secure	Possible
European Starling	*Sturnus vulgaris*			SNA	Exotic	Possible

Table 6 Bird Species Recorded in the Breeding Bird Atlas Square on the Donkin Peninsula

Common Name	Scientific Name	COSEWIC Rank	NSESA Rank	AC CDC Rank	NSDNR Rank	Breeding Status
Cedar Waxwing	*Bombycilla cedrorum*			S5B	Secure	Possible
Tennessee Warbler	*Vermivora peregrina*			S3S4B	Sensitive	Possible
Yellow Warbler	*Dendroica petechia*			S5B	Secure	Confirmed
Magnolia Warbler	*Dendroica magnolia*			S5B	Secure	Confirmed
Yellow-rumped Warbler	*Dendroica coronata*			S5B	Secure	Possible
Palm Warbler	*Dendroica palmarum*			S5B	Secure	Possible
Blackpoll Warbler	*Dendroica striata*			S3S4B	Sensitive	Possible
Black-and-white Warbler	*Mniotilta varia*			S4S5B	Secure	Possible
American Redstart	*Setophaga ruticilla*			S5B	Secure	Possible
Mourning Warbler	*Oporornis philadelphia*			S4B	Secure	Probable
Common Yellowthroat	*Geothlypis trichas*			S5B	Secure	Possible
Wilson's Warbler	*Wilsonia pusilla*			S3S4B	Sensitive	Possible
Savannah Sparrow	*Passerculus sandwichensis*			S4B	Secure	Possible
Song Sparrow	*Melospiza melodia*			S5B	Secure	Probable
Swamp Sparrow	*Melospiza georgiana*			S5B	Secure	Possible
White-throated Sparrow	*Zonotrichia albicollis*			S5B	Secure	Possible
Dark-eyed Junco	*Junco hyemalis*			S4S5	Secure	Probable
Bobolink	*Dolichonyx oryzivorus*	Threatened		S3S4B	Sensitive	Probable
Red-winged Blackbird	*Agelaius phoeniceus*			S4S5B	Secure	Confirmed
Common Grackle	*Quiscalus quiscula*			S5B	Secure	Confirmed
Purple Finch	*Carpodacus purpureus*			S4S5	Secure	Possible
Red Crossbill	*Loxia curvirostra*			S4?	Secure	Confirmed
White-winged Crossbill	*Loxia leucoptera*			S4S5	Secure	Possible
American Goldfinch	*Carduelis tristis*			S5	Secure	Probable

Figure J.1 **Aerial satellite view of the six transect start (*e.g.*, T1.0) and end (*e.g.*, T1.4) locations on the Donkin Peninsula used for surveying birds during the autumn of 2010. Base image from Google Earth, December 2010.**

APPENDIX K
Wetlands

WETLAND FUNCTIONAL ASSESSMENT (for non-wildlife functions)

Contents

WETLAND EVALUATION FORM ADDITIONAL INSTRUCTIONS

The following provides extra detail and references for filling out the Wetland Evaluation Form

1. From the Canadian Wetland Classification System (NWWG 1997). Try to limit it to three types for wetland complexes but use back if more are needed.
2. Leave blank if wetland is undisturbed/unaltered
3. What is the cover type of adjacent uplands that are connected to wetland hydrological
4. What is the slope of adjacent areas, and any other anecdotal observations of these
5. General morphological form of wetland – if other, identify.
6. Topography of the wetland surface – if other, identify
7. Rank if it is apparent what the comparative contributions are, check if unknown
8. Are springs in the wetland or discharging to wetland from upgradient. Make note if spring supports a watercourse that discharges directly to wetland, if apparent.
9. Open water areas include channels, hollows, large pools, etc.
10. If there is no flow in wetland, try to discern what the flow might look like at highwater.
11. This may be in delineation sheet as well, but record here for convenience
12. If channel is dry, place ‘0’ in wet width. Use margins or back for additional channels.
13. If channel is dry, place ‘0’ in wet width. Use margins or back for additional channels.
14. These are Army Corps hydrological indicators. Goal is to find evidence of water table fluctuations above current water table.
15. Estimate the distance between the current water table and the estimated high water.
16. If you can, give an indication of how frequently the area is flooded. Very subjective.
17. Is peat present?
18. A rough estimate based on test pits or or soil probes in several locations, if possible
19. Good to compare data from 12 and 13 and make a judgment call in the field
20. If water levels are low in the watershed due to seasonal dry periods, wetland may still discharge water and support baseflow.
21. – 25. explained below.

FUNCTION ASSESSMENT

This proposed method considers the wetland structural features as indicators of potential for performance of functions. For some functions, evidence of functional performance may also be available. Information will be collected using the Stantec Wetland Evaluation Form. Numbers shown in bold **below (#)** refer to the corresponding questions on that form. **(DE)** indicates that desktop evaluation is required to answer a certain question.

Hydrology

Baseflow Maintenance:

Wetland contributes to flow in downgradient water bodies in dry conditions. The conditions that would exist for a wetland to have potential to provide this function include (some of these may be redundant in some situations):

1. Wetland apparently has greater channel outflow than inflow **(12, 13)**. Assumption is that the channel inflow and outflow on an individual wetland are in the same surficial material and therefore wet / dry width and centre depth can be used to compare relative discharge. If the wetland or watershed is recently altered, this may not be valid (**2).**

2. Wetland is a headwater to a stream (channel outflow but no channel inflow, spring source water) **(8, 12, 13).**

3. Wetland has a channel outflow and a stable water level **(11, 13, 14).** Wetland may or may not have channel inflow.

4. Wetland is very large with good storage capacity and/or abundance of saturated organic soil **(DE, 6, 9,11,delineation form).** If the wetland provides long term water storage, the assumption is that it is raising local water table and therefore contributing directly or indirectly to the baseflow of adjacent watercourses.

5. In certain conditions, evidence of function performance may be observed

    - In "dry" (subjective) conditions, outflow from wetland was observed **(21)**

    - The key determinant of the capacity of wetlands to modify flow from a watershed is the extent of wetland area in comparison to the total drainage area (Mitsch and Gosselink 2000). **(DE)**

    - Active springs are observed feeding the wetland **(8)**

Stormwater Management:

Wetland collects and stores surface water during storm/high water events. Evaluation of this function is based on the features of stormwater retention and detention basins design where peak flows are maintained for 18 to 48 hours (Schueler, 1992). The conditions that would exist for a wetland to have potential to provide this function would be that it has a fluctuating water table (Winter and Woo 1990; Devito et al. 1996; Gosselink et al. 1990; Waddington et al. 1993)

6. Regular and/or high water marks observed above existing water levels **(14, 15, 16)**

7. Wetland is topographically confined (basin form) and surface water fed (at least partially) **(5, 13)**

8. Wetland has a dry discharge channel, or much larger dry channel than wet channel (>30cm) and is surface water fed (watercourse or runoff) **(13)**

9. Wetland is not a bog because by definition, bogs do not collect surface flows (exception, question 11) **(1)**

10. Wetland is a floodplain form **(1, 5)**

11. Sloped BOG or FEN with ribbed microtopograhy perpendicular to slope provides stormwater management (1 & 6)

12. In certain conditions, evidence of function performance or value may be observed

    - Wetland water levels have been observed at multiple elevations, or high water marks (from other than freshet ["in-growing-season"]) are readily observable on trees or in surrounding upland **(DE)**

    - Valued resources are present downgradient that benefit from stormflow moderation (fish habitat, human infrastructure, etc.). **DE**

    - A culvert, drainage ditch or other artificial surface water conveyance discharges directly or indirectly to the wetland. **(2, 7)**

Shoreline Erosion Control:

Wetland slows flow, stabilizes soils or disperses energy in a way that reduces erosive forces of flows (Tiner 2003). By nature of wetland vegetation, all vegetated riparian forms have the potential to provide this function

13. Wetland is a vegetated shoreline feature fringing on an upland **(1,5)**

14. In certain conditions, evidence of function performance or value may be observed

    - Waves or currents observed in adjacent waters indicate erosive potential of water **(22)**

    - Ice scouring on trees/vegetation observed where the shoreline is intact indicate erosive action of water **(23)**

    - Observations of erosion in shoreline areas lacking wetland vegetation indicate erosion control performance of wetland vegetation **(24)**

Coastal Surge Protection:

Wetland disperses wave energy from coastal surge, thereby protecting in land areas from erosion or damage. None in our study area so not included on FA form.

Water Storage

The function of water storage (as opposed to stormwater management) is related to the general value of water retained on the surface for wildlife, raising local water table, local climate moderation, aesthetics, chemical processes, agricultural and fire use, etc. This function is generally captured in other categories.

15. Water is retained at or near surface **(9,11, 19)**

Groundwater Recharge:

Wetland captures surface flows and/or direct precipitation and discharges all or a portion to the water table. The extent of groundwater recharge by a wetland is dependent upon substrate permeability, vegetation, site, perimeter to volume ratio, and water table gradient (Dempster et al. 2006; Verry and Timmons 1982; Carter and Novitzki 1988) and the position of the wetland with respect to different-scale groundwater flow systems (Winter 1999; Price and Waddington 2000). Each situation is unique and dependent on local topography, climate, geology and watershed characteristics; using wetland ecology and geomorphology as groundwater recharge indicators is associated with high uncertainty. Watershed location will be used as the determinant of potential performance because the presence of wetlands in areas of groundwater recharge may increase water retention time to facilitate infiltration of precipitation and runoff (Mitsch and Gosselink 2000; Carter 1997). The conditions that would exist for a wetland to have potential to provide this function include:

16. Basin or flat wetlands located in topographical highs, or near watershed divides **(1, 5, DE)**

17. Not spring or groundwater fed, not riparian form, and outflow is not greater than inflow **(7, 20)**

18. Non-riparian wetlands with a channel inflow but no channel outflow (or subterranean outflow) **(12 and 13)**

Biogeochemical Function

Water Quality Improvement:

Wetland improves water quality through physical processes and chemical and metabolic transformations. Several conditions may indicate the potential of a wetland to improve water quality:

19. Surface- flow sourced wetlands with fluctuating water tables associated with precipitation events (i.e., alternating aerobic and anaerobic conditions, high primary productivity, and high soil-water interactions) are the most efficient nutrient transformers. These are also associated with sediment removal. **(14,15,16)**

20. Groundwater or spring source wetlands in agricultural watersheds (high soil/water interaction, source of nutrients; Hill 1991) **(DE,7,8)**

21. Riparian wetlands are important sinks for pollutants carried in upland runoff and from upstream areas such as agricultural soils (Gilliam 1996; Carpenter et al. 1998). They are noted for processing large fluxes of energy and materials from upstream sources, and they typically show high primary productivity (Mitsch and Gosselink 2000). **(1, 5, 7)**

22. Because precipitation-fed systems (bogs and certain marshes) are largely isolated from other surface water resources, they typically contribute little to watershed surface water quality (Mitsch and Gosselink 2000). **(1, 7)**

23. Surface-flow sourced wetlands with sheet flow (no open channel) and flow-impeding stem density **(7, 10, 24)**

24. Surface-flow sourced wetlands with flow-impeding micro-topography (hummocks, sinuous or braided flow channels, ribs/ridges) **(6, 7)**

Carbon Sequestration and Storage:

Wetland captures atmospheric carbon and stores it such that it contributes to mitigation of global climate change. Two generalizations can be made regarding wetlands performance of the carbon sequestration function:

25. Fluctuating water tables allow deposited organic material to be oxidized and thus lower carbon sequestration rates can be expected (Whiting and Chanton 2001). **(14,15,16,1)**

26. Greater water flows and gradients would not generally promote accumulation or organic matter, however lower gradients and flows would allow deposition. **(9,10,11)**

27. Other strong evidence of carbon storage are peat presence (arbitrarily greater than 50cm depth) **(17, 18)** and woody vegetation **(Delineation forms/Wildlife FA)**

Food Chain Support:

Wetlands provide or export nutrients, organic carbon or other food sources to support the food web. It is assumed that any riparian form wetland, or any wetland with an outflow feature is performing this function

28. Riparian or floodplain form wetland, or wetland with a surface water discharge **(1, 13)**

Social Function

Observations of the following (or observations along the same vein) may indicate human use or value of the wetland

29. Actual observations of humans in the wetland **(26)**

30. Indirect observations of human presence in the wetland, such as garbage, hunting blinds, shell casings, canoe-launch, trails, boardwalks, interpretive signs, protective signs [e.g. “no ATVs”] etc. **(26)**

31. Documentation of commercial use such as peat, salt hay, rice, fruit or wood harvesting **(DE)**

32. Evidence or documentation of indigenous use or value of the wetland **(DE)**

Cited and referenced:

Carpenter S. R., N. F. Caraco, D. L. Correll, R. W. Howarth, A. N. Sharpley, V. H. 1998 Smith Ecological Applications, 8: 559-568

Carter,V. and Novitzki, R.P. (1988) Some comments on the relation between groundwater and wetlands,Ch. 7. In: Hook, D.D. (ed.), The Ecology and Management of Wetlands, Vol. 1, The Ecology of Wetlands London: Croom-Helm.

Carter V., 1997. Wetland hydrology, water quality, and associated functions National Water Summary on Wetland Resources, Water Supply Paper 2425, United States Geological Survey, Reston, VA. Viewed at http://water.usgs.gov/nwsum/WSP2425/hydrology.html

Demptster, A., P. Ellis, B. Wright, M.Stone, and J. Price, 2006. Hydrogeological Evaluation of a Southern Ontario Kettle-hole peatland and its linkage to a regional aquifer. Wetlands 26:49-56

Devito, K. J., A. R. Hill, and N. Roulet. 1996. Groundwater-surface interactions in headwater forested wetlands of the Canadian Shield. Journal of Hydrology 181:127-147

Gilliam, J.W., J.E.Parsons, and R.L.Mikkelsen. 1996. Water quality benefits of riparian wetlands. Pp. 61–65 in Solutions: A Technical Conference on Water Quality Proceedings, NC State University.

Gosselink, J.G., B.A.Touchet, J.V.Beek, D.Hamilton, and panel. 1990. Bottomland hardwood forest ecosystem hydrology and the influence of human activities: The report of the hydrology workgroup. Pp. 347–387 in Ecological Processes and Cumulative Impacts: Illustrated by Bottomland Hardwood Wetland Ecosystems, J.G.Gosselink, L.C. Lee, and T.A.Muir, eds. Chelsea, MI: Lewis.

Hill, A 1991. A ground water nitrogen budget for a headwater swamp in an area of permanent ground water discharge. Biogeochemistry 14: 209 - 224

Kadlec RH and SD Wallace 2009 Treatment Wetlands CRC Press Taylor & Francis Group Boca Raton FL

Mitsch, W.J., and J.G. Gosselink, 2000. Wetlands. Third Edition. John Wiley & Sons, Inc. Toronto. pp 920.

Price, J.S. and Waddington, J.M., 2000. Advances in Canadian wetland hydrology and biogeochemistry. Hydrological Processes, 14: 1579-1589.

Schueler, TR Metropolitan Washington Council of Governments 1992. Design of Stormwater Wetland System: Guidelines for Creating Diverse and Effective Stormwater Wetlands in the Mid-Atlantic Region. Washington, D.C.

Tiner, R.W. 2003. Correlating Enhanced National Wetlands Inventory Data with Wetland Functions or Watershed Assessments: A Rationale for Northeastern U.S. Wetlands. U.S. Fish and Wildlife Service, National Wetlands Inventory Program, Region 5, Hadley, MA. 26 pp.

Verry, E.S., and D.R. Timmons. 1982. Waterborne nutrient flow through an upland–peatland watershed in Minnesota. Ecology 63:1456–1467.[

Waddington, J.M., N. T. Roulet, and A. R. Hill. 1993. Runoff mechanisms in a forested groundwater discharge wetland. Journal of Hydrology 147:37-60.

Whiting, G.J. and J.P. Chanton. 2001. Greenhouse Carbon Balance of Wetlands: Methane emission versus Carbon Sequestration. Tellus B 53:521-528.

Winter, T. C. and M. K.Woo. 1990. Hydrology of lakes and wetlands. In: Surface Water Hydrology (M. G. Wolman and H. C. Riggs, 159-87. Boulder, CO: The Geological Society of America.

Winter, T.C., 1999, Relation of streams, lakes, and wetlands to groundwater flow systems: Hydrogeology Journal, 7: 28-45.

WILDLIFE FUNCTIONAL ASSESSMENT FOR WETLANDS: A REFERENCE (modified from Tiner, 2009)

Contents

Vegetation

Interpretation: The vegetation component of the assessment incorporates two principal components: diversity and integrity. Measures of plant diversity are to be interpreted in terms of the ability of the wetland to provide habitat for plants themselves as well as for other wildlife. A range of diversity indicators have been selected and include the number of distinct plant communities, plant species richness, and the occurrence of rare taxa within the wetland. Integrity refers to the overall condition of the plant community and for the purposes of this functional assessment, is interpreted by indicators of anthropogenic stress.

1. Number of plant communities[1] associated with the wetland.

2. Types of plant communities associated with the wetland (which occupy >10% of area).

3. List all species of vascular plants observed in wetland.

4. Plant species richness within wetland.

5. Does the wetland support plant species that are considered "at Risk" or of "Conservation concern"[2] (for information on specific species refer to wetland plant lists)?

6. Does the wetland have any dominant species that are non-native to NS (see habitat descriptions for species and estimated cover).

7. Does the wetland contain any potentially invasive exotic plant species (as identified by Hill and Blaney 2010)?

8. Intensity of disturbance: Severe (H)_____ Minor (M) _____ Relatively Undisturbed (L)_____
   Types of disturbance: Harvest (H)___ Herbicides (He)___ Salt Intrusion (SI)___ Grazing (G)___ Mowing (M)____ Ditching/drainage (D)___ Impoundment (I)___ Other Altered Hydrology (OH)___ Insect Infestation (II)___ Storm Damage (SD)___ Sedimentation (S)____ Eutrophication (E)
   Comments:_____

9. Stressed vegetation: Dead woody plants (DW)_____ Other_____ (specify_____)

10. Characterize the current vegetative quality of each wetland. Use the following definitions:

[1] The Canadian Wetland Classification System (CWCS) is to be adhered to for the identification and naming of plant communities

- *High Quality*: Plant community shows minimal evidence of human disturbance or other influences. Community composed of native species characteristic of the wetland type. Exotic species are absent or of minimal importance.

- *Moderate Quality*: Plant community shows obvious signs of human disturbance or other influences but is composed mostly of native species characteristic of the wetland type. Exotic species cumulatively comprise less than 20 percent cover of any stratum.

- *Low Quality*: Plant community strongly reflects human disturbance or other human influence; non-native species cumulatively comprise >20 percent cover of any stratum.

Interpretation: The vegetative quality / integrity of the wetland is determined by a combination of factors, including the presence and abundance of exotics, human disturbance, and surrounding land-use. Although guidelines have been outlined, these designations are somewhat subjective. To ensure consistency, discussion amongst field surveyors is essential.

Fauna

General

11. Vegetation interspersion: for freshwater marshes or shallow open water-wetland types select the cover category that best illustrates the interspersion of open water and emergent, submergent, or floating-leaved vegetation within the wetland. High_____ Medium_____ Low_____ N/A_____ (Not applicable for other wetland types).

12. What is the ratio of this vegetation to open water? _____

13. For wetlands having more than one vegetative community, indicate the interspersion category that best fits the wetland. High_____ Medium_____ Low_____ *N/A* =Only one community present.

Birds

14. Check whether the following wetland types are present:
__Salt marsh with tidal creeks and neighboring tidal flats (SM)
__Freshwater marsh adjacent to open water (FM)
__Swamp with adjacent open water (e.g., beaver pond) (SW)

15. List species birds observed (highlight waterfowl and other water birds).

16. Does the wetland support any birds that are “At Risk’ or of “Conservation Concern”?

Herpetiles

17. Amphibian breeding potential – is the wetland is inundated long enough in most years to provide appropriate herpetile breeding potential for:
____Vernal pool species (V)
____Permanent pool species (PP)
____Vernal pool and permanent pool species (VPP)

Interpretation: Frogs, toads and salamanders reproduce at different times from late March into June, depending on the species. Early breeders (such as spring peepers, wood frogs, and salamanders) typically reproduce in shallow, seasonal wetlands. Green frogs reproduce in larger more permanent wetlands. For breeding to be successful, the wetland must remain inundated long enough for the larval stages to metamorphose into adults. Direct evidence of amphibian breeding may be an indication of a sufficient hydroperiod. Such evidence would include observations of frogs calling, egg masses in the water, presence of tadpoles or presence of young, newly metamorphosed frogs, toads or salamanders at, the wetland. Note however, that some species are opportunistic and will lay eggs in temporary pools that will not remain inundated long enough for successful reproduction. Exercise caution when using this indicator.

18. Amphibian breeding potential - fish presence

H =Wetland is connected with a lake or river so that predatory fish are always present or the wetland is used for rearing of game fish.
M =Wetland may occasionally be connected to other waters; predatory fish may be present in some years.
L =Wetland is isolated so that predatory fish are never present.
Comments_____

Interpretation: Optimal amphibian breeding habitat is characterized by a lack of predatory fish. These habitats are wetlands that winterkill, dry periodically, are periodically anoxic, and are not connected to waters bearing predatory fish. The wetland should not be used to rear bait or game fish. This question utilizes observable characteristics of the wetland to infer about the status of fish. Direct observation or knowledge about fish presence should be substituted where possible.

19. Herpetile overwintering habitat

H =Wetland is normally more than 1.5 meters deep (never or rarely winterkills).
M = Wetland is normally around I meter deep (may occasionally winterkill).
L =Wetland is normally less than I meter deep and often freezes to the bottom.
N/A =Wetland never or rarely contains standing water or is nearly always dry in winter.

Interpretation: Wetlands that are deep and well oxygenated provide overwintering habitat for leopard, green, bull, and mink frogs, as well as turtles. Evidence of over-wintering would be observations of migrations of frogs to the wetland in fall and away from the wetland in spring and basking turtles in the spring.

20. Logs floating in water (resting areas for turtles): Yes_ No_

21. Amphibian species for which there is evidence of occurrence (visual observations, heard calling, egg masses, juveniles, etc.).

22. Presence of herpetiles that are “At Risk’ or of “Conservation Concern”.

Mammals

23. Potential habitat for otter?

24. Potential habitat for mink?

25. Potential habitat for muskrat?

26. Potential habitat for beaver?

27. List mammals for which evidence was observed within wetland.

28. Presence of mammals that are “At Risk’ or of “Conservation Concern”

Fish

29. Rate the value of the wetland as fish habitat, based on the following descriptions:

High Value - Those wetlands that are lentic, lotic, or estuarine or otherwise contiguous with a permanent waterbody or watercourse that was determined to support native fish species.

Moderate Value – Wetlands that were contiguous with a permanent watercourse considered to have potential to support fish, but for which no fish were found during fish-out efforts.

Low Value - Wetlands which were connected to a watercourse which was not considered to have potential for supporting fish (and for which no fishing effort was thereby performed).

Negligible Value - Wetlands which are isolated from all waterbodies or watercourses.

30. Were any fish observed? Y N
List species (if possible):_____

Table 1 Class and Area of Wetlands on the Donkin Peninsula

Wetland ID	Class	Area within LAA (ha)	Area within PDA (ha)
Baileys Wetland	Swamp / Shallow water / Fen / Marsh	43.49	12.44
DEVCO Wetland	Marsh / Shallow water / Swamp / Bog	18.13	1.51
1	Swamp	0.04	0.00
2	Swamp / Fen	3.07	0.00
3	Swamp	0.43	0.43
4	Swamp	0.13	0.13
5	Swamp	0.12	0.12
6	Swamp	0.10	0.00
7	Swamp	0.01	0.00
8	Swamp	4.65	4.64
9	Swamp	0.09	0.05
10	Swamp	0.05	0.00
11	Swamp	0.05	0.00
12	Swamp	0.09	0.09
13	Swamp / Marsh	0.43	0.43
14	Swamp	0.30	0.30
15	Swamp	0.12	0.00
16	Swamp	0.03	0.03
17	Swamp	0.01	0.00
18	Swamp	0.37	0.00
19	Marsh	0.01	0.00
20	Swamp	0.04	0.00
21	Swamp	0.08	0.08
22	Swamp	0.46	0.46
23	Swamp / Fen / Marsh	13.36	11.90
24	Swamp / Marsh	1.07	1.07
25	Swamp	0.01	0.01
26	Swamp	0.38	0.00
27	Swamp	0.75	0.11
28	Swamp	0.06	0.06
29	Swamp	0.05	0.05
30	Swamp	0.10	0.10
31	Swamp	0.17	0.00
32	Swamp	0.18	0.00
33	Swamp	0.02	0.00
34	Marsh	0.02	0.00
35	Swamp	0.51	0.00
36	Swamp	0.13	0.00
37	Swamp	0.41	0.00
38	Swamp	0.29	0.29
39	Swamp	0.10	0.10
40	Swamp	0.08	0.00
41	Swamp	0.07	0.07
42	Marsh	0.33	0.33
43	Swamp	0.03	0.03
44	Marsh / Shallow Water	0.26	0.26
45	Swamp	0.01	0.01
46	Swamp	0.07	0.00
47	Swamp	2.50	0.17
48	Swamp	0.04	0.00
49	Swamp	3.59	2.02
50	Marsh	0.06	0.06
51	Swamp	0.05	0.00
52	Swamp / Fen	2.09	0.00
53	Swamp	0.35	0.00
54	Swamp	0.20	0.00
55	Swamp	0.48	0.00
56	Swamp / Marsh	1.38	0.00

Table 1 Class and Area of Wetlands on the Donkin Peninsula

Wetland ID	Class	Area within LAA (ha)	Area within PDA (ha)
57	Swamp / Fen	0.42	0.00
58	Swamp	0.34	0.02
59	Swamp	0.04	0.00
60	Swamp	0.02	0.00
61	Swamp	0.51	0.00
62	Swamp	1.46	0.00
63	Swamp	0.01	0.01
64	Swamp	0.03	0.03
65	Swamp	0.01	0.01
66	Swamp	0.52	0.00
67	Swamp	1.71	0.00
68	Swamp	0.14	0.00
69	Swamp	0.09	0.00
70	Swamp	0.85	0.00
71	Swamp	1.78	0.00
72	Swamp	0.08	0.00
73	Swamp / Marsh	0.14	0.00
74	Swamp / Marsh	0.14	0.00
75	Swamp / Marsh	0.21	0.21
76	Swamp	0.12	0.00
77	Swamp	0.50	0.00
78	Swamp	1.21	0.00
79	Swamp	0.51	0.00
80	Swamp	9.23	4.53
81	Swamp	0.16	0.00
82	Swamp	0.10	0.02
83	Swamp	0.47	0.00

Table 2 Wildlife Functional Assessment Data

WETLAND ID	WETLAND CLASS	PLANT COMMUNITIES				DISTURBANCE													
		# OF PLANT COMMUNITIES	PLANT COMMUNITIES - 1	PLANT COMMUNITIES - 2	PLANT COMMUNITIES - 3	INTENSITY OF DISTURBANCE	H	He	SI	G	M	D	I	OH	II	IN	SD	S	E	COMMENTS
22	SWAMP	2	MIXED SHRUB SWAMP (REGEN) (90%)	CONIFEROUS TREED SWAMP (20%)	N/A	M	Y													SHRUB SWAMP IN REGENERATION ~20 YRS OLD
24	SWAMP (W MINOR MARSH ELEMENT)	3	MIXES SHRUB SWAMP (REGENERATING CTS) (80%)	TALL SHRUB SWAMP (%15)	GRAMINOID MARSH (5%)	M	Y						Y	Y						SOUTH SPUR MAY BE ANTHRO; HARVESTED > 20 YRS AGO
25	SWAMP	1	GRAMINOID AND FRINGING TALL SHRUB	N/A	N/A	H						Y								WETLAND IS DITCH ON SITE AT OLD ROAD
26	SWAMP	1	CONIFEROUS TREED SWAMP	N/A	N/A	L						Y								WESTERN END DISTURBED BY OLD ROAD
27	SWAMP	1	CONIFEROUS TREED SWAMP	N/A	N/A	L														NONE EVIDENT
28	SWAMP	1	TALL SHRUB SWAMP	N/A	N/A	H	Y					Y		Y						WL PRIMARILY ANTHRO- RUNS ALONG OLD WOODS ROAD
34	MARSH	1	GRAMINOID MARSH	N/A	N/A	H						Y								WL IS ANTHROPOGENIC-OCCURS ENTIRELY ALONG OLD ROADS
38	SWAMP	2	MIXES SHRUB SWAMP (85%)	CONIFEROUS TREED SWAMP (15%)	N/A	M	Y						Y							N EDGE INFILLED; EVIDENCE OF HARVESTS ? & ADJACENT UPLAND REGEN
39	SWAMP	1	TALL SHRUB SWAMP	N/A	N/A	M						Y	Y	Y						BORDERED BY INFILLED AREAS
41	SWAMP (W MINOR MARSH ELEMENT)	2	MIXED SHRUB SWAMP (CUTOVER) (90%)	GRAMINOID MARSH (10%)	N/A	M	Y													SWAMP CUT 10-20 YRS AGO
42	MARSH	1	GRAMINOID (TALL RUSH) MARSH	N/A	N/A	H						Y								WL A DRAINAGE CHANNEL B/W INFILLED AREAS
43	SWAMP	1	MIXED SHRUB SWAMP	N/A	N/A	H						Y		Y						ON OLD ROAD BED- AN ANTHRO. SCRAPE
44	MARSH / SHALLOW WATER	3	GRAMINOID MARSH (50%)	TALL RUSH GRAMINOID MARSH (20%)	NON-VEGETATED SHALLOW WATER (30%)	H						Y		Y						WL ANTHROPOGENIC-ADJAENT UPLAND DISTRUBED; WL MAY BE DITCHED
45	SWAMP	1	MIXED SHRUB SWAMP	N/A	N/A	M	Y													SURROUNDING FOREST YOUNG; ROADS THROUGHOUT
49	SWAMP	3	MIXES SHRUB SWAMP (50%)	CONIFEROUS TREED SWAMP	TALL SHRUB SWAMP (15%)	M	Y													SHRUB COMPONENTS REGENERATING
50	MARSH	1	TALL RUSH GRAMINOID MARSH	N/A	N/A	H						Y	Y	Y						WL ANTHROPOGENIC-ESSENTIALLY A DITCH ON EDGE OF DISTRUBED AREA
56	SWAMP/MARSH	3	CONIFEROUS TREED SWAMP (50%)	GRAMINOID MARSH (45%)	MIXED TREED SWAMP (5%)	H						Y	Y	Y						MARSH COMPONENT ANTHROPOGENIC- IN OLD ROAD, INFILLED PORTIONS ON SIDE
57	SWAMP / FEN	2	CONIFEROUS TREED SWAMP (90%)	LOW SHRUB FEN (10%)	N/A	L						Y		Y						ATV TRAIL @ SOUTHERN BOUNDARY
60	SWAMP	1	CONIFEROUS TREED SWAMP	N/A	N/A	L														NONE EVIDENT

Table 2 Wildlife Functional Assessment Data

WETLAND ID	WETLAND CLASS	STRESSED VEGETATION			VEGETATIVE INTEGRITY		INTERSPERSION				DETRITUS	WATERFOWL		HERPETILES	
		STRESSED VEGETATION	OTHER	COMMENTS	VEGETATIVE INTEGRITY	COMMENTS	INTERSPERSION OF VEG AND WATER	RATIO	VEGETATION INTERSPERSION	COMMENTS	DETRITUS	WETLAND TYPES (FOR BIRDS)	COMMENTS	HERP BREEDING	COMMENTS
22	SWAMP	N/A	N/A	N/A	H	N/A	N/A	N/A	L	N/A	M	N/A	N/A	V	N/A
24	SWAMP (W MINOR MARSH ELEMENT)	N/A	N/A	N/A	H	N/A	N/A	N/A	M	N/A	M	N/A	N/A	V PP	N/A
25	SWAMP	N/A	N/A	N/A	M	N/A	N/A	N/A	N/A	N/A	M	N/A	N/A	PP	N/A
26	SWAMP	N/A	N/A	N/A	H	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	V	N/A
27	SWAMP	N/A	N/A	N/A	H	N/A	N/A	N/A	N/A	N/A	M	N/A	N/A	V	N/A
28	SWAMP	N/A	N/A	N/A	M	N/A	N/A	N/A	N/A	N/A	L	N/A	N/A	V	N/A
34	MARSH	N/A	N/A	N/A	M	N/A	N/A	N/A	N/A	N/A	L	N/A	N/A	V	N/A
38	SWAMP	N/A	N/A	N/A	H	N/A	N/A	N/A	H	MSS HIGHLY VARIABLE IN STRUCTURE	M	N/A	N/A	V	N/A
39	SWAMP	N/A	N/A	N/A	M	N/A	N/A	N/A	N/A	N/A	M	N/A	N/A	V	N/A
41	SWAMP (W MINOR MARSH ELEMENT)	N/A	N/A	N/A	H	N/A	N/A	N/A	L	N/A	M	N/A	N/A	V	N/A
42	MARSH	N/A	N/A	N/A	M	N/A	L	95:5 (SOME OPEN POOLS AT W END)	N/A	N/A	H	N/A	VEG COVER GENERALLY TOO HIGH TO BE OF MUCH USE	V	N/A
43	SWAMP	N/A	N/A	N/A	M	DISTURBANCE HIGH; EXOTICS NONE	N/A	N/A	N/A	N/A	L	N/A	N/A	V	N/A
44	MARSH / SHALLOW WATER	DW	N/A	LOTS OF SNAGS IN LINEAR PORTION OF WL	M	DISTURBANCE HIGH; EXOTICS NONE	M	30:70	L	N/A	M	FM	N/A	PP	N/A
45	SWAMP	N/A	N/A	N/A	H	NO EXOTICS	N/A	N/A	N/A	N/A	L	N/A	N/A	V	N/A
49	SWAMP	N/A	N/A	N/A	H	N/A	N/A	N/A	L	N/A	M	N/A	N/A	V	N/A
50	MARSH	N/A	N/A	N/A	M	NO DOMINANT EXOTICS BUT LOTS ON UPLAND EDGES	N/A	N/A	N/A	N/A	M	N/A	N/A	V	N/A
56	SWAMP/MARSH	N/A	N/A	N/A	M	N/A	L	90:10 OPEN WATER IN MARSH	L	N/A	M	FM	POOLS SMALL <10X10M	V PP	N/A
57	SWAMP / FEN	N/A	N/A	N/A	H	N/A	N/A	N/A	L	N/A	M	N/A	N/A	V	N/A
60	SWAMP	N/A	N/A	N/A	H	N/A	N/A	N/A	N/A	N/A	M	N/A	N/A	V	MINOR OPPORTUNITIES ONLY

Table 2 Wildlife Functional Assessment Data

WETLAND ID	WETLAND CLASS	HERPETILES						FISH			FISH		
		AMPHIBIANS - FISH PRESENCE	COMMENTS	HERP OVERWINTERING	COMMENTS	LOGS	COMMENTS	FISH SPAWNING OR NURSERY AREA	COMMENTS	FISH HABITAT	COMMENTS	FISH OBSERVED	SPECIES
22	SWAMP	L	N/A	N/A	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
24	SWAMP (W MINOR MARSH ELEMENT)	L	N/A	L	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
25	SWAMP	L	N/A	L	N/A	N	N/A	N	N/A	L	MAY BE CONNECTED TO MINE DRAINAGE	N	N/A
26	SWAMP	L	N/A	L	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
27	SWAMP	L	N/A	L	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
28	SWAMP	L	N/A	L	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
34	MARSH	L	N/A	L	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
38	SWAMP	L	N/A	N/A	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
39	SWAMP	L	N/A	N/A	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
41	SWAMP (W MINOR MARSH ELEMENT)	L	N/A	L	N/A	N	N/A	N	N/A	N/A	ISOLATED AND NO STANDING WATER	N	N/A
42	MARSH	M	RECEIVES DRAINAGE FROM MINE WASTE; DRAINS TO SCHOONER POND	L	N/A	N	N/A	N	N/A	H	N/A	N	N/A
43	SWAMP	L	N/A	N/A	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
44	MARSH / SHALLOW WATER	L	WETLAND ISOLATED	H	N/A	Y	N/A	N	N/A	L	INUNDATED BUT ISOLATED	N	N/A
45	SWAMP	L	N/A	L	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
49	SWAMP	L	N/A	L	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
50	MARSH	M	CONNECTED TO OUTFLOW OF MINE PONDS W/ FISH	L	N/A	N	N/A	N	N/A	M	CONNECTED TO MINE WATER OUTFLOW @ LOW END	N	BUT OBSERVED NEAR OUTFLOW IN WATER FROM MINE DRAINAGE
56	SWAMP/MARSH	L	N/A	H	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
57	SWAMP / FEN	L	N/A	L	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A
60	SWAMP	L	N/A	N/A	N/A	N	N/A	N	N/A	N/A	N/A	N	N/A

Table 3 Hydrological and Biogeochemical Functional Assessment Data

Wetland ID	GENERAL DESCRIPTION																	
	1 - GENERAL DESCRIPTION											2 - ALTERATION/DISTURBANCE						
	% COVER	CLASS 1	FORM 1	TYPE 1	% COVER	CLASS 2	FORM 2	TYPE 2	% COVER	CLASS 3	FORM 3	TYPE 3	INFILL	EXCAVATION	COMPACTION	VEG-CLEARING	IMPOUNDMENT	DRAINAGE	OTHER
22	50	SWAMP	BASIN	LOW SHRUB	45	SWAMP	BASIN	CONIFEROUS TREED	5	MARSH	BASIN	GRAMINOID	NO	NO	NO	NO	NO	NO	CLASS 1 AREA PROBABLY HISTORICALLY CLEARED. CLASS 3 IS AN OLD ROAD NO LONGER USED
24	65	SWAMP	BASIN	LOW SHRUB	35	MARSH	DRAINAGE WAY/BASIN	GRAMINOID	N/A	N/A	N/A	N/A	NO	NO	NO	NO	NO	NO	LIKELY HISTORICALLY CLEARED
25	100	SWAMP	DRAINAGE WAY	GRAMINOID / FRINGING TALL SHRUB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	YES	NO	NO	NO
26	90	SWAMP	SLOPE	CONIFEROUS TREED	10	SWAMP	DRAINAGE WAY	GRAMINOID	N/A	N/A	N/A	N/A	NO	NO	NO	NO	NO	NO	EASTERN EDGE OF WL-ROAD NOW A WL, DRAINS DOWN IT
27	100	SWAMP	SLOPE	CONIFEROUS TREED	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO	NO	NO	NO
28	100	SWAMP	DRAINAGE WAY	TALL SHRUB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO	YES	NO	NO	NO	NO	HEAVILY ALTERED WL. MOSTLY FOLLOWS AN OLD ROAD, DRAINAGE CHANNEL OUTFLOW WAS EXCAVATED
34	100	MARSH	DRAINAGE WAY	GRAMINOID	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO	NO	NO	WL HAS FORMED ON THE JUNCTION OF TWO OLD ROADS
38	100	SWAMP	BASIN	LOW SHRUB / TALL SHRUB / GRAMANOID MIX	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	YES	NO	NO	ONE SIDE OF WL ABUTS INFILL. APPROX. 4M HIGH
39	60	SWAMP	BASIN	TALL SHRUB	40	SWAMP	BASIN	LOW SHRUB	N/A	N/A	N/A	N/A	YES	NO	NO	YES	NO	NO	ALONG EASTERN EDGE OF WL-FOLLOWS BOUNDARY FOR ALL OF THAT SIDE. HISTORIC CLEARING.
41	100	SWAMP	BASIN	GRAMINOID / LOW SHRUB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	YES	NO	NO	VEG. CLEARING HISTORIC
42	100	MARSH	DRAINAGE WAY	GRAMINOID	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO	NO	YES	INFILL ON EITHER SIDE OF WL. DRAINAGE FROM MINE IS DISCHARGED THROUGH CHANNEL SYSTEM AND INTO WL.
43	100	SWAMP	SLOPE	GRAMINOID / LOW SHRUB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	YES	NO	NO	OLD ROAD
44	100	MARSH / SHALLOW WATER	BASIN	GRAMINOID	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO	NO	NO	LIKELY TO HAVE HISTORICALLY BEEN ALTERED, OLD ROAD NEARBY
45	100	SWAMP	BASIN	LOW SHRUB/GRAMINOID	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO	NO	NO	NO
49	100	SWAMP	BASIN	LOW SHRUB / TALL SHRUB?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO	NO	NO	NO
50	100	MARSH	DRAINAGE WAY	GRAMINOID	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO	YES	NO	NO	NO	NO	WL EXISTS BECAUSE IT IS AN EXCAVATED CHANNEL AND DEVELOPED INTO A MARSH
56	50	SWAMP	BASIN	MIXED TREED	50	SWAMP	DRAINAGE WAY	GRAMINOID	N/A	N/A	N/A	N/A	NO	NO	NO	YES	NO	NO	OLD ROAD THROUGH WL
57	90	SWAMP	BASIN / DRAINAGE WAY	CONIFEROUS TREED	10	FEN	BASIN	GRAMINOID / LOW SHRUB	N/A	N/A	N/A	N/A	NO	NO	NO	NO	NO	NO	NO
60	100	SWAMP	BASIN	MIXED TREED	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO	NO	NO	NO

Table 3 Hydrological and Biogeochemical Functional Assessment Data

3 - ADJACENT UPLAND COVER									MORPHOLOGY									
									4 - MORPHOLOGY						5 - HYDROLOGICAL FORM			
FOREST	FIELD	BEDROCK	SHRUB	LANDSCAPED	PAVED	UNPAVED	AGRICULTURE	OTHER	ADJACENT SLOPE GRADE (RANK) 0-10%	ADJACENT SLOPE GRADE (RANK) 10-20%	ADJACENT SLOPE GRADE (RANK) >33%	ADJACENT SLOPE LENGTH (RANK) <15M	ADJACENT SLOPE LENGTH 15-50M	ADJACENT SLOPE LENGTH >50M	CONFINED BASIN	CHANNEL	SLOPED	RIPARIAN RIVERINE
YES	NO	NO	NO	NO	NO	YES	NO	NO	2	1	0	2	1	0	YES	NO	NO	NO
YES	NO	NO	NO	NO	NO	YES	NO	NO	2	1	0	2	1	0	YES	YES	NO	NO
YES	NO	NO	NO	NO	NO	YES	NO	LARGE INFILL AREA, 2-3M HIGHER IN ELEV	0	2	1	1,2	0	0	NO	YES	NO	NO
YES	NO	NO	NO	NO	NO	YES	NO	NO	1	2	0	2	0	1	NO	NO	YES	NO
YES	NO	NO	NO	NO	NO	YES	NO	NO	1	2	0	2	0	1	NO	NO	YES	NO
YES	NO	NO	NO	NO	NO	YES	NO	NO	0	2	1	1	2	0	NO	YES	NO	NO
YES	NO	NO	NO	NO	NO	YES	NO	NO	0	2	1	1	2	0	NO	YES	NO	NO
YES	NO	NO	NO	NO	NO	YES	NO	LARGE GRADED PAD, INFILL ABUTS ONE SIDE OF WL	0	2	1	1	2	0	YES	NO	NO	NO
YES	NO	NO	NO	NO	NO	NO	NO	LARGE INFILL PAD, 3M HIGHER THAN WL	0	2	1	1	2	0	YES	NO	NO	NO
YES	NO	NO	NO	NO	NO	NO	NO	NO	1	0	0	0	1	0	YES	NO	NO	NO
NO	NO	NO	NO	NO	NO	YES	NO	LARGE GRADED PADS, APPROX. 4M HIGHER THAN WL	0	0	1	1	0	0	YES	YES	NO	NO
YES	NO	NO	NO	NO	NO	YES	NO	NO	1	0	0	0	1	0	NO	NO	YES	NO
YES	NO	NO	NO	NO	NO	NO	NO	NO	0	2	1	1	2	0	YES	NO	NO	NO
YES	NO	NO	NO	NO	NO	NO	NO	NO	0	1	0	0	1	0	YES	NO	NO	NO
YES	NO	NO	NO	NO	NO	NO	NO	NO	2	1	0	0	1,2	0	YES	NO	NO	NO
YES	NO	NO	NO	NO	NO	YES	NO	DONKIN SITE: BUILDINGS, DISTURBED GRADED AREAS	2	1	0	1	0	2	NO	YES	NO	NO
YES	NO	NO	NO	NO	NO	NO	NO	NO	1	2	0	0	1,2	0	YES	NO	NO	NO
YES	NO	NO	NO	NO	NO	NO	NO	OCEAN	2	1	0	0	1,2	0	YES	NO	NO	NO
YES	NO	NO	NO	NO	NO	NO	NO	NO	2	1	0	0	1,2	0	YES	NO	NO	NO

Table 3 Hydrological and Biogeochemical Functional Assessment Data

		HYDROLOGY																			
		6 - MICROTOPOGRAPHY						7 - SOURCE WATER						8 - SPRINGS OBSERVED		9 - OPEN WATER			10 - SURFACE FLOW		
RIPARIAN LACUSTRINE	FLOODPLAIN	CONCAVE	CONVEX	FLAT	HUMMOCK	RIBBED	SMOOTH	WATERCOURSE	RUNOFF	SPRING	GROUNDWATER	PRECIPITATION	DITCH/ CULVERT	IN	UPGRADIENT	OPEN WATER	% COVER	EST. DEPTH (cm)	SHEET	STRAIGHT	MEANDERING	BRAIDED
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	YES	NO	YES	NO	1	2	N/A	5	20	NO	NO	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	YES	YES	YES	NO	YES	NO	0	2	N/A	5	10	NO	NO	YES	YES
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	70	10	YES	NO	NO	NO
NO	NO	NO	NO	YES	YES	NO	NO	YES	YES	YES	NO	YES	NO	0	0	N/A	3	2	NO	NO	NO	NO
NO	NO	NO	NO	YES	YES	NO	NO	NO	YES	YES	NO	YES	NO	0	0	N/A	3	2	NO	NO	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	YES	YES	YES	NO	YES	NO	0	0	N/A	20	15	NO	YES	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	YES	NO	YES	NO	0	0	N/A	25	5	NO	YES	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	2	3	NO	NO	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	4	10	NO	NO	NO	NO
NO	NO	NO	NO	YES	N/A	N/A	N/A	NO	YES	NO	NO	YES	NO	0	0	N/A	5	3	NO	NO	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	YES	YES	NO	NO	YES	NO	0	0	N/A	40	15	YES	NO	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	YES	NO	YES	NO	0	0	N/A	0	N/A	NO	NO	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	YES	NO	YES	NO	0	0	N/A	50	50+	YES	NO	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	0	N/A	NO	NO	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	2	2	NO	NO	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	2	1	NO	YES	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	10	15	NO	NO	YES	NO
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	5	5	NO	NO	NO	NO
NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	0	N/A	NO	NO	NO	NO

Table 3 Hydrological and Biogeochemical Functional Assessment Data

		11 - WATER TABLE (cm)			12 - CHANNEL INFLOW								13 - CHANNEL OUTFLOW							
DISCONTINUOUS	OTHER	CLASS 1	CLASS 2	CLASS 3	WET WIDTH INFLOW 1	DRY WIDTH INFLOW 1	DEPTH INLFOW 1	FLOW INLFOW 1	WET WIDTH INFLOW 2	DRY WIDTH INFLOW 2	DEPTH INLFOW 2	FLOW INLFOW 2	WET WIDTH OUTFLOW 1	DRY WIDTH OUTFLOW 1	DEPTH OUTFLOW 1	FLOW OUTFLOW 1	WET WIDTH OUTFLOW 2	DRY WIDTH OUTFLOW 2	DEPTH OUTFLOW 2	FLOW OUTFLOW 2
NO	NO	-10	-5	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NO	NO	-5	0	N/A	60	30	5	LOW	N/A	N/A	N/A	N/A	60	100	5	LOW	N/A	N/A	N/A	N/A
NO	NO	0	N/A	N/A	70	70	4	LOW	N/A	N/A	N/A	N/A	80	150	3	STAGNANT	N/A	N/A	N/A	N/A
NO	NO	-10	0	N/A	20	30	4	LOW	N/A	N/A	N/A	N/A	30	40	4	LOW	N/A	N/A	N/A	N/A
NO	NO	-10	N/A	N/A	70	90	5	LOW	N/A	N/A	N/A	N/A	N/A	2	N/A	NO WATER	N/A	N/A	N/A	N/A
NO	NO	0	N/A	N/A	50	100	4	LOW	N/A	N/A	N/A	N/A	80	120	4	LOW	N/A	N/A	N/A	N/A
NO	NO	0	N/A	N/A	30	50	1	LOW	N/A	N/A	N/A	N/A	30	100	3	LOW	N/A	N/A	N/A	N/A
NO	NO	-5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NO	NO	-10	-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NO	NO	-5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NO	NO	-5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NO	NO	0	N/A	N/A	140	140	10	MODERATE	N/A	N/A	N/A	N/A	70	70	10	MODERATE	N/A	N/A	N/A	N/A
NO	NO	-5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NO	NO	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NO	NO	UNKNOWN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NO	NO	-5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NO	NO	-2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20	70	1	STAGNANT	N/A	N/A	N/A	N/A
NO	NO	-10	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NO	NO	0- -5	-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NO	NO	UNKNOWN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3 Hydrological and Biogeochemical Functional Assessment Data

																FUNCTION QUESTIONS	
14 - RECENT/REGULAR INUNDATION											15	16	17	18	19	20	21
WATER MARKS	SEDIMENT DEPOSITS	DRIFT DEPOSITS	ALGAL MAT	IRON DEPOSITS	SPARSELY VEGETATED CONCAVE SURFACE	WATER STAINED LEAVES	SURFACE SOIL CRACKS	DRAINAGE PATTERNS	MOSS TRIM LINES	OTHER	ELEVATION OF INUNDATION (CM)	FREQUENCY OF HIGH-WATER	PEAT PRESENCE	ESTIMATED DEPTH OF PEAT	PEAT SATURATED	WETLAND APPARENTLY HAS GREATER CHANNEL OUTFLOW THAN INFLOW	IN 'DRY' (SUBJECTIVE) CONDIDTIONS, OUTFLOW FROM WETLAND WAS OBSERVED
NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	SOME WATER MARKS IN MARSH	5 (MARSH)	N/A	YES	50	FIBRIC	NO	NO
YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	WATER MARKS IN MARSH	5	N/A	YES	80	FIBRIC	NO	YES
YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	5	HIGH PRECIP. EVENTS	NO	N/A	N/A	NO	YES
YES	NO	NO	NO	NO	NO	YES	NO	YES	NO	AT DISTRUBED ROAD PORTION OF WL ONLY- NOT SIGNIFICANTLY INFLUENCING THE WHOLE WL.	5	HIGH PRECIP. EVENTS	YES	40	FIBRIC	YES	YES
NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	5	HIGH PRECIP. EVENTS	YES	50	FIBRIC, HEMIC	NO	N/A
YES	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	5	HIGH PRECIP. EVENTS	NO	N/A	N/A	YES	YES
YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	5	HIGH PRECIP. EVENTS	NO	N/A	N/A	YES	YES
YES	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO	3	HIGH PRECIP. EVENTS	YES	18	FIBRIC	YES	N/A
YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	ONLY IN SMALL OPEN WATER PART OF WL	N/A	N/A	YES	25	FIBRIC	N/A	NO
YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	8	N/A	YES	30	FIBRIC	N/A	NO
YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	5	HIGH PRECIP. EVENTS	YES	N/A	N/A	NO	YES
YES	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO	5	N/A	NO	N/A	N/A	N/A	NO
YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	UP TO 40	HIGH PRECIP. EVENTS	NO	N/A	N/A	NO	NO
YES	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO	WATER AT SURFACE	HIGH PRECIP. EVENTS	NO	N/A	N/A	NO	NO
NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	5	N/A	YES	70	FIBRIC, HEMIC	N/A	N/A
YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	15	HIGH PRECIP. EVENTS	NO	N/A	N/A	YES	YES
YES	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO	5	N/A	YES	30	FIBRIC	N/A	NO
YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	4	N/A	YES	40	FIBRIC	NO	NO
YES	NO	NO	NO	NO	YES	YES	NO	YES	NO	NO	WATER AT SURFACE	HIGH PRECIP. EVENTS	YES	5	FIBRIC	NO	NO

Table 3 Hydrological and Biogeochemical Functional Assessment Data

FUNCTION QUESTIONS					OTHER PERTINENET OBSERVATIONS
22	23	24	25	26	27
WAVES OR CURRENTS OBSERVED IN WATERS ADJACENT TO RIPARIAN WETLAND	SCOURING ON TREES/VEG IN AND ADJACENT TO RIPARIAN WETLAND	EROSION IN SHORELINE AREAS LACKING WETLAND VEG NEAR WETLAND	WATER FLOWS THROUGH AREAS OF DENSE EMERGENT VEG IN WETLAND	HUMAN USE OBSERVATIONS	ADDITIONAL DATA
N/A	N/A	N/A	NO		ha23 (123) NOW CONNECTS WITH WL 126 THROUGH A SMALL SUB-SURFACE DRAINAGE WAY. APPEARS THAT MARSH OVER-TOPS AND FLOWS WESTWARD, WHILE SWAMPS SLOPE GENTLY EASTWARD.
N/A	N/A	N/A	YES	NO	SEEPAGE FROM WL123, WHICH IS HIGHER IN ELEV. MAJORITY OF SURFACE WATER IN MARSH AREA, WHICH HAS A STREAM RUNNING THROUGH IT.
N/A	N/A	N/A	YES		WETLAND FOLLOWS ROADSIDE DRAINAGE.
N/A	N/A	N/A	NO	NO	CHANNEL IN/OUTFLOW CLASS 2. CLASS 1 & 2 QUITE DIFFERENT HYDROLOGICAL REGIMES.
N/A	N/A	N/A	NO	NO	SOME PEATY CHANNELS DOWN WL SLOPES. BECOMES SUBSURFACE AND DRAINS INTO WL119 IN TWO PLACES. CHANNEL LIKELY FEEDS WATER TO WL117 DOWNSLOPE.
N/A	N/A	N/A	NO	NO	TWO SUBSURFACE FLOW AREAS, WHICH ARE LIKELY AT SURFACE IN HIGH PRECIP. EVENTS. THESE ARE OUTFLOWS FROM WL121.
N/A	N/A	N/A	NO	NO	
N/A	N/A	N/A	NO	NO	PEAT PRESENT ONLY IN PATCHES. TWO AREAS OF SEEPAGE AT WESTERN END OF WL. BOTH CONNECT AND DRAIN THROUGH A CULVERT. THERE WAS SOME FLOW 3 WEEKS AGO, NOW MINIMAL FLOW, MOSTLY SUBSURFACE SEEPAGE DRAINING DIRECTLY TO CULVERT.
N/A	N/A	N/A	NO	NO	WL LIKELY QUITE ALTERED BY HISTORIC DISTURBANCE, VEG CLEARING AND INFILLING.
N/A	N/A	N/A	NO	NO	NO
N/A	N/A	N/A	YES	NO	CATTAIL MARSH, SQUEEZED BY INFILL ALONG BOTH LONG EDGES OF WL. HYDROLOGY LARGELY DEPENDENT ON WHAT IS PUMPED OUT OF THE MINE. OUTFLOW THROUGH CULVERT, UNDER ROAD, OUT TO LARGER WL NEAR SCHOONERS POND.
N/A	N/A	N/A	NO	NO	WL EITHER FORMED ON ROAD, OR WAS ALTERED BY THE ROAD, WHICH IS VERY OLD (NOT USED IN 10+ YEARS)
N/A	N/A	N/A	YES	NO	DEAD TREES IN MARSH SUGGEST THIS IS A RELATIVELY YOUNG MARSH AND INUNDATION MAY HAVE KILLED THE TREES. THE SMALLER BULB OF THE WL ONLY HAS AROUND 15% OPEN WATER, MOSTLY A CATTAIL MARSH. MAIN PART OF WL IS PREDOMINANTLY OPEN WATER.
N/A	N/A	N/A	NO	NO	MAYBE A YOUNG WL. LOTS OF SPHAGNUM BUT NO PEAT. WATER TABLE IS NOT DETECTED NOW, BUT WAS VISIBLE AT SURFACE 2/3 WEEKS AGO. OBVIOUSLY DRAINS WELL, BUT RETAINS ENOUGH HYDROLOGY TO SUSTAIN HYDRIC CONDITIONS.
N/A	N/A	N/A	NO	NO	WATER VERY CLOSE TO SURFACE IN MIDDLE OF WL, BUT DROPS TOWARDS EDGES.
N/A	N/A	N/A	YES	NO	MARSH FORMED IN EXCAVATED DRAINAGE CHANNEL. OBSERVED TO HAVE 20CM WATER 3WKS AGO, WHICH HAS SINCE DRAINED. NOT SURE WHAT WATER SOURCE IS. A LITTLE MYSTERY. MAYBE JUST RUNOFF.
N/A	N/A	N/A	YES	4WD PATH THROUGH OCEAN SIDE OF WL.	SEVERAL PEATY CHANNELS OBSERVED, WOULD PROVIDE SOME SURFACE OUTFLOWS DURING HIGH PRECIP. EVENTS. DISCONTINUOUS CHANNELS, MORE SEEPAGE IN APPEARANCE RATHER THAN OUTFLOW CHANNELS.
N/A	N/A	N/A	NO	OLD 4WD PATH ALONG ONE EDGE	
N/A	N/A	N/A	NO	NO	WATER OBSERVED AT SURFACE 3 WKS AGO.

Table 4 Potential Hydrological and Biogeochemical Functions Performed by the Assessed Wetlands

Wetland ID	Baseflow Maintenance	Erosion Control	Stormwater Management	Groundwater Recharge	Water Storage	Carbon Sequestration	Water Quality Improvement	Food Chain Support
22	✓					✓	✓	
24	✓		✓			✓	✓	✓
25			✓		✓		✓	✓
26	✓		✓			✓	✓	✓
27	✓		✓	✓		✓	✓	
28	✓		✓		✓		✓	✓
34	✓		✓		✓		✓	✓
38	✓		✓			✓	✓	
39				✓		✓	✓	
41				✓		✓		
42	✓		✓		✓		✓	✓
43	✓							
44	✓		✓		✓		✓	
45				✓			✓	
49	✓			✓		✓	✓	
50	✓						✓	✓
56	✓		✓	✓	✓	✓	✓	
57			✓	✓		✓	✓	
60				✓		✓	✓	

Table 5 Vascular Plants Identified Within Wetlands During 2011 Functional Assessments and Information on their Provincial Population Status

Scientific Name	Common Name	NSDNR Rank	AC CDC Rank	Wetland ID																	
				22	24	25	26	27	28	34	38	39	41	42	43	44	45	49	50	56	57	60
Abies balsamea	Balsam Fir	Secure	S5					✓	✓		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
Acer rubrum	Red Maple	Secure	S5	✓								✓			✓			✓		✓		
Agrostis perennans	Upland Bent Grass	Secure	S4S5		✓																	
Agrostis scabra	Rough Bent Grass	Secure	S5		✓		✓			✓	✓	✓	✓			✓			✓	✓	✓	
Agrostis stolonifera	Creeping Bent Grass	Secure	S5									✓		✓					✓		✓	
Alisma triviale	Northern Water Plantain	Secure	S5											✓								
Alnus incana	Speckled Alder	Secure	S5		✓													✓				
Alnus viridis	Green Alder	Secure	S5		✓	✓	✓		✓		✓	✓	✓	✓		✓	✓		✓		✓	
Amelanchier sp.	a Serviceberry	N/A	N/A					✓	✓			✓	✓	✓	✓		✓	✓			✓	
Anaphalis margaritacea	Pearly Everlasting	Secure	S5											✓		✓			✓			
Angelica sylvestris	Woodland Angelica	Exotic	SNA											✓								
Aralia nudicaulis	Wild Sarsaparilla	Secure	S5	✓			✓				✓	✓	✓									✓
Athyrium filix-femina	Common Lady Fern	Secure	S5								✓	✓										
Bartonia paniculata	Branched Bartonia	Secure	S4S5										✓					✓			✓	
Betula alleghaniensis	Yellow Birch	Secure	S5						✓													
Betula papyrifera	Paper Birch	Secure	S5	✓	✓			✓			✓	✓			✓	✓	✓			✓	✓	✓
Betula papyrifera var. cordifolia	Heart-leaved Birch	Secure	S5					✓				✓										
Bidens frondosa	Devil's Beggarticks	Secure	S5											✓		✓						
Calamagrostis canadensis	Bluejoint Reed Grass	Secure	S5	✓		✓	✓		✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	
Callitriche palustris	Marsh Water-starwort	Secure	S5			✓			✓													
Calopogon tuberosus	Tuberous Grass Pink	Secure	S4												✓							
Carex aquatilis	Water Sedge	Secure	S5								✓			✓								
Carex brunnescens	Brownish Sedge	Secure	S5		✓						✓											
Carex canescens	Silvery Sedge	Secure	S5								✓					✓				✓		
Carex crinita	Fringed Sedge	Secure	S5								✓											
Carex echinata	Star Sedge	Secure	S5				✓		✓	✓		✓						✓		✓	✓	
Carex exilis	Coastal Sedge	Secure	S4		✓						✓		✓									
Carex folliculata	Northern Long Sedge	Secure	S5					✓	✓			✓						✓				
Carex gynandra	Nodding Sedge	Secure	S5			✓					✓	✓		✓		✓						
Carex intumescens	Bladder Sedge	Secure	S5									✓				✓						
Carex magellanica	Boreal Bog Sedge	Secure	S5	✓				✓	✓		✓	✓	✓							✓	✓	
Carex nigra	Smooth Black Sedge	Secure	S5	✓									✓	✓							✓	
Carex scoparia	Broom Sedge	Secure	S5		✓		✓				✓			✓		✓			✓			
Carex stipata	Awl-fruited Sedge	Secure	S5			✓								✓								
Carex trisperma	Three-seeded Sedge	Secure	S5	✓			✓	✓	✓		✓						✓	✓		✓	✓	✓
Centaurea nigra	Black Knapweed	Exotic	SNA																✓			
Cerastium fontanum	Common Chickweed	Exotic	SNA									✓										
Chamaedaphne calyculata	Leatherleaf	Secure	S5																	✓		
Chamerion angustifolium	Fireweed	Secure	S5									✓		✓								
Chelone glabra	White Turtlehead	Secure	S5						✓							✓						
Cirsium arvense	Canada Thistle	Exotic	SNA											✓								
Clintonia borealis	Yellow Bluebead Lily	Secure	S5	✓																		
Comarum palustre	Marsh Cinquefoil	Secure	S5													✓						
Coptis trifolia	Goldthread	Secure	S5	✓			✓	✓	✓		✓		✓					✓		✓		
Cornus canadensis	Bunchberry	Secure	S5	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
Cypripedium acaule	Pink Lady's-Slipper	Secure	S5					✓				✓	✓					✓				✓
Danthonia spicata	Poverty Oat Grass	Secure	S5										✓		✓							
Dennstaedtia punctilobula	Eastern Hay-Scented Fern	Secure	S5		✓			✓		✓												
Deschampsia flexuosa	Wavy Hair Grass	Secure	S5		✓		✓		✓		✓					✓	✓				✓	
Diervilla lonicera	Northern Bush Honeysuckle	Secure	S5								✓					✓						
Doellingeria umbellata	Hairy Flat-top White Aster	Secure	S5	✓	✓			✓	✓			✓	✓	✓	✓	✓	✓	✓		✓	✓	
Drosera rotundifolia	Round-leaved Sundew	Secure	S5	✓			✓		✓	✓	✓		✓		✓			✓		✓	✓	
Dryopteris campyloptera	Mountain Wood Fern	Secure	S5					✓			✓					✓					✓	
Dryopteris carthusiana	Spinulose Wood Fern	Secure	S5					✓	✓		✓					✓	✓			✓	✓	
Dryopteris cristata	Crested Wood Fern	Secure	S5													✓						
Dryopteris intermedia	Evergreen Wood Fern	Secure	S5																			✓
Eleocharis obtusa	Blunt Spikerush	Secure	S5			✓			✓					✓								
Eleocharis tenuis	Slender Spikerush	Secure	S5							✓												
Empetrum nigrum	Black Crowberry	Secure	S5	✓					✓		✓	✓	✓		✓			✓			✓	
Epigaea repens	Trailing Arbutus	Secure	S5		✓																	
Epilobium ciliatum	Northern Willowherb	Secure	S5			✓						✓		✓		✓						
Epilobium palustre	Marsh Willowherb	Secure	S5								✓	✓	✓		✓	✓			✓	✓		
Equisetum arvense	Field Horsetail	Secure	S5			✓		✓				✓	✓	✓					✓			
Equisetum sylvaticum	Woodland Horsetail	Secure	S5		✓		✓		✓	✓	✓	✓		✓		✓				✓		
Eriophorum vaginatum	Tussock Cottongrass	Secure	S5										✓					✓				
Eriophorum virginicum	Tawny Cottongrass	Secure	S5	✓	✓				✓		✓	✓	✓		✓			✓		✓	✓	
Eriophorum viridicarinatum	Green-keeled Cottongrass	Secure	S4																	✓		
Eurybia radula	Low Rough Aster	Secure	S5	✓			✓	✓	✓		✓		✓		✓	✓	✓	✓		✓		
Euthamia graminifolia	Grass-leaved Goldenrod	Secure	S5								✓			✓		✓			✓			
Fragaria virginiana	Wild Strawberry	Secure	S5		✓	✓						✓		✓		✓			✓			
Galium trifidum	Three-petaled Bedstraw	Secure	S5													✓						
Gaultheria hispidula	Creeping Snowberry	Secure	S5	✓			✓	✓			✓					✓		✓		✓		
Gaultheria procumbens	Eastern Teaberry	Secure	S5						✓													
Gaylussacia baccata	Black Huckleberry	Secure	S5		✓													✓				
Glyceria grandis	Common Tall Manna Grass	Secure	S4S5		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓				✓		
Hieracium scabrum	Rough Hawkweed	Secure	S5									✓										
Hieracium sp.	a Hawkweed	N/A	N/A											✓								
Hieracium x flagellare	Whiplash Hawkweed	Exotic	SNA									✓										
Hypericum canadense	Canada St. John's-wort	Secure	S5							✓					✓						✓	
Hypericum ellipticum	Pale St. John's-Wort	Secure	S5						✓												✓	
Ilex verticillata	Common Winterberry	Secure	S5	✓				✓	✓	✓	✓	✓		✓		✓		✓		✓		
Iris versicolor	Harlequin Blue Flag	Secure	S5						✓					✓				✓				
Juncus articulatus	Jointed Rush	Secure	S5		✓					✓				✓					✓			
Juncus balticus	Arctic Rush	Secure	S5							✓												
Juncus brevicaudatus	Short-tailed Rush	Secure	S5	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	
Juncus effusus	Soft Rush	Secure	S5	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	
Juncus filiformis	Thread Rush	Secure	S5							✓												
Juncus pelocarpus	Brown-Fruited Rush	Secure	S5													✓				✓	✓	
Juncus sp.	a Rush	N/A	N/A				✓							✓						✓		
Kalmia angustifolia	Sheep Laurel	Secure	S5	✓	✓		✓	✓		✓	✓	✓	✓				✓	✓		✓	✓	
Kalmia polifolia	Pale Bog Laurel	Secure	S5	✓							✓									✓	✓	
Larix laricina	Tamarack	Secure	S5				✓		✓		✓	✓		✓				✓				
Ledum groenlandicum	Common Labrador Tea	Secure	S5	✓	✓			✓			✓	✓	✓			✓	✓	✓		✓	✓	
Linnaea borealis	Twinflower	Secure	S5	✓	✓		✓	✓	✓	✓	✓	✓			✓		✓	✓		✓	✓	
Lonicera canadensis	Canada Fly Honeysuckle	Secure	S5						✓		✓	✓										
Lonicera villosa	Mountain Fly Honeysuckle	Secure	S4S5								✓											
Luzula multiflora	Common Woodrush	Secure	S5								✓											
Lycopodiella inundata	Northern Bog Clubmoss	Secure	S5										✓		✓							
Lycopodium clavatum	Running Clubmoss	Secure	S5				✓															
Lycopus uniflorus	Northern Water Horehound	Secure	S5									✓		✓		✓			✓		✓	
Lysimachia terrestris	Swamp Yellow Loosestrife	Secure	S5		✓		✓		✓	✓							✓		✓			
Maianthemum canadense	Wild Lily-of-The-Valley	Secure	S5						✓		✓		✓								✓	✓
Maianthemum trifolium	Three-leaved False Soloman's Seal	Secure	S5	✓			✓	✓	✓		✓	✓	✓					✓		✓	✓	
Malaxis unifolia	Green Adder's-Mouth	Secure	S4S5										✓			✓						
Mitchella repens	Partridgeberry	Secure	S5	✓			✓					✓						✓				
Monotropa uniflora	Indian Pipe	Secure	S5				✓															
Morella pensylvanica	Northern Bayberry	Secure	S5	✓							✓		✓		✓	✓	✓	✓		✓	✓	
Myosotis laxa	Small Forget-Me-Not	Secure	S5													✓						
Myrica gale	Sweet Gale	Secure	S5											✓								
Nemopanthus mucronatus	Mountain Holly	Secure	S5	✓			✓	✓	✓	✓	✓	✓			✓		✓	✓				✓
Oclemena acuminata	Whorled Wood Aster	Secure	S5	✓	✓			✓	✓	✓	✓	✓			✓		✓	✓		✓		

Table 5 Vascular Plants Identified Within Wetlands During 2011 Functional Assessments and Information on their Provincial Population Status

Scientific Name	Common Name	NSDNR Rank	AC CDC Rank	Wetland ID																		
				22	24	25	26	27	28	34	38	39	41	42	43	44	45	49	50	56	57	60
Oclemena nemoralis	Bog Aster	Secure	S5										✓				✓			✓	✓	
Oclemena x blakei	a hybrid White Panicled American-Aster	Secure	S4S5		✓		✓	✓	✓	✓		✓				✓	✓	✓		✓		
Oenothera biennis	Common Evening Primrose	Secure	S5											✓								
Onoclea sensibilis	Sensitive Fern	Secure	S5													✓						
Orthilia secunda	One-sided Wintergreen	Secure	S5				✓											✓				
Osmunda cinnamomea	Cinnamon Fern	Secure	S5	✓	✓		✓		✓		✓	✓	✓		✓	✓	✓	✓			✓	✓
Osmunda claytoniana	Interrupted Fern	Secure	S5	✓					✓	✓	✓	✓				✓	✓			✓		
Oxalis montana	Common Wood Sorrel	Secure	S5					✓													✓	
Phegopteris connectilis	Northern Beech Fern	Secure	S5							✓	✓	✓								✓		
Photinia floribunda	Purple Chokeberry	Secure	S5								✓		✓					✓				
Photinia melanocarpa	Black Chokeberry	Secure	S5						✓													
Picea glauca	White Spruce	Secure	S5						✓		✓						✓					✓
Picea mariana	Black Spruce	Secure	S5	✓	✓		✓	✓	✓	✓			✓		✓	✓	✓	✓		✓	✓	
Plantago major	Common Plantain	Exotic	SNA											✓								
Platanthera aquilonis	Tall Northern Green Orchid	Secure	S4?									✓										
Platanthera clavellata	Club Spur Orchid	Secure	S5		✓		✓		✓		✓		✓		✓	✓	✓	✓		✓		
Platanthera sp.	an Orchid	N/A	N/A								✓											
Poa compressa	Canada Blue Grass	Exotic	SNA									✓		✓					✓			
Poa palustris	Fowl Blue Grass	Secure	S5			✓								✓		✓			✓			
Poa pratensis	Kentucky Blue Grass	Secure	S5													✓						
Polygonum sagittatum	Arrow-leaved Smartweed	Secure	S5											✓								
Populus balsamifera	Balsam Poplar	Secure	S4																✓			
Populus tremuloides	Trembling Aspen	Secure	S5						✓													
Potamogeton epihydrus	Ribbon-leaved Pondweed	Secure	S5						✓													
Potamogeton foliosus	Leafy Pondweed	Secure	S4S5			✓													✓			
Potentilla norvegica	Rough Cinquefoil	Secure	S5																✓			
Prenanthes trifoliolata	Three-leaved Rattlesnakeroot	Secure	S5				✓		✓		✓	✓			✓		✓	✓				
Prunus pensylvanica	Pin Cherry	Secure	S5								✓	✓		✓								
Prunus virginiana	Chokecherry	Secure	S5													✓						
Pteridium aquilinum	Bracken Fern	Secure	S5	✓	✓		✓	✓	✓		✓	✓	✓		✓		✓			✓		
Ranunculus repens	Creeping Buttercup	Exotic	SNA			✓			✓													
Rhododendron canadense	Rhodora	Secure	S5								✓	✓	✓		✓	✓		✓				
Rhynchospora alba	White Beakrush	Secure	S5																		✓	
Ribes glandulosum	Skunk Currant	Secure	S5								✓			✓		✓				✓		
Rosa multiflora	Multiflora Rose	Exotic	SNA						✓													
Rosa nitida	Shining Rose	Secure	S4		✓									✓				✓				
Rosa virginiana	Virginia Rose	Secure	S5								✓					✓					✓	
Rubus canadensis	Smooth Blackberry	Secure	S5		✓		✓			✓		✓					✓					
Rubus chamaemorus	Cloudberry	Secure	S4	✓				✓	✓									✓				
Rubus hispidus	Bristly Dewberry	Secure	S5		✓						✓											
Rubus idaeus	Red Raspberry	Secure	S5		✓	✓	✓		✓		✓	✓		✓		✓		✓				
Rubus pubescens	Dwarf Red Raspberry	Secure	S5		✓	✓			✓		✓	✓		✓		✓	✓			✓	✓	
Rubus setosus	Bristly Blackberry	Secure	S4?													✓						
Rubus sp.	a Blackberry	N/A	N/A												✓			✓	✓		✓	
Rumex crispus	Curled Dock	Exotic	SNA																✓			
Rumex orbiculatus	Greater Water Dock	Secure	S5			✓													✓			
Salix bebbiana	Bebb's Willow	Secure	S5						✓		✓	✓	✓	✓		✓	✓		✓	✓		
Salix discolor	Pussy Willow	Secure	S5								✓	✓				✓						
Salix humilis	Upland Willow	Secure	S5		✓							✓				✓						
Salix sp.	a Willow	N/A	N/A	✓		✓	✓			✓	✓	✓										
Sarracenia purpurea	Northern Pitcher Plant	Secure	S5												✓							
Scirpus cyperinus	Common Woolly Bulrush	Secure	S5	✓	✓				✓	✓	✓	✓	✓		✓					✓		
Scirpus microcarpus	Small-fruited Bulrush	Secure	S5												✓	✓						
Solanum dulcamara	Bittersweet Nightshade	Exotic	SNA											✓								
Solidago canadensis	Canada Goldenrod	Secure	S5			✓								✓					✓			
Solidago puberula	Downy Goldenrod	Secure	S5												✓							
Solidago rugosa	Rough-stemmed Goldenrod	Secure	S5		✓	✓			✓		✓	✓		✓		✓	✓		✓		✓	
Solidago uliginosa	Northern Bog Goldenrod	Secure	S5	✓					✓		✓	✓	✓	✓		✓		✓			✓	
Sorbus americana	American Mountain Ash	Secure	S5		✓			✓	✓		✓		✓					✓				
Sparganium americanum	American Burreed	Secure	S5						✓							✓					✓	
Spiraea alba	White Meadowsweet	Secure	S5		✓	✓			✓		✓	✓	✓	✓	✓	✓						
Spiranthes romanzoffiana	Hooded Ladies'-Tresses	Secure	S4											✓								
Symphyotrichum novi-belgii	New York Aster	Secure	S5		✓	✓	✓		✓		✓	✓		✓		✓			✓		✓	
Tanacetum vulgare	Common Tansy	Exotic	SNA											✓					✓			
Taxus canadensis	Canada Yew	Secure	S5						✓													
Thalictrum pubescens	Tall Meadow-Rue	Secure	S5						✓			✓										
Thelypteris noveboracensis	New York Fern	Secure	S5	✓	✓		✓		✓	✓	✓	✓				✓		✓				
Triadenum fraseri	Fraser's Marsh St. John's-wort	Secure	S5													✓				✓	✓	
Trientalis borealis	Northern Starflower	Secure	S5						✓		✓	✓						✓			✓	✓
Tussilago farfara	Coltsfoot	Exotic	SNA			✓			✓		✓	✓		✓					✓			
Typha latifolia	Broad-leaved Cattail	Secure	S5			✓					✓	✓		✓		✓			✓	✓		
Utricularia geminiscapa	Twin-stemmed Bladderwort	Secure	S4																	✓		
Utricularia sp.	a Bladderwort	N/A	N/A													✓						
Vaccinium angustifolium	Late Lowbush Blueberry	Secure	S5	✓					✓			✓	✓			✓	✓	✓		✓	✓	
Vaccinium macrocarpon	Large Cranberry	Secure	S5	✓	✓					✓	✓		✓		✓	✓	✓	✓			✓	
Vaccinium myrtilloides	Velvet-leaved Blueberry	Secure	S5								✓											
Vaccinium oxycoccos	Small Cranberry	Secure	S5	✓					✓	✓	✓	✓	✓		✓			✓		✓	✓	
Vaccinium vitis-idaea	Mountain Cranberry	Secure	S5	✓				✓	✓				✓					✓		✓	✓	
Viburnum nudum	Northern Wild Raisin	Secure	S5	✓			✓	✓	✓		✓	✓	✓		✓	✓		✓			✓	
Vicia cracca	Tufted Vetch	Exotic	SNA									✓										
Viola sp.	a Violet	N/A	N/A		✓	✓	✓		✓	✓	✓					✓	✓			✓	✓	

Table 6 Wildlife Recorded within Wetlands of the Donkin Peninsula During 2011 Functional Assessments and Information on their Population Status

Wildlife	Scientific Name	Common Name	NSDNR Rank	AC CDC Rank	Wetland ID																
					22	25	26	27	28	34	38	39	41	42	43	44	45	49	50	56	57	60
Birds	*Bombycilla cedrorum*	Cedar Waxwing	Secure	S5B	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	
	Carduelis tristis	American Goldfinch	Secure	S5												✓			✓			
	Turdus migratorius	American Robin	Secure	S5B								✓		✓		✓		✓				
	Poecile hudsonica	Boreal Chickadee	Sensitive	S3												✓				✓	✓	
	Corvus corax	Common Raven	Secure	S5														✓				
	Geothlypis trichas	Common Yellowthroat	Secure	S5B		✓			✓			✓							✓			
	Junco hyemalis	Dark-eyed Junco	Secure	S4S5																	✓	
	Vireo olivaceus	Red-eyed Vireo	Secure	S5B								✓										
	Melospiza melodia	Song Sparrow	Secure	S5B										✓								
Herpetiles	*Rana clamitans*	Green Frog	Secure	S5					✓							✓			✓	✓	✓	
	Rana palustris	Pickerel Frog	Secure	S5					✓									✓			✓	
	Rana sylvatica	Wood Frog	Secure	S5									✓									
Mammals	*Canis latrans*	Eastern Coyote	Secure	S5											✓							
	Tamiasciurus hudsonicus	Red Squirrel	Secure	S5							✓											✓
	Lepus americanus	Snowshoe Hare	Secure	S5				✓			✓						✓					
	Odocoileus virginianus	White-tailed Deer	Secure	S5			✓		✓	✓			✓		✓				✓	✓		✓

APPENDIX L
Rare Plants

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Balsam Fir	*Abies balsamea*	na	na	Secure	S5	✓	✓
Manitoba Maple	*Acer negundo*	na	na	Exotic	SNA		✓
Striped Maple	*Acer pensylvanicum*	na	na	Secure	S5		✓
Norway Maple	*Acer platanoides*	na	na	Exotic	SNA		✓
Sycamore Maple	*Acer pseudoplatanus*	na	na	Exotic	SNA		✓
Red Maple	*Acer rubrum*	na	na	Secure	S5	✓	✓
Sugar Maple	*Acer saccharum*	na	na	Secure	S5		✓
Mountain Maple	*Acer spicatum*	na	na	Secure	S5		✓
Common Yarrow	*Achillea millefolium*	na	na	Secure	S5	✓	✓
Velvet Bent Grass	*Agrostis canina*	na	na	Exotic	SNA		✓
Colonial Bent Grass	*Agrostis capillaris*	na	na	Exotic	SNA	✓	✓
Redtop	*Agrostis gigantea*	na	na	Exotic	SNA	✓	
Upland Bent Grass	*Agrostis perennans*	na	na	Secure	S4S5	✓	✓
Rough Bent Grass	*Agrostis scabra*	na	na	Secure	S5	✓	✓
Bentgrass	*Agrostis sp.*	na	na	na	na		✓
Creeping Bent Grass	*Agrostis stolonifera*	na	na	Secure	S5	✓	✓
Northern Water Plantain	*Alisma triviale*	na	na	Secure	S5	✓	✓
Speckled Alder	*Alnus incana*	na	na	Secure	S5	✓	✓
Green Alder	*Alnus viridis*	na	na	Secure	S5	✓	✓
Water Foxtail	*Alopecurus geniculatus*	na	na	Exotic	SNA		✓
Meadow Foxtail	*Alopecurus pratensis*	na	na	Exotic	SNA	✓	✓
Common Ragweed	*Ambrosia artemisiifolia*	na	na	Secure	S5		✓
Bartram's Serviceberry	*Amelanchier bartramiana*	na	na	Secure	S5		✓
Canada Serviceberry	*Amelanchier canadensis*	na	na	Secure	S4?		✓
Inland Serviceberry	*Amelanchier interior*	na	na	Secure	S4S5		✓
Smooth Serviceberry	*Amelanchier laevis*	na	na	Secure	S5		✓
a Serviceberry	*Amelanchier sp.*	na	na	na	na	✓	✓
American Beach Grass	*Ammophila breviligulata*	na	na	Secure	S5		✓
Pearly Everlasting	*Anaphalis margaritacea*	na	na	Secure	S5	✓	✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Bog Rosemary	*Andromeda polifolia*	na	na	Secure	S5	✓	✓
Purple-stemmed Angelica	*Angelica atropurpurea*	na	na	Secure	S3S4		✓
Woodland Angelica	*Angelica sylvestris*	na	na	Exotic	SNA	✓	✓
Large Sweet Vernal Grass	*Anthoxanthum odoratum*	na	na	Exotic	SNA		✓
Bristly Sarsaparilla	*Aralia hispida*	na	na	Secure	S5		✓
Wild Sarsaparilla	*Aralia nudicaulis*	na	na	Secure	S5	✓	✓
Common Burdock	*Arctium minus*	na	na	Exotic	SNA		✓
Common Silverweed	*Argentina anserina*	na	na	Secure	S5	✓	
Egede's Silverweed	*Argentina egedii*	na	na	Secure	S4S5		✓
Beach Wormwood	*Artemisia stelleriana*	na	na	Exotic	SNA	✓	✓
Common Wormwood	*Artemisia vulgaris*	na	na	Exotic	SNA	✓	✓
Common Milkweed	*Asclepias syriaca*	na	na	Exotic	SNA		✓
Common Lady Fern	*Athyrium filix-femina*	na	na	Secure	S5	✓	✓
Frankton's Saltbush	*Atriplex franktonii*	na	na	Secure	S3S4		✓
Spreading Orache	*Atriplex patula*	na	na	Exotic	SNA	✓	
Saltbush	*Atriplex sp.*	na	na	na	na	✓	✓
Branched Bartonia	*Bartonia paniculata*	na	na	Secure	S4S5	✓	✓
Yellow Birch	*Betula alleghaniensis*	na	na	Secure	S5	✓	✓
Paper Birch	*Betula papyrifera*	na	na	Secure	S5	✓	✓
Heart-leaved Birch	*Betula papyrifera var. cordifolia*	na	na	Secure	S5	✓	✓
Gray Birch	*Betula populifolia*	na	na	Secure	S5		✓
Devil's Beggarticks	*Bidens frondosa*	na	na	Secure	S5	✓	✓
Bearded Shorthusk	*Brachyelytrum erectum*	na	na	na	SNA		✓
Northern Shorthusk	*Brachyelytrum septentrionale*	na	na	Secure	S5		✓
American Searocket	*Cakile edentula ssp. edentula*	na	na	Secure	S5		✓
American Searocket	*Cakile edentula var. edentula*	na	na	Secure	S5		✓
Bluejoint Reed Grass	*Calamagrostis canadensis*	na	na	Secure	S5	✓	✓
Bluejoint Reed Grass	*Calamagrostis canadensis var. canadensis*	na	na	Secure	S5		✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Pickering's Reed Grass	*Calamagrostis pickeringii*	na	na	Secure	S4S5		✓
Large Water-Starwort	*Callitriche heterophylla*	na	na	Secure	S4		✓
Marsh Water-starwort	*Callitriche palustris*	na	na	Secure	S5	✓	✓
Water-Starwort	*Callitriche sp.*	na	na	na	na		✓
Tuberous Grass Pink	*Calopogon tuberosus*	na	na	Secure	S4	✓	✓
Hedge False Bindweed	*Calystegia sepium*	na	na	Secure	S5	✓	✓
Water Sedge	*Carex aquatilis*	na	na	Secure	S5	✓	✓
Drooping Woodland Sedge	*Carex arctata*	na	na	Secure	S5		✓
Silvery-flowered Sedge	*Carex argyrantha*	na	na	Secure	S3S4		✓
Atlantic Sedge	*Carex atlantica*	na	na	Secure	S4		✓
Atlantic Sedge	*Carex atlantica ssp. atlantica*	na	na	Secure	S4		✓
Brownish Sedge	*Carex brunnescens*	na	na	Secure	S5	✓	✓
Silvery Sedge	*Carex canescens*	na	na	Secure	S5	✓	✓
Fibrous-Root Sedge	*Carex communis*	na	na	Secure	S5	✓	✓
Crawford's Sedge	*Carex crawfordii*	na	na	Secure	S5		✓
Fringed Sedge	*Carex crinita*	na	na	Secure	S5	✓	✓
White-edged Sedge	*Carex debilis*	na	na	Secure	S5	✓	✓
Northern Sedge	*Carex deflexa*	na	na	Secure	S4		✓
Two-seeded Sedge	*Carex disperma*	na	na	Secure	S5		✓
Star Sedge	*Carex echinata*	na	na	Secure	S5	✓	✓
Coastal Sedge	*Carex exilis*	na	na	Secure	S4	✓	✓
Fescue Sedge	*Carex festucacea*	na	na	na	SNA		✓
Yellow Sedge	*Carex flava*	na	na	Secure	S5		✓
Hay Sedge	*Carex foenea*	na	na	Secure	S3?		✓
Northern Long Sedge	*Carex folliculata*	na	na	Secure	S5	✓	✓
Graceful Sedge	*Carex gracillima*	na	na	Secure	S4S5		✓
Nodding Sedge	*Carex gynandra*	na	na	Secure	S5	✓	✓
Bladder Sedge	*Carex intumescens*	na	na	Secure	S5	✓	✓
Slender Sedge	*Carex lasiocarpa*	na	na	Secure	S5		✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Bristly-stalked Sedge	*Carex leptalea*	na	na	Secure	S5		✓
Finely-Nerved Sedge	*Carex leptonervia*	na	na	Secure	S5		✓
Sallow Sedge	*Carex lurida*	na	na	Secure	S5		✓
Boreal Bog Sedge	*Carex magellanica*	na	na	Secure	S5	✓	✓
Boreal Bog Sedge	*Carex magellanica ssp. irrigua*	na	na	Secure	S5	✓	✓
Michaux's Sedge	*Carex michauxiana*	na	na	Secure	S4		✓
Smooth Black Sedge	*Carex nigra*	na	na	Secure	S5	✓	✓
New England Sedge	*Carex novae-angliae*	na	na	Secure	S5		✓
Chaffy Sedge	*Carex paleacea*	na	na	Secure	S5		✓
Pale Sedge	*Carex pallescens*	na	na	Secure	S5		✓
Few-Flowered Sedge	*Carex pauciflora*	na	na	Secure	S4S5		✓
Necklace Sedge	*Carex projecta*	na	na	Secure	S5	✓	✓
Estuary Sedge	*Carex recta*	na	na	Secure	S4?		✓
Retrorse Sedge	*Carex retrorsa*	na	na	Secure	S4		✓
Broom Sedge	*Carex scoparia*	na	na	Secure	S5	✓	✓
a Sedge	*Carex sp.*	na	na	na	na		✓
Awl-fruited Sedge	*Carex stipata*	na	na	Secure	S5	✓	✓
Tussock Sedge	*Carex stricta*	na	na	Secure	S5		✓
Deep Green Sedge	*Carex tonsa*	na	na	Secure	S5		✓
Twisted Sedge	*Carex torta*	na	na	Secure	S5		✓
Three-seeded Sedge	*Carex trisperma*	na	na	Secure	S5	✓	✓
Northern Beaked Sedge	*Carex utriculata*	na	na	Secure	S5		✓
Wiegand's Sedge	*Carex wiegandii*	na	na	May Be At Risk	S1		✓
Wild Caraway	*Carum carvi*	na	na	Exotic	SNA		✓
Black Knapweed	*Centaurea nigra*	na	na	Exotic	SNA	✓	✓
Common Centaury	*Centaurium erythraea*	na	na	Exotic	SNA	✓	
Common Chickweed	*Cerastium fontanum*	na	na	Exotic	SNA	✓	✓
Leatherleaf	*Chamaedaphne calyculata*	na	na	Secure	S5	✓	✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Fireweed	*Chamerion angustifolium*	na	na	Secure	S5	✓	✓
Greater Celandine	*Chelidonium majus*	na	na	Exotic	SNA		✓
White Turtlehead	*Chelone glabra*	na	na	Secure	S5	✓	✓
Wild Chicory	*Cichorium intybus*	na	na	Exotic	SNA		✓
Spotted Water-Hemlock	*Cicuta maculata*	na	na	Secure	S5		✓
Drooping Wood Reed Grass	*Cinna latifolia*	na	na	Secure	S5		✓
Canada Thistle	*Cirsium arvense*	na	na	Exotic	SNA	✓	✓
Bull Thistle	*Cirsium vulgare*	na	na	Exotic	SNA	✓	✓
Virginia Clematis	*Clematis virginiana*	na	na	Secure	S5		✓
Yellow Bluebead Lily	*Clintonia borealis*	na	na	Secure	S5	✓	✓
Marsh Cinquefoil	*Comarum palustre*	na	na	Secure	S5	✓	✓
Field Bindweed	*Convolvulus arvensis*	na	na	Exotic	SNA		✓
Goldthread	*Coptis trifolia*	na	na	Secure	S5	✓	✓
Spotted Coralroot	*Corallorhiza maculata*	na	na	Secure	S4		✓
Broom Crowberry	*Corema conradii*	na	na	Secure	S4	✓	✓
Alternate-leaved Dogwood	*Cornus alternifolia*	na	na	Secure	S5		✓
Bunchberry	*Cornus canadensis*	na	na	Secure	S5	✓	✓
Red Osier Dogwood	*Cornus sericea*	na	na	Secure	S5		✓
Pink Lady's-Slipper	*Cypripedium acaule*	na	na	Secure	S5	✓	✓
Orchard Grass	*Dactylis glomerata*	na	na	Exotic	SNA		✓
Poverty Oat Grass	*Danthonia spicata*	na	na	Secure	S5	✓	✓
Queen Anne's Lace	*Daucus carota*	na	na	Exotic	SNA	✓	✓
Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	na	na	Secure	S5	✓	✓
Wavy Hair Grass	*Deschampsia flexuosa*	na	na	Secure	S5	✓	✓
Northern Panic Grass	*Dichanthelium boreale*	na	na	Secure	S5		✓
Northern Bush Honeysuckle	*Diervilla lonicera*	na	na	Secure	S5	✓	✓
Hairy Flat-top White Aster	*Doellingeria umbellata*	na	na	Secure	S5	✓	✓
Spoon-Leaved Sundew	*Drosera intermedia*	na	na	Secure	S5		✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Round-leaved Sundew	*Drosera rotundifolia*	na	na	Secure	S5	✓	✓
Mountain Wood Fern	*Dryopteris campyloptera*	na	na	Secure	S5	✓	✓
Spinulose Wood Fern	*Dryopteris carthusiana*	na	na	Secure	S5	✓	✓
Crested Wood Fern	*Dryopteris cristata*	na	na	Secure	S5	✓	✓
Evergreen Wood Fern	*Dryopteris intermedia*	na	na	Secure	S5	✓	✓
a Hybrid Wood-fern	*Dryopteris x boottii*	na	na	Not Assessed	SNA		✓
a Hybrid Wood-fern	*Dryopteris x triploidea*	na	na	Not Assessed	SNA		✓
Three-Way Sedge	*Dulichium arundinaceum*	na	na	Secure	S5		✓
Large Barnyard Grass	*Echinochloa crus-galli*	na	na	Exotic	SNA		✓
Common Viper's Bugloss	*Echium vulgare*	na	na	Exotic	SNA		✓
Needle Spikerush	*Eleocharis acicularis*	na	na	Secure	S5		✓
Blunt Spikerush	*Eleocharis obtusa*	na	na	Secure	S5	✓	✓
Common Spikerush	*Eleocharis palustris*	na	na	Secure	S5	✓	✓
Robbins' Spikerush	*Eleocharis robbinsii*	na	na	Secure	S4		✓
a Spikerush	*Eleocharis sp.*	na	na	na	na		✓
Slender Spikerush	*Eleocharis tenuis*	na	na	Secure	S5	✓	✓
Quack Grass	*Elymus repens*	na	na	Exotic	SNA	✓	✓
Black Crowberry	*Empetrum nigrum*	na	na	Secure	S5	✓	✓
Trailing Arbutus	*Epigaea repens*	na	na	Secure	S5	✓	✓
Northern Willowherb	*Epilobium ciliatum*	na	na	Secure	S5	✓	✓
Northern Willowherb	*Epilobium ciliatum ssp. ciliatum*	na	na	Secure	S5		✓
Northern Willowherb	*Epilobium ciliatum ssp. glandulosum*	na	na	Secure	S4S5		✓
Purple-veined Willowherb	*Epilobium coloratum*	na	na	Sensitive	S2?		✓
Bog Willowherb	*Epilobium leptophyllum*	na	na	Secure	S5	✓	✓
Marsh Willowherb	*Epilobium palustre*	na	na	Secure	S5	✓	✓
Willow-Herb	*Epilobium sp.*	na	na	na	na		✓
Helleborine	*Epipactis helleborine*	na	na	Exotic	SNA		✓
Field Horsetail	*Equisetum arvense*	na	na	Secure	S5	✓	✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Water Horsetail	*Equisetum fluviatile*	na	na	Secure	S5		✓
Woodland Horsetail	*Equisetum sylvaticum*	na	na	Secure	S5	✓	✓
a Hybrid Horsetail	*Equisetum x litorale*	na	na	Not Assessed	SNA		✓
Eastern Burnweed	*Erechtites hieraciifolia*	na	na	Secure	S5		✓
Narrow-leaved Cottongrass	*Eriophorum angustifolium*	na	na	Secure	S5	✓	✓
Narrow-leaved Cottongrass	*Eriophorum angustifolium ssp. subarcticum*	na	na	Secure	S5		✓
a Cotton-grass	*Eriophorum sp.*	na	na	na	na		✓
Rough Cottongrass	*Eriophorum tenellum*	na	na	Secure	S4S5		✓
Tussock Cottongrass	*Eriophorum vaginatum*	na	na	Secure	S5	✓	✓
Tawny Cottongrass	*Eriophorum virginicum*	na	na	Secure	S5	✓	✓
Green-keeled Cottongrass	*Eriophorum viridicarinatum*	na	na	Secure	S4	✓	✓
Spotted Joe-pye-weed	*Eupatorium maculatum*	na	na	Secure	S5	✓	✓
Common Boneset	*Eupatorium perfoliatum*	na	na	Secure	S5	✓	✓
Common Eyebright	*Euphrasia nemorosa*	na	na	Secure	S5	✓	
Stiff Eyebright	*Euphrasia stricta*	na	na	Exotic	SNA		✓
Low Rough Aster	*Eurybia radula*	na	na	Secure	S5	✓	✓
Grass-leaved Goldenrod	*Euthamia graminifolia*	na	na	Secure	S5	✓	✓
American Beech	*Fagus grandifolia*	na	na	Secure	S5		✓
Hair Fescue	*Festuca filiformis*	na	na	Exotic	SNA		✓
Spreading Fescue	*Festuca heteromalla*	na	na	Exotic	SNA		✓
Red Fescue	*Festuca rubra*	na	na	Secure	S5	✓	✓
Woodland Strawberry	*Fragaria vesca*	na	na	Secure	S4		✓
Wild Strawberry	*Fragaria virginiana*	na	na	Secure	S5	✓	✓
Glossy Buckthorn	*Frangula alnus*	na	na	Exotic	SNA		✓
White Ash	*Fraxinus americana*	na	na	Secure	S5		✓
European Ash	*Fraxinus excelsior*	na	na	Exotic	SNA		✓
Common Hemp-nettle	*Galeopsis tetrahit*	na	na	Exotic	SNA		✓
Rough Bedstraw	*Galium asprellum*	na	na	Secure	S5		✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Common Marsh Bedstraw	*Galium palustre*	na	na	Secure	S5		✓
a Bedstraw	*Galium sp.*	na	na	na	na		✓
Dyer's Bedstraw	*Galium tinctorium*	na	na	Secure	S5	✓	✓
Three-petaled Bedstraw	*Galium trifidum*	na	na	Secure	S5	✓	✓
Three-petaled Bedstraw	*Galium trifidum ssp. trifidum*	na	na	Secure	S5		✓
Three-flowered Bedstraw	*Galium triflorum*	na	na	Secure	S5		✓
Creeping Snowberry	*Gaultheria hispidula*	na	na	Secure	S5	✓	✓
Eastern Teaberry	*Gaultheria procumbens*	na	na	Secure	S5	✓	✓
Black Huckleberry	*Gaylussacia baccata*	na	na	Secure	S5	✓	✓
Large-Leaved Avens	*Geum macrophyllum*	na	na	Secure	S5		✓
Water Avens	*Geum rivale*	na	na	Secure	S5		✓
Sea Milkwort	*Glaux maritima*	na	na	Secure	S5		✓
Northern Manna Grass	*Glyceria borealis*	na	na	Secure	S5		✓
Canada Manna Grass	*Glyceria canadensis*	na	na	Secure	S5		✓
Common Tall Manna Grass	*Glyceria grandis*	na	na	Secure	S4S5	✓	✓
Northern Mannagrass	*Glyceria laxa*	na	na	Secure	S4?		✓
Slender Manna Grass	*Glyceria melicaria*	na	na	Secure	S4		✓
Plicate Manna Grass	*Glyceria notata*	na	na	Exotic	SNA		✓
a Manna-grass	*Glyceria sp.*	na	na	na	na		✓
Fowl Manna Grass	*Glyceria striata*	na	na	Secure	S5		✓
Marsh Cudweed	*Gnaphalium uliginosum*	na	na	Exotic	SNA		✓
Checkered Rattlesnake-Plantain	*Goodyera tesselata*	na	na	Secure	S4	✓	
Common Oak Fern	*Gymnocarpium dryopteris*	na	na	Secure	S5		✓
Spurred Gentian	*Halenia deflexa*	na	na	Sensitive	S2S3	✓	
Jerusalem Artichoke	*Helianthus tuberosus*	na	na	Exotic	SNA		✓
Common Cow Parsnip	*Heracleum maximum*	na	na	Secure	S5		✓
Orange Hawkweed	*Hieracium aurantiacum*	na	na	Exotic	SNA		✓
Field Hawkweed	*Hieracium caespitosum*	na	na	Exotic	SNA	✓	✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Canada Hawkweed	*Hieracium canadense*	na	na	Secure	S4S5		✓
Kalm's Hawkweed	*Hieracium kalmii*	na	na	Undetermined	S2?	✓	
Common Hawkweed	*Hieracium lachenalii*	na	na	Exotic	SNA	✓	✓
Wall Hawkweed	*Hieracium murorum*	na	na	Exotic	SNA		✓
Mouse-ear Hawkweed	*Hieracium pilosella*	na	na	Exotic	SNA	✓	✓
Tall Hawkweed	*Hieracium piloselloides*	na	na	Exotic	SNA	✓	✓
Rough Hawkweed	*Hieracium scabrum*	na	na	Secure	S5	✓	✓
a Hawkweed	*Hieracium sp.*	na	na	na	na	✓	✓
Whiplash Hawkweed	*Hieracium x flagellare*	na	na	Exotic	SNA	✓	
Smoothish Hawkweed	*Hieracium x floribundum*	na	na	Exotic	SNA		✓
Vanilla Sweet Grass	*Hierochloe odorata*	na	na	Secure	S4S5		✓
Common Mare's-Tail	*Hippuris vulgaris*	na	na	Secure	S4	✓	
Foxtail Barley	*Hordeum jubatum*	na	na	Secure	S5		✓
Shining Firmoss	*Huperzia lucidula*	na	na	Secure	S5		✓
Garden Stonecrop	*Hylotelephium telephium*	na	na	Exotic	SNA		✓
Northern St. John's-Wort	*Hypericum boreale*	na	na	Secure	S5		✓
Canada St. John's-wort	*Hypericum canadense*	na	na	Secure	S5	✓	✓
Pale St. John's-Wort	*Hypericum ellipticum*	na	na	Secure	S5	✓	
Common St. John's-wort	*Hypericum perforatum*	na	na	Exotic	SNA	✓	✓
Inkberry	*Ilex glabra*	na	na	Secure	S5		✓
Common Winterberry	*Ilex verticillata*	na	na	Secure	S5	✓	✓
Spotted Jewelweed	*Impatiens capensis*	na	na	Secure	S5		✓
Harlequin Blue Flag	*Iris versicolor*	na	na	Secure	S5	✓	✓
Jointed Rush	*Juncus articulatus*	na	na	Secure	S5	✓	✓
Arctic Rush	*Juncus balticus*	na	na	Secure	S5	✓	✓
Short-tailed Rush	*Juncus brevicaudatus*	na	na	Secure	S5	✓	✓
Toad Rush	*Juncus bufonius*	na	na	Secure	S5	✓	✓
Bulbous Rush	*Juncus bulbosus*	na	na	Undetermined	S1		✓
Canada Rush	*Juncus canadensis*	na	na	Secure	S5		✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Soft Rush	*Juncus effusus*	na	na	Secure	S5	✓	✓
Soft Rush	*Juncus effusus var. solutus*	na	na	Secure	S5		✓
Thread Rush	*Juncus filiformis*	na	na	Secure	S5	✓	✓
Black-Grass Rush	*Juncus gerardii*	na	na	Secure	S5		✓
Brown-Fruited Rush	*Juncus pelocarpus*	na	na	Secure	S5	✓	✓
a Rush	*Juncus sp.*	na	na	na	na	✓	✓
Woodland Rush	*Juncus subcaudatus*	na	na	Sensitive	S3		✓
Path Rush	*Juncus tenuis*	na	na	Secure	S5	✓	✓
Common Juniper	*Juniperus communis*	na	na	Secure	S5	✓	✓
Creeping Juniper	*Juniperus horizontalis*	na	na	Secure	S4	✓	
Sheep Laurel	*Kalmia angustifolia*	na	na	Secure	S5	✓	✓
Pale Bog Laurel	*Kalmia polifolia*	na	na	Secure	S5	✓	✓
Canada Lettuce	*Lactuca canadensis*	na	na	Secure	S5		✓
Purple Dead-nettle	*Lamium purpureum*	na	na	Exotic	SNA		✓
Tamarack	*Larix laricina*	na	na	Secure	S5	✓	✓
Marsh Vetchling	*Lathyrus palustris*	na	na	Secure	S5		✓
Common Labrador Tea	*Ledum groenlandicum*	na	na	Secure	S5	✓	✓
Rice Cut Grass	*Leersia oryzoides*	na	na	Secure	S5		✓
Lesser Duckweed	*Lemna minor*	na	na	na	SNA	✓	✓
Turion Duckweed	*Lemna turionifera*	na	na	Secure	S5		✓
Fall Dandelion	*Leontodon autumnalis*	na	na	Exotic	SNA	✓	✓
Oxeye Daisy	*Leucanthemum vulgare*	na	na	Exotic	SNA	✓	✓
Scotch Lovage	*Ligusticum scoticum*	na	na	Secure	S5	✓	✓
Sea Lavender	*Limonium carolinianum*	na	na	Secure	S5		✓
Striped Toadflax	*Linaria repens*	na	na	Exotic	SNA		✓
Butter-And-Eggs	*Linaria vulgaris*	na	na	Exotic	SNA	✓	✓
Twinflower	*Linnaea borealis*	na	na	Secure	S5	✓	✓
Loesel's Twayblade	*Liparis loeselii*	na	na	Secure	S3S4	✓	
Tall Fescue	*Lolium arundinaceum*	na	na	Exotic	SNA		✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Meadow Fescue	*Lolium pratense*	na	na	Exotic	SNA		✓
Western Honeysuckle	*Lonicera caerulea*	na	na	na	na	✓	
Canada Fly Honeysuckle	*Lonicera canadensis*	na	na	Secure	S5	✓	✓
Mountain Fly Honeysuckle	*Lonicera villosa*	na	na	Secure	S4S5	✓	✓
Garden Bird's-foot Trefoil	*Lotus corniculatus*	na	na	Exotic	SNA		✓
Large-Leaved Lupine	*Lupinus polyphyllus*	na	na	Exotic	SNA		✓
Hairy Woodrush	*Luzula acuminata*	na	na	Secure	S5		✓
Common Woodrush	*Luzula multiflora*	na	na	Secure	S5	✓	✓
Northern Bog Clubmoss	*Lycopodiella inundata*	na	na	Secure	S5	✓	✓
Stiff Clubmoss	*Lycopodium annotinum*	na	na	Secure	S5		✓
Running Clubmoss	*Lycopodium clavatum*	na	na	Secure	S5	✓	✓
Northern Clubmoss	*Lycopodium complanatum*	na	na	Secure	S3S4		✓
Round-branched Tree-clubmoss	*Lycopodium dendroideum*	na	na	Secure	S5		✓
Hickey's Tree-clubmoss	*Lycopodium hickeyi*	na	na	Secure	S4?		✓
Flat-branched Tree-clubmoss	*Lycopodium obscurum*	na	na	Secure	S4S5		✓
American Water Horehound	*Lycopus americanus*	na	na	Secure	S5	✓	✓
Northern Water Horehound	*Lycopus uniflorus*	na	na	Secure	S5	✓	✓
Swamp Yellow Loosestrife	*Lysimachia terrestris*	na	na	Secure	S5	✓	✓
Purple Loosestrife	*Lythrum salicaria*	na	na	Exotic	SNA		✓
Wild Lily-of-The-Valley	*Maianthemum canadense*	na	na	Secure	S5	✓	✓
Starry False Solomon's Seal	*Maianthemum stellatum*	na	na	Secure	S4		✓
Three-leaved False Soloman's Seal	*Maianthemum trifolium*	na	na	Secure	S5	✓	✓
Green Adder's-Mouth	*Malaxis unifolia*	na	na	Secure	S4S5	✓	✓
Common Apple	*Malus pumila*	na	na	Exotic	SNA		✓
Pineapple Weed	*Matricaria discoidea*	na	na	Exotic	SNA	✓	✓
Black Medick	*Medicago lupulina*	na	na	Exotic	SNA		✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Alfalfa	*Medicago sativa*	na	na	Exotic	SNA		✓
American Cow Wheat	*Melampyrum lineare*	na	na	Secure	S5		✓
White Sweet-clover	*Melilotus albus*	na	na	Exotic	SNA	✓	✓
Tall Yellow Sweet-clover	*Melilotus altissimus*	na	na	Exotic	SNA		✓
Yellow Sweet-clover	*Melilotus officinalis*	na	na	Exotic	SNA		✓
Wild Mint	*Mentha arvensis*	na	na	Secure	S5		✓
Square-stemmed Monkeyflower	*Mimulus ringens*	na	na	Secure	S4S5	✓	✓
Partridgeberry	*Mitchella repens*	na	na	Secure	S5	✓	✓
Blunt-leaved Sandwort	*Moehringia lateriflora*	na	na	Secure	S5		✓
One-flowered Wintergreen	*Moneses uniflora*	na	na	Secure	S5	✓	✓
Pinesap	*Monotropa hypopithys*	na	na	Secure	S4	✓	✓
Indian Pipe	*Monotropa uniflora*	na	na	Secure	S5	✓	✓
Northern Bayberry	*Morella pensylvanica*	na	na	Secure	S5	✓	✓
Bog Muhly	*Muhlenbergia uniflora*	na	na	Secure	S5		✓
Small Forget-Me-Not	*Myosotis laxa*	na	na	Secure	S5	✓	✓
Sweet Gale	*Myrica gale*	na	na	Secure	S5	✓	✓
Mountain Holly	*Nemopanthus mucronatus*	na	na	Secure	S5	✓	✓
Variegated Pond-lily	*Nuphar lutea*	na	na	Secure	S5		✓
Variegated Pond-lily	*Nuphar lutea ssp. variegata*	na	na	Secure	S5		✓
Fragrant Water-lily	*Nymphaea odorata*	na	na	Secure	S5		✓
Whorled Wood Aster	*Oclemena acuminata*	na	na	Secure	S5	✓	✓
Bog Aster	*Oclemena nemoralis*	na	na	Secure	S5	✓	✓
a hybrid White Panicled American-Aster	*Oclemena x blakei*	na	na	Secure	S4S5	✓	✓
Red Bartsia	*Odontites vernus*	na	na	Exotic	SNA		✓
Common Evening Primrose	*Oenothera biennis*	na	na	Secure	S5	✓	✓
Perennial Evening Primrose	*Oenothera perennis*	na	na	Secure	S5		✓
Sensitive Fern	*Onoclea sensibilis*	na	na	Secure	S5	✓	✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
One-sided Wintergreen	*Orthilia secunda*	na	na	Secure	S5	✓	✓
Hairy Sweet Cicely	*Osmorhiza claytonii*	na	na	Secure	S4		✓
Cinnamon Fern	*Osmunda cinnamomea*	na	na	Secure	S5	✓	✓
Interrupted Fern	*Osmunda claytoniana*	na	na	Secure	S5	✓	✓
Royal Fern	*Osmunda regalis*	na	na	Secure	S5		✓
Common Wood Sorrel	*Oxalis montana*	na	na	Secure	S5	✓	✓
a Panic-grass	*Panicum sp.*	na	na	na	na		✓
Reed Canary Grass	*Phalaris arundinacea*	na	na	Secure	S5		✓
Northern Beech Fern	*Phegopteris connectilis*	na	na	Secure	S5	✓	✓
Common Timothy	*Phleum pratense*	na	na	Exotic	SNA	✓	✓
Purple Chokeberry	*Photinia floribunda*	na	na	Secure	S5	✓	✓
Black Chokeberry	*Photinia melanocarpa*	na	na	Secure	S5	✓	✓
Red Chokeberry	*Photinia pyrifolia*	na	na	Secure	S4?		✓
White Spruce	*Picea glauca*	na	na	Secure	S5	✓	✓
Black Spruce	*Picea mariana*	na	na	Secure	S5	✓	✓
Red Spruce	*Picea rubens*	na	na	Secure	S5	✓	✓
Eastern White Pine	*Pinus strobus*	na	na	Secure	S5		✓
English Plantain	*Plantago lanceolata*	na	na	Exotic	SNA	✓	✓
Common Plantain	*Plantago major*	na	na	Exotic	SNA	✓	✓
Seaside Plantain	*Plantago maritima*	na	na	Secure	S5	✓	✓
Tall Northern Green Orchid	*Platanthera aquilonis*	na	na	Secure	S4?	✓	✓
White Fringed Orchid	*Platanthera blephariglottis*	na	na	Secure	S4	✓	✓
Club Spur Orchid	*Platanthera clavellata*	na	na	Secure	S5	✓	✓
White Bog Orchid	*Platanthera dilatata*	na	na	Secure	S4S5		✓
Leafy Northern Green Orchis	*Platanthera hyperborea*	na	na	na	SNA	✓	
Ragged Fringed Orchid	*Platanthera lacera*	na	na	Secure	S4S5	✓	
Small Round-leaved Orchid	*Platanthera orbiculata*	na	na	Secure	S3		✓
Small Purple Fringed Orchid	*Platanthera psycodes*	na	na	Secure	S4		✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
an Orchid	*Platanthera sp.*	na	na	na	na	✓	✓
Annual Blue Grass	*Poa annua*	na	na	Exotic	SNA		✓
Canada Blue Grass	*Poa compressa*	na	na	Exotic	SNA	✓	✓
Wood Blue Grass	*Poa nemoralis*	na	na	Exotic	SNA		✓
Wood Blue Grass	*Poa nemoralis ssp. nemoralis*	na	na	Exotic	SNA		✓
Fowl Blue Grass	*Poa palustris*	na	na	Secure	S5	✓	✓
Kentucky Blue Grass	*Poa pratensis*	na	na	Secure	S5	✓	✓
Weak Blue Grass	*Poa saltuensis*	na	na	Secure	S4S5		✓
Rough Blue Grass	*Poa trivialis*	na	na	Exotic	SNA		✓
Hairy Soloman's Seal	*Polygonatum pubescens*	na	na	Secure	S4S5		✓
Oval-Leaf Knotweed	*Polygonum arenastrum*	na	na	Secure	S5		✓
Fringed Black Bindweed	*Polygonum cilinode*	na	na	Secure	S5	✓	✓
Japanese Knotweed	*Polygonum cuspidatum*	na	na	Exotic	SNA		✓
Marshpepper Smartweed	*Polygonum hydropiper*	na	na	Exotic	SNA		✓
False Waterpepper	*Polygonum hydropiperoides*	na	na	Secure	S5		✓
Spotted Lady's-thumb	*Polygonum persicaria*	na	na	Exotic	SNA		✓
Dotted Smartweed	*Polygonum punctatum*	na	na	Secure	S5		✓
Giant Knotweed	*Polygonum sachalinense*	na	na	Exotic	SNA		✓
Arrow-leaved Smartweed	*Polygonum sagittatum*	na	na	Secure	S5	✓	✓
Bindweed	*Polygonum sp.*	na	na	na	na		✓
White Poplar	*Populus alba*	na	na	Exotic	SNA		✓
Balsam Poplar	*Populus balsamifera*	na	na	Secure	S4	✓	✓
Large-toothed Aspen	*Populus grandidentata*	na	na	Secure	S5		✓
Trembling Aspen	*Populus tremuloides*	na	na	Secure	S5	✓	✓
Alga Pondweed	*Potamogeton confervoides*	na	na	Secure	S4S5	✓	✓
Ribbon-leaved Pondweed	*Potamogeton epihydrus*	na	na	Secure	S5	✓	✓
Leafy Pondweed	*Potamogeton foliosus*	na	na	Secure	S4S5	✓	✓
Floating-leaved Pondweed	*Potamogeton natans*	na	na	Secure	S5		✓
Oakes' Pondweed	*Potamogeton oakesianus*	na	na	Secure	S4S5	✓	✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Clasping-leaved Pondweed	*Potamogeton perfoliatus*	na	na	Secure	S4S5	✓	
Small Pondweed	*Potamogeton pusillus*	na	na	Secure	S5	✓	✓
a Pondweed	*Potamogeton sp.*	na	na	na	na		✓
Silvery Cinquefoil	*Potentilla argentea*	na	na	Exotic	SNA		✓
Rough Cinquefoil	*Potentilla norvegica*	na	na	Secure	S5	✓	✓
Old Field Cinquefoil	*Potentilla simplex*	na	na	Secure	S5		✓
Tall Rattlesnakeroot	*Prenanthes altissima*	na	na	Secure	S5		✓
Three-leaved Rattlesnakeroot	*Prenanthes trifoliolata*	na	na	Secure	S5	✓	✓
Common Self-heal	*Prunella vulgaris*	na	na	Secure	S5		✓
Common Self-heal	*Prunella vulgaris ssp. lanceolata*	na	na	Secure	S5		✓
Common Self-heal	*Prunella vulgaris ssp. vulgaris*	na	na	Exotic	SNA		✓
Pin Cherry	*Prunus pensylvanica*	na	na	Secure	S5	✓	✓
Pin Cherry	*Prunus pensylvanica var. pensylvanica*	na	na	Secure	S5		✓
Black Cherry	*Prunus serotina*	na	na	Secure	S5		✓
Chokecherry	*Prunus virginiana*	na	na	Secure	S5	✓	✓
Bracken Fern	*Pteridium aquilinum*	na	na	Secure	S5	✓	✓
Round-leaved Pyrola	*Pyrola americana*	na	na	Secure	S5		✓
Pink Pyrola	*Pyrola asarifolia*	na	na	Secure	S3	✓	
Green-flowered Pyrola	*Pyrola chlorantha*	na	na	Secure	S4		✓
Shinleaf	*Pyrola elliptica*	na	na	Secure	S5		✓
Lesser Pyrola	*Pyrola minor*	na	na	Sensitive	S2		✓
Wintergreen	*Pyrola sp.*	na	na	na	na		✓
English Oak	*Quercus robur*	na	na	Exotic	SNA		✓
Common Buttercup	*Ranunculus acris*	na	na	Exotic	SNA		✓
Bristly Buttercup	*Ranunculus hispidus*	na	na		SNA		✓
Creeping Buttercup	*Ranunculus repens*	na	na	Exotic	SNA	✓	✓
Little Yellow Rattle	*Rhinanthus minor*	na	na	Secure	S5	✓	✓
Little Yellow Rattle	*Rhinanthus minor ssp. minor*	na	na	Secure	S5		✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Rhodora	*Rhododendron canadense*	na	na	Secure	S5	✓	✓
White Beakrush	*Rhynchospora alba*	na	na	Secure	S5	✓	✓
Skunk Currant	*Ribes glandulosum*	na	na	Secure	S5	✓	✓
Smooth Gooseberry	*Ribes hirtellum*	na	na	Secure	S5		✓
Bristly Black Currant	*Ribes lacustre*	na	na	Secure	S5		✓
Watercress	*Rorippa nasturtium-aquaticum*	na	na	Exotic	SNA		✓
Carolina Rose	*Rosa carolina*	na	na	Secure	S4S5		✓
Briar Rose	*Rosa eglanteria*	na	na	Exotic	SNA	✓	
Multiflora Rose	*Rosa multiflora*	na	na	Exotic	SNA	✓	✓
Shining Rose	*Rosa nitida*	na	na	Secure	S4	✓	✓
Swamp Rose	*Rosa palustris*	na	na	Secure	S3		✓
Red-leaved Rose	*Rosa rubrifolia*	na	na	na	SNA		✓
Rugosa Rose	*Rosa rugosa*	na	na	Exotic	SNA	✓	
a Rose	*Rosa sp.*	na	na	na	na		✓
Virginia Rose	*Rosa virginiana*	na	na	Secure	S5	✓	✓
Allegheny Blackberry	*Rubus allegheniensis*	na	na	Secure	S5	✓	✓
Allegheny Blackberry	*Rubus allegheniensis var. allegheniensis*	na	na	Secure	S5		✓
Smooth Blackberry	*Rubus canadensis*	na	na	Secure	S5	✓	✓
Cloudberry	*Rubus chamaemorus*	na	na	Secure	S4	✓	✓
Bristly Dewberry	*Rubus hispidus*	na	na	Secure	S5	✓	✓
Red Raspberry	*Rubus idaeus*	na	na	Secure	S5	✓	✓
Red Raspberry	*Rubus idaeus ssp. strigosus*	na	na	Secure	S5		✓
Pennsylvania Blackberry	*Rubus pensilvanicus*	na	na	Secure	S4		✓
Dwarf Red Raspberry	*Rubus pubescens*	na	na	Secure	S5	✓	✓
Arching Dewberry	*Rubus recurvicaulis*	na	na	Secure	SNR	✓	✓
Bristly Blackberry	*Rubus setosus*	na	na	Secure	S4?	✓	✓
a Blackberry	*Rubus sp.*	na	na	na	na	✓	✓
Sheep Sorrel	*Rumex acetosella*	na	na	Exotic	SNA	✓	✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Curled Dock	*Rumex crispus*	na	na	Exotic	SNA	✓	✓
Long-leaved Dock	*Rumex longifolius*	na	na	Exotic	SNA	✓	
Bitter Dock	*Rumex obtusifolius*	na	na	Exotic	SNA		✓
Greater Water Dock	*Rumex orbiculatus*	na	na	Secure	S5	✓	✓
Sea Ditchgrass	*Ruppia maritima*	na	na	Secure	S5		✓
Sea Glasswort	*Salicornia maritima*	na	na	Secure	S5		✓
Bebb's Willow	*Salix bebbiana*	na	na	Secure	S5	✓	✓
Goat Willow	*Salix caprea*	na	na	Exotic	SNA		✓
Pussy Willow	*Salix discolor*	na	na	Secure	S5	✓	✓
Cottony Willow	*Salix eriocephala*	na	na	Secure	S5		✓
Upland Willow	*Salix humilis*	na	na	Secure	S5	✓	✓
Shining Willow	*Salix lucida*	na	na	Secure	S5		✓
Laurel Willow	*Salix pentandra*	na	na	Exotic	SNA		✓
Meadow Willow	*Salix petiolaris*	na	na	Secure	S3		✓
Purple Willow	*Salix purpurea*	na	na	Exotic	SNA		✓
Balsam Willow	*Salix pyrifolia*	na	na	Secure	S5		✓
Silky Willow	*Salix sericea*	na	na	May Be At Risk	S2		✓
a Willow	*Salix sp.*	na	na	na	na	✓	✓
Basket Willow	*Salix viminalis*	na	na	Exotic	SNA		✓
Black Elderberry	*Sambucus nigra*	na	na	Secure	S5		✓
Black Elderberry	*Sambucus nigra ssp. canadensis*	na	na	Secure	S5		✓
Red Elderberry	*Sambucus racemosa*	na	na	Secure	S5		✓
Bloodroot	*Sanguinaria canadensis*	na	na	Secure	S3S4		✓
Canada Burnet	*Sanguisorba canadensis*	na	na	Secure	S4	✓	✓
Northern Pitcher Plant	*Sarracenia purpurea*	na	na	Secure	S5	✓	✓
Three-Square Bulrush	*Schoenoplectus pungens*	na	na	Secure	S5		✓
Water Bulrush	*Schoenoplectus subterminalis*	na	na	Secure	S5		✓
Soft-stemmed Bulrush	*Schoenoplectus tabernaemontani*	na	na	Secure	S5	✓	✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Black-girdled Bulrush	*Scirpus atrocinctus*	na	na	Secure	S5		✓
Woolgrass Bulrush	*Scirpus atrovirens*	na	na	na	SNA	✓	
Common Woolly Bulrush	*Scirpus cyperinus*	na	na	Secure	S5	✓	✓
Georgia Bulrush	*Scirpus georgianus*	na	na	na	SNA		✓
Mosquito Bulrush	*Scirpus hattorianus*	na	na	Secure	S5		✓
Small-fruited Bulrush	*Scirpus microcarpus*	na	na	Secure	S5	✓	✓
a Bullrush	*Scirpus sp.*	na	na	na	na		✓
Marsh Skullcap	*Scutellaria galericulata*	na	na	Secure	S5		✓
Mad-dog Skullcap	*Scutellaria lateriflora*	na	na	Secure	S5		✓
Mossy Stonecrop	*Sedum acre*	na	na	Exotic	SNA		✓
Tansy Ragwort	*Senecio jacobaea*	na	na	Exotic	SNA		✓
Sticky Ragwort	*Senecio viscosus*	na	na	Exotic	SNA		✓
Three-Toothed Cinquefoil	*Sibbaldiopsis tridentata*	na	na	Secure	S5	✓	✓
Bladder Campion	*Silene vulgaris*	na	na	Exotic	SNA		✓
Mountain Blue-eyed-grass	*Sisyrinchium montanum*	na	na	Secure	S5	✓	✓
Black Nightshade	*Solanum americanum*	na	na	na	SNA		✓
Bittersweet Nightshade	*Solanum dulcamara*	na	na	Exotic	SNA	✓	✓
Canada Goldenrod	*Solidago canadensis*	na	na	Secure	S5	✓	✓
Giant Goldenrod	*Solidago gigantea*	na	na	Secure	S5		✓
Downy Goldenrod	*Solidago puberula*	na	na	Secure	S5	✓	✓
Rough-stemmed Goldenrod	*Solidago rugosa*	na	na	Secure	S5	✓	✓
Seaside Goldenrod	*Solidago sempervirens*	na	na	Secure	S5	✓	✓
a Goldenrod	*Solidago sp.*	na	na	na	na	✓	✓
Northern Bog Goldenrod	*Solidago uliginosa*	na	na	Secure	S5	✓	✓
Field Sow Thistle	*Sonchus arvensis*	na	na	Exotic	SNA	✓	✓
American Mountain Ash	*Sorbus americana*	na	na	Secure	S5	✓	✓
Showy Mountain Ash	*Sorbus decora*	na	na	Secure	S4		✓
American Burreed	*Sparganium americanum*	na	na	Secure	S5	✓	✓
Narrow-leaved Burreed	*Sparganium angustifolium*	na	na	Secure	S5	✓	✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Green-fruited Burreed	*Sparganium emersum*	na	na	Secure	S5	✓	✓
Broad-fruited Burreed	*Sparganium eurycarpum*	na	na	Secure	S4		✓
a Bur-reed	*Sparganium sp.*	na	na	na	na		✓
Smooth Cord Grass	*Spartina alterniflora*	na	na	Secure	S5		✓
Prairie Cord Grass	*Spartina pectinata*	na	na	Secure	S5	✓	✓
Saltmarsh Sandspurrey	*Spergularia salina*	na	na	Secure	S5		✓
White Meadowsweet	*Spiraea alba*	na	na	Secure	S5	✓	✓
Steeplebush	*Spiraea tomentosa*	na	na	Secure	S5		✓
Nodding Ladies'-Tresses	*Spiranthes cernua*	na	na	Secure	S5		✓
Slender Ladies'-tresses	*Spiranthes lacera*	na	na	Secure	S5	✓	
Hooded Ladies'-Tresses	*Spiranthes romanzoffiana*	na	na	Secure	S4	✓	✓
Ladies'-Tresses	*Spiranthes sp.*	na	na	na	na		✓
Marsh Hedge-Nettle	*Stachys palustris*	na	na	Exotic	SNA		✓
Trailing Stitchwort	*Stellaria alsine*	na	na	Secure	S4		✓
Boreal Stitchwort	*Stellaria borealis*	na	na	Secure	S4		✓
Little Starwort	*Stellaria graminea*	na	na	Exotic	SNA	✓	✓
Common Starwort	*Stellaria media*	na	na	Exotic	SNA	✓	
Starwort	*Stellaria sp.*	na	na	na	na		✓
Clasping-leaved Twisted-stalk	*Streptopus amplexifolius*	na	na	Secure	S4S5		✓
White Sea-blite	*Suaeda maritima*	na	na	Secure	S5		✓
Lance-leaved Aster	*Symphyotrichum lanceolatum*	na	na	Secure	S4S5		✓
Calico Aster	*Symphyotrichum lateriflorum*	na	na	Secure	S5		✓
New York Aster	*Symphyotrichum novi-belgii*	na	na	Secure	S5	✓	✓
Purple-stemmed Aster	*Symphyotrichum puniceum*	na	na	Secure	S5		✓
Common Tansy	*Tanacetum vulgare*	na	na	Exotic	SNA	✓	✓
Common Dandelion	*Taraxacum officinale*	na	na	Exotic	SNA	✓	✓
Canada Yew	*Taxus canadensis*	na	na	Secure	S5	✓	✓
Tall Meadow-Rue	*Thalictrum pubescens*	na	na	Secure	S5	✓	✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
New York Fern	*Thelypteris noveboracensis*	na	na	Secure	S5	✓	✓
Eastern Marsh Fern	*Thelypteris palustris*	na	na	Secure	S5	✓	✓
Bog Fern	*Thelypteris simulata*	na	na	Secure	S4S5		✓
Eastern White Cedar	*Thuja occidentalis*	na	Vulnerable	At Risk	S1S2		✓
Pale False Manna Grass	*Torreyochloa pallida*	na	na	Secure	S4S5		✓
Meadow Goatsbeard	*Tragopogon pratensis*	na	na	Exotic	SNA		✓
Fraser's Marsh St. John's-wort	*Triadenum fraseri*	na	na	Secure	S5	✓	✓
Virginia St. John's-wort	*Triadenum virginicum*	na	na	Secure	S5	✓	
Tufted Clubrush	*Trichophorum caespitosum*	na	na	Secure	S5		✓
Northern Starflower	*Trientalis borealis*	na	na	Secure	S5	✓	✓
Rabbit's-foot Clover	*Trifolium arvense*	na	na	Exotic	SNA		✓
Low Hop Clover	*Trifolium campestre*	na	na	Exotic	SNA	✓	✓
Alsike Clover	*Trifolium hybridum*	na	na	Exotic	SNA		✓
Red Clover	*Trifolium pratense*	na	na	Exotic	SNA	✓	✓
White Clover	*Trifolium repens*	na	na	Exotic	SNA	✓	✓
Seaside Arrowgrass	*Triglochin maritima*	na	na	Secure	S5		✓
Seashore Chamomile	*Tripleurospermum maritima*	na	na	Exotic	SNA		✓
Coltsfoot	*Tussilago farfara*	na	na	Exotic	SNA	✓	✓
Narrow-Leaved Cattail	*Typha angustifolia*	na	na	Secure	S5		✓
Broad-leaved Cattail	*Typha latifolia*	na	na	Secure	S5	✓	✓
Stinging Nettle	*Urtica dioica*	na	na	Secure	S4		✓
Twin-stemmed Bladderwort	*Utricularia geminiscapa*	na	na	Secure	S4	✓	✓
Humped Bladderwort	*Utricularia gibba*	na	na	Secure	S3S4		✓
Flat-leaved Bladderwort	*Utricularia intermedia*	na	na	Secure	S5		✓
Greater Bladderwort	*Utricularia macrorhiza*	na	na	Secure	S5	✓	✓
a Bladderwort	*Utricularia sp.*	na	na	na	na	✓	
Late Lowbush Blueberry	*Vaccinium angustifolium*	na	na	Secure	S5	✓	✓
Large Cranberry	*Vaccinium macrocarpon*	na	na	Secure	S5	✓	✓

Table 1 Vascular Plants Recorded During 2006 - 2011 Surveys and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Mine	Transmission[1]
Velvet-leaved Blueberry	*Vaccinium myrtilloides*	na	na	Secure	S5	✓	✓
Small Cranberry	*Vaccinium oxycoccos*	na	na	Secure	S5	✓	✓
Mountain Cranberry	*Vaccinium vitis-idaea*	na	na	Secure	S5	✓	✓
Common Mullein	*Verbascum thapsus*	na	na	Exotic	SNA		✓
American Speedwell	*Veronica americana*	na	na	Secure	S5		✓
Common Speedwell	*Veronica officinalis*	na	na	Exotic	S5		✓
Marsh Speedwell	*Veronica scutellata*	na	na	Secure	S5		✓
Thyme-Leaved Speedwell	*Veronica serpyllifolia ssp. serpyllifolia*	na	na	Exotic	SNA		✓
Speedwell	*Veronica sp.*	na	na	na	na		✓
Northern Wild Raisin	*Viburnum nudum*	na	na	Secure	S5	✓	✓
Highbush Cranberry	*Viburnum opulus*	na	na	Secure	S5		✓
Highbush Cranberry	*Viburnum opulus var. opulus*	na	na	Exotic	SNA		✓
Tufted Vetch	*Vicia cracca*	na	na	Exotic	SNA	✓	✓
Common Vetch	*Vicia sativa*	na	na	Exotic	SNA		✓
Shaggy Vetch	*Vicia villosa*	na	na	Exotic	SNA	✓	
Sweet White Violet	*Viola blanda*	na	na	Secure	S5		✓
Marsh Blue Violet	*Viola cucullata*	na	na	Secure	S5		✓
Lance-leaved Violet	*Viola lanceolata*	na	na	Secure	S5	✓	✓
Small White Violet	*Viola macloskeyi*	na	na	Secure	S5		✓
Northern Woodland Violet	*Viola septentrionalis*	na	na	Secure	S5?		✓
Woolly Blue Violet	*Viola sororia*	na	na	Secure	S5		✓
a Violet	*Viola sp.*	na	na	na	na	✓	✓
Northern Yellow-Eyed-Grass	*Xyris montana*	na	na	Secure	S4		✓

[1]Species recorded here as being observed in association with the transmission line reflect those which were recorded along a previously considered railway alignment which runs parallel to the transmission corridor for much of its extent. SHowever, some of these species (*e.g.*, northern clubmoss and small round-leaved orchid) were recrded outside of the transmission corridor.

Table 2 Locations (NAD 83) and Population Status of Species of Conservation Interest Recorded During Field Surveys

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	X	Y	Year observed	Notes
Purple-stemmed Angelica	*Angelica atropurpurea*	na	na	Secure	S3S4	725979	5118227	2010	Scattered in wetlands, often mixed with A. sylvestris, possibly hybrirds
Purple-stemmed Angelica	*Angelica atropurpurea*	na	na	Secure	S3S4	734136	5117123	2010	Scattered in wetlands, often mixed with A. sylvestris, possibly hybrirds
Purple-stemmed Angelica	*Angelica atropurpurea*	na	na	Secure	S3S4	734348	5116994	2010	Scattered in wetlands, often mixed with A. sylvestris, possibly hybrirds
Purple-stemmed Angelica	*Angelica atropurpurea*	na	na	Secure	S3S4	734963	5116709	2010	Scattered in wetlands, often mixed with A. sylvestris, possibly hybrirds
Purple-stemmed Angelica	*Angelica atropurpurea*	na	na	Secure	S3S4	735578	5116428	2010	Scattered in wetlands, often mixed with A. sylvestris, possibly hybrirds
Purple-stemmed Angelica	*Angelica atropurpurea*	na	na	Secure	S3S4	735824	5116316	2010	Scattered in wetlands, often mixed with A. sylvestris, possibly hybrirds
Frankton's Saltbush	*Atriplex franktonii*	na	na	Secure	S3S4	735690	5116355	2010	Scattered in salt marsh habitat along estuary
Silvery-flowered Sedge	*Carex argyrantha*	na	na	Secure	S3S4	723378	5117840	2010	Scattered along old track
Silvery-flowered Sedge	*Carex argyrantha*	na	na	Secure	S3S4	734886	5116745	2010	Scattered along old track
Silvery-flowered Sedge	*Carex argyrantha*	na	na	Secure	S3S4	735485	5116479	2010	Scattered along old track
Hay Sedge	*Carex foenea*	na	na	Secure	S3?	730803	5117985	2010	Scattered along old track
Hay Sedge	*Carex foenea*	na	na	Secure	S3?	736867	5116955	2010	Scattered along old track
Hay Sedge	*Carex foenea*	na	na	Secure	S3?	737136	5116983	2010	Scattered along old track
Hay Sedge	*Carex foenea*	na	na	Secure	S3?	737699	5117173	2010	1 clump with approximately 40 heads in open area on side of track
Wiegand's Sedge	*Carex wiegandii*	na	na	May Be At Risk	S1	728142	5118054	2010	Few scattered in deciduous treed swamp
Wiegand's Sedge	*Carex wiegandii*	na	na	May Be At Risk	S1	728413	5117771	2010	Few scattered in deciduous treed swamp
Purple-veined Willowherb	*Epilobium coloratum*	na	na	Sensitive	S2?	731106	5118081	2010	Scattered in swamp habitat.
Spurred Gentian	*Halenia deflexa*	na	na	Sensitive	S2S3	746053	5118122	2011	> 35 stems on flat grassy coast headland,~ 2m from edge
Spurred Gentian	*Halenia deflexa*	na	na	Sensitive	S2S3	745856	5118553	2006	> 40 stems on grassy coast headland, <5 m from edge
Kalm's Hawkweed	*Hieracium kalmii*	na	na	Undeter mined	S2?	na	na	2006	Observed in mine yard.
Bulbous Rush	*Juncus*	na	na	Undeter	S1	722728	5118797	2010	Approximately 50 patches in river

Table 2 Locations (NAD 83) and Population Status of Species of Conservation Interest Recorded During Field Surveys

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	X	Y	Year observed	Notes
	bulbosus			mined					between here and bridge
Bulbous Rush	*Juncus bulbosus*	na	na	Undeter mined	S1	722749	5118772	2010	2 patches in side channel
Bulbous Rush	*Juncus bulbosus*	na	na	Undeter mined	S1	722750	5118757	2010	Common in shallow river , both up and downstream of bridge
Bulbous Rush	*Juncus bulbosus*	na	na	Undeter mined	S1	722762	5118735	2010	Approximately 30 patches upstream of bridge.
Bulbous Rush	*Juncus bulbosus*	na	na	Undeter mined	S1	734288	5117047	2010	1 plant in large track pond
Bulbous Rush	*Juncus bulbosus*	na	na	Undeter mined	S1	734291	5117048	2010	Small patch in rut pool
Woodland Rush	*Juncus subcaudatus*	na	na	Sensitive	S3	734887	5116745	2010	Scattered in wetland
Woodland Rush	*Juncus subcaudatus*	na	na	Sensitive	S3	742652	5117979	2010	Scattered in wetland.
Loesel's Twayblade	*Liparis loeselii*	na	na	Secure	S3S4	na	na	2006	Single plant observed in mine yard.
Northern Clubmoss	*Lycopodium complanatum*	na	na	Secure	S3S4	726460	5117990	2010	Small colony in deciduous woods
Small Round-leaved Orchid	*Platanthera orbiculata*	na	na	Secure	S3	726694	5118088	2010	In seepy streamlet area
Small Round-leaved Orchid	*Platanthera orbiculata*	na	na	Secure	S3	726697	5118083	2010	Few in moist deciduous forest.
Pink Pyrola	*Pyrola asarifolia*	na	na	Secure	S3	na	na	2006	Two plants identified on headland.
Lesser Pyrola	*Pyrola minor*	na	na	Sensitive	S2	724265	5118656	2010	Approximately 100 individuals
Lesser Pyrola	*Pyrola minor*	na	na	Sensitive	S2	726606	5118065	2010	Scattered in immature hardwood on edge of mixed treed swamp
Lesser Pyrola	*Pyrola minor*	na	na	Sensitive	S2	na	na	2006	Near stream crossing by Port Caledonia
Swamp Rose	*Rosa palustris*	na	na	Secure	S3	735132	5116582	2010	Edge of wetland
Meadow Willow	*Salix petiolaris*	na	na	Secure	S3	731950	5117729	2010	Generally observed singly in wetland habitat
Meadow Willow	*Salix petiolaris*	na	na	Secure	S3	733963	5117165	2010	Generally observed singly in wetland habitat
Meadow Willow	*Salix petiolaris*	na	na	Secure	S3	735145	5116563	2010	Generally observed singly in wetland habitat

Table 2 Locations (NAD 83) and Population Status of Species of Conservation Interest Recorded During Field Surveys

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	X	Y	Year observed	Notes
Meadow Willow	*Salix petiolaris*	na	na	Secure	S3	735146	5116562	2010	Single in transmissionline corridor
Silky Willow	*Salix sericea*	na	na	May Be At Risk	S2	733961	5117162	2010	One individual, wet habitat off ditch
Bloodroot	*Sanguinaria canadensis*	na	na	Secure	S3S4	723880	5118487	2010	Large patch on embankment at edge of river
Bloodroot	*Sanguinaria canadensis*	na	na	Secure	S3S4	723886	5118495	2010	Large patch on embankment at edge of river
Bloodroot	*Sanguinaria canadensis*	na	na	Secure	S3S4	735496	5116542	2010	In road ditch
Eastern White Cedar	*Thuja occidentalis*	na	Vulnerable	At Risk	S1S2	729240	5117837	2010	Single sapling on side of trail (a garden escape)
Humped Bladderwort	*Utricularia gibba*	na	na	Secure	S3S4	733351	5117375	2010	Dominant in shallow water approximately 18cm deep.
Humped Bladderwort	*Utricularia gibba*	na	na	Secure	S3S4	734687	5116879	2010	Scattered in wet mire.
Humped Bladderwort	*Utricularia gibba*	na	na	Secure	S3S4	734736	5116828	2010	Locally abundant.
Humped Bladderwort	*Utricularia gibba*	na	na	Secure	S3S4	734736	5116837	2010	Dominant in peaty mire pond.

Table 3 Rare and Sensitive Vascular Plants Identified by the Modelling Exercise as Being Potentially Present in the LAA and Information on Their Preferred Habitat, Phenology, and Population Status

Common Name	Scientific Name	Preferred Habitat	Phenology	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Distance from LAA Center (km)
Wild Chives	*Allium schoenoprasum*	Wet lowlands near the sea.	Flowers late June and July	na	na	May Be At Risk	S2	29 ±10
Wild Chives	*Allium schoenoprasum var. sibiricum*	Wet lowlands near the sea.	Flowers late June and July	na	na	May Be At Risk	S2	16 ±1
Short-awned Foxtail	*Alopecurus aequalis*	Muddy margins of rivers and shallow ponds, and gravel margins where competitor species are few.	Summer	na	na	Sensitive	S2S3	52 ±1
Fernald's Serviceberry	*Amelanchier fernaldii*	Bogs and barrens, mainly in calcareous areas.	Early June to August	na	na	Undetermined	S2?	21 ±0.5
Swamp Milkweed	*Asclepias incarnata*	Wet or rocky thickets, usually near a stream or lakeshore.	Flowers in early August	na	na	Secure	S3	39 ±10
Swamp Milkweed	*Asclepias incarnata ssp. pulchra*	Swamps, thickets and on shores.	Flowers in early August	na	na	Undetermined	S2S3	81 ±1
Maritime Saltbush	*Atriplex acadiensis*	Salt marshes, and on the frindges of sandy and cobbly beaches in protected bays and inlets.	Not provided	na	na	Undetermined	S1?	19 ±10
Frankton's Saltbush	*Atriplex franktonii*	Sea beaches, salt marshes, or inland saline soils,	na	na	na	Secure	S3S4	46 ±0.1

Table 3 Rare and Sensitive Vascular Plants Identified by the Modelling Exercise as Being Potentially Present in the LAA and Information on Their Preferred Habitat, Phenology, and Population Status

Common Name	Scientific Name	Preferred Habitat	Phenology	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Distance from LAA Center (km)
Yellow Bartonia	*Bartonia virginica*	Lakeshores, sandy and peaty bogs, even dry barrens.	Flowers July to September	na	na	Secure	S3	90 ±0.1
Newfoundland Dwarf Birch	*Betula michauxii*	Peat and sphagnous bogs.	June and July (later than most birches)	na	na	Sensitive	S2	25 ±0.5
Bog Birch	*Betula pumila*	Bogs and bog meadows, often mixed with alders matching the 1-3m height of the birches.	May and June. Can be identified without flowers.	na	na	Sensitive	S2S3	64 ±5
Bog Birch	*Betula pumila var. pumila*	Bogs and bog meadows, often mixed with alders matching the 1-3m height of the birches.	May and June. Can be identified without flowers.	na	na	Sensitive	S2S3	78 ±10
Red Bulrush	*Blysmus rufus*	Brackish or salt marshes.	July to September	na	na	May Be At Risk	S1	89 ±0.1
Cut-leaved Moonwort	*Botrychium dissectum*	Sandy, gravelly, turfy, or open soils.	Spores September to November	na	na	Secure	S3	34 ±5
Least Moonwort	*Botrychium simplex*	Usually on lakeshores or the mossy edges of streams or waterfalls although it has been reported in a wide variety of habitats.	Late May and June	na	na	Sensitive	S2S3	50 ±1
Slim-stemmed Reed Grass	*Calamagrostis stricta*	Around lakes and bogs, wet cliff-faces.	Not given for NS	na	na	Sensitive	S1S2	99 ±0

Table 3 Rare and Sensitive Vascular Plants Identified by the Modelling Exercise as Being Potentially Present in the LAA and Information on Their Preferred Habitat, Phenology, and Population Status

Common Name	Scientific Name	Preferred Habitat	Phenology	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Distance from LAA Center (km)
Slim-stemmed Reed Grass	*Calamagrostis stricta ssp. inexpansa*	Around lakes and bogs, wet cliff faces.	Flowering time not given, summer	na	na	Sensitive	S1	98 ±5
Slim-stemmed Reed Grass	*Calamagrostis stricta ssp. stricta*	Around lakes and bogs, wet cliff faces, and landward edges of saltmarshes.	Flowering time not given, summer	na	na	Sensitive	S1S2	63 ±1
Yellow Marsh Marigold	*Caltha palustris*	Relatively rich swamps wet meadows and wet woods. In damp seepage areas and along creeks.	Flowers in early June but can be identified fro early May to late October	na	na	Sensitive	S2	59 ±10
Marsh Bellflower	*Campanula aparinoides*	Meadows, ditches and river banks.	August	na	na	Sensitive	S3	91 ±5
Cuckoo Flower	*Cardamine pratensis var. angustifolia*	Meadows, moist fields, and low areas.	Late May and early June	na	na	May Be At Risk	S1	78 ±10
Lesser Brown Sedge	*Carex adusta*	Dry, open places. Rocky coastal, nonforested, upland.	June to September	na	na	Sensitive	S2S3	68 ±5
Atlantic Sedge	*Carex atlantica ssp. capillacea*	Swamps, bogs, and peaty barrens.	Flowers May to early August	na	na	Undetermined	S2	27 ±0.1
Chestnut Sedge	*Carex castanea*	Swamps and wet meadows, cliff crevices and ledges.	Not given for NS, Summer. Seeds (perigynia) required for identification	na	na	May Be At Risk	S2	52 ±10
Bearded Sedge	*Carex comosa*	Swamps and shallow water.	June to August	na	na	Sensitive	S2	99 ±10

Table 3 Rare and Sensitive Vascular Plants Identified by the Modelling Exercise as Being Potentially Present in the LAA and Information on Their Preferred Habitat, Phenology, and Population Status

Common Name	Scientific Name	Preferred Habitat	Phenology	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Distance from LAA Center (km)
Porcupine Sedge	*Carex hystericina*	Swamps, swales, and along brooks.	June to October	na	na	May Be At Risk	S2	39 ±10
Russet Sedge	*Carex saxatilis*	Damp, peaty or gravelly soils.	Flowering time not given, summer	na	na	May Be At Risk	S1	64 ±10
Sparse-Flowered Sedge	*Carex tenuiflora*	Wet woods and bogs.	not given for NS, most members of Heleonastesgroup flower June to August	na	na	May Be At Risk	S1	88 ±0.5
Wiegand's Sedge	*Carex wiegandii*	Boggy and peaty soils, conifer and alder swamps.	Matures in summer	na	na	May Be At Risk	S1	98 ±0
Red Pigweed	*Chenopodium rubrum*	Salt marshes, seashores, and saline soils.	August to November	na	na	May Be At Risk	S1?	12 ±10
Long-bracted Frog Orchid	*Coeloglossum viride var. virescens*	Boggy spots, damp mature woods, and fir or floodplain forests.	May to August	na	na	May Be At Risk	S2S3	86 ±1
Early Coralroot	*Corallorhiza trifida*	Coniferous woods, often under dense growth where there is very little light. Gypsum sinkholes.	Flowers May to July	na	na	Secure	S3	39 ±5
Water Pygmyweed	*Crassula aquatica*	Brackish, muddy shores and sandy flats. The borders of muddy ponds near the coast.	July to September	na	na	Sensitive	S2	20 ±0.1

Table 3 Rare and Sensitive Vascular Plants Identified by the Modelling Exercise as Being Potentially Present in the LAA and Information on Their Preferred Habitat, Phenology, and Population Status

Common Name	Scientific Name	Preferred Habitat	Phenology	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Distance from LAA Center (km)
Swamp Loosestrife	*Decodon verticillatus*	Quaking margins, edges of ponds or lakes.	July and August	na	na	Sensitive	S3	92 ±5
Quill Spikerush	*Eleocharis nitida*	Moist soil, often over basalt.	Flowers/Fruit as early as mid-June	na	na	Secure	S3	26 ±0.5
Wiegand's Wild Rye	*Elymus wiegandii*	Rich streambanks and meadows.	Flowers July and August, not readily noticable untill bloom	na	na	May Be At Risk	S1	16 ±1
Downy Willowherb	*Epilobium strictum*	Wet meadows, boggy swales and marshes.	July to September	na	na	Sensitive	S3	62 ±1
Variegated Horsetail	*Equisetum variegatum*	Streambanks, bogs, and wet thickets.	Not provided	na	na	Secure	S3	69 ±10
Philadelphia Fleabane	*Erigeron philadelphicus*	Old fields, meadows, and springy slopes.	Flowers June to August	na	na	Sensitive	S2	30 ±10
Proliferous Fescue	*Festuca prolifera*	Pastures, exposed situations, in sand and gravel along beaches, and in the upper zones of salt marshes.	June to July.	Not At Risk	na	Sensitive	S1S2	84 ±10
Black Ash	*Fraxinus nigra*	Low ground, damp woods and swamps.	May and June. Can be identified without flowers.	na	na	Sensitive	S2S3	22 ±10
Lesser Rattlesnake-plantain	*Goodyera repens*	Under conifers, growing with very few other plants.	Flowers July and August	na	na	Sensitive	S3	26 ±0.1

Table 3 Rare and Sensitive Vascular Plants Identified by the Modelling Exercise as Being Potentially Present in the LAA and Information on Their Preferred Habitat, Phenology, and Population Status

Common Name	Scientific Name	Preferred Habitat	Phenology	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Distance from LAA Center (km)
Spurred Gentian	*Halenia deflexa*	Bleak, exposed headlands.	July to September.	na	na	Sensitive	S2S3	12 ±10
Spurred Gentian	*Halenia deflexa ssp. brentoniana*	Bleak, exposed headlands.	July to September.	na	na	Undetermined	S1?	93 ±1
American False Pennyroyal	*Hedeoma pulegioides*	Stony till and upland pastures, throughout northern part of NS. Near seashores occasionally.	August	na	na	Sensitive	S2S3	19 ±1
Large St. John's-wort	*Hypericum majus*	Wet or dry open soil.	July to September	na	na	May Be At Risk	S1	64 ±0.1
Slender Blue Flag	*Iris prismatica*	Wet ground near the coast.	Mid-July.	na	Vulnerable	May Be At Risk	S1	43 ±10
Acadian Quillwort	*Isoetes acadiensis*	Water up to 1 m deep, bordering lakes or ponds, and occassionally along rivers.	Megaspores required for identification.	Special Concern	na	Sensitive	S3	24 ±5
Big-leaved Marsh-elder	*Iva frutescens ssp. oraria*	Roadside embankments and salt marshes, always near the seashore.	August to September	na	na	Sensitive	S2	8 ±10
Alpine Rush	*Juncus alpinoarticulatus ssp. nodulosus*	Wet shores, marshes, and similar locations - usually calareous.	July and August	na	Vulnerable	May Be At Risk	S1S2	93 ±5

Table 3 Rare and Sensitive Vascular Plants Identified by the Modelling Exercise as Being Potentially Present in the LAA and Information on Their Preferred Habitat, Phenology, and Population Status

Common Name	Scientific Name	Preferred Habitat	Phenology	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Distance from LAA Center (km)
Bulbous Rush	*Juncus bulbosus*	Along the borders of freshwater ponds, ditches, canals, and roadsides, especially in alkaline soils.	Late July to September.	Special Concern	na	Undetermined	S1	11 ±0.5
Moor Rush	*Juncus stygius ssp. americanus*	Open areas in wet moss, bogs and bog pools.	July and August	na	na	Sensitive	S1S2	27 ±0.1
Southern Mudwort	*Limosella australis*	Low areas by ponds, gravel lakeshores, the muddy edges of ponds behind barrier beaches and muddy river margins.	Late June to October.	na	na	Sensitive	S3	19 ±1
Loesel's Twayblade	*Liparis loeselii*	Bogs, peaty meadows, moist ditches, cobbly lake shores, the enges of ponds and bogs, and behond coastal barrier beaches.	Flowers late June and July	na	na	Secure	S3S4	32 ±0.5
Southern Twayblade	*Listera australis*	Among the shaded sphagnum moss of bogs or damp woods.	June. Quickly senesces after flowering.	na	na	May Be At Risk	S2	91 ±10

Table 3 Rare and Sensitive Vascular Plants Identified by the Modelling Exercise as Being Potentially Present in the LAA and Information on Their Preferred Habitat, Phenology, and Population Status

Common Name	Scientific Name	Preferred Habitat	Phenology	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Distance from LAA Center (km)
Northern Clubmoss	*Lycopodium complanatum*	Deciduous forests, on hillsides under brush, and spreading into neglected fields.	na	na	na	Secure	S3S4	31 ±5
Water Beggarticks	*Megalodonta beckii*	Shallow, quiet waters, slow-moving streams, and ponds.	August and September	na	na	Sensitive	S3	28 ±1
Northern Adder's-tongue	*Ophioglossum pusillum*	Sterile meadows, grassy swamps, and damp, sandy, or cobbly beaches of lakes.	Late May to August. Can beidentified until early October if stipe and sporangia are present.	na	na	Sensitive	S2S3	34 ±5
Blunt Sweet Cicely	*Osmorhiza depauperata*	Moist woods and clearings.	Late June and July	na	na	May Be At Risk	S1	98 ±0.5
Marsh Lousewort	*Pedicularis palustris*	Marshes and meadows.	July	na	na	May Be At Risk	S1	27 ±0.5
Large Purple Fringed Orchid	*Platanthera grandiflora*	Wet meadows and along streams.	Flowers in July	na	na	Secure	S3	21 ±1
Small Round-leaved Orchid	*Platanthera orbiculata*	Damp woods in deep shade, the Var. Macrophylla or P. macrophylla is usually in rich old deciduous or mixed woods.	Blooms in August	na	na	Secure	S3	67 ±5
Blood Milkwort	*Polygala sanguinea*	Poor or acidic fields, damp slopes, and open woods or bush.	Late June to October.	na	na	Sensitive	S2S3	56 ±10

Table 3 Rare and Sensitive Vascular Plants Identified by the Modelling Exercise as Being Potentially Present in the LAA and Information on Their Preferred Habitat, Phenology, and Population Status

Common Name	Scientific Name	Preferred Habitat	Phenology	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Distance from LAA Center (km)
Pennsylvania Smartweed	*Polygonum pensylvanicum*	Roadside ditches, dyked marshes, grain fields.	Flowers July to September	na	na	Secure	S3	92 ±0.1
Mistassini Primrose	*Primula mistassinica*	Springy stream banks and dripping ledges.	Flowers May to August	na	na	Sensitive	S2	78 ±1
Lesser Pyrola	*Pyrola minor*	Characteristic of mature coniferous woods in northern Cape Breton.	Flowers in July and August	na	na	Sensitive	S2	27 ±0.1
Cursed Buttercup	*Ranunculus sceleratus*	Marshes, ditches, swampy meadows.	Not given for NS	na	na	May Be At Risk	S1S2	21 ±1
Northern Dewberry	*Rubus flagellaris*	Dry fields, forest openings, and the borders of thickets.	Flowers early May to June	na	na	Undetermined	S1?	33 ±1
Triangular-valve Dock	*Rumex salicifolius var. mexicanus*	Beaches or along rivers.	Not Given, Summer	na	na	Sensitive	S2	19 ±10
Satiny Willow	*Salix pellita*	Streambanks and fertile thickets.	May and June.	na	na	Undetermined	S2S3	89 ±5
Bloodroot	*Sanguinaria canadensis*	Low ground in rich intervales, or along streams, usually in shade. Often growing just above high-water level.	Flowers in early May	na	na	Secure	S3S4	73 ±0
Little Curlygrass Fern	*Schizaea pusilla*	Fairly moist areas.	Not given for NS	na	na	Secure	S3	25 ±1

Table 3 Rare and Sensitive Vascular Plants Identified by the Modelling Exercise as Being Potentially Present in the LAA and Information on Their Preferred Habitat, Phenology, and Population Status

Common Name	Scientific Name	Preferred Habitat	Phenology	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Distance from LAA Center (km)
Sturdy Bulrush	*Schoenoplectus robustus*	Saltmarsh.	na	na	na	Undetermined	S1?	61 ±5
Lance-leaved Figwort	*Scrophularia lanceolata*	Open woods or dryish thickets, only occasionally in open ground.	Flowers June to July	na	na	Undetermined	S1	59 ±10
Low Spikemoss	*Selaginella selaginoides*	Moist areas borderingbog tussocks, peat bogs, and stream margins.	Produces spores in July and August. Likely identifiable when not snow covered but very easily overlooked	na	na	May Be At Risk	S2	87 ±1
Northern Burreed	*Sparganium hyperboreum*	Peaty pools.	Not Given for NS. Likely identifiable in late summer	na	na	Sensitive	S1S2	25 ±0.5
Small Burreed	*Sparganium natans*	The shallow waters of pools, the edges of ponds, and alkaline sink holes.	na	na	na	Secure	S3	18 ±0.5
Shining Ladies'-Tresses	*Spiranthes lucida*	Alluvial soils and rocky shores. Thickets and meadows.	Flowers early July	na	na	May Be At Risk	S2	64 ±1
Saltmarsh Starwort	*Stellaria humifusa*	Around salt marshes.	Flowers June to August	na	na	Sensitive	S2	25 ±0.5
Thread-leaved Pondweed	*Stuckenia filiformis ssp. alpina*	Shallow calcareous water	na	na	na	Undetermined	S2S3	49 ±10
Horned Sea-blite	*Suaeda calceoliformis*	Saline or alkaline flats and marshes.	Not given for NS	na	na	Secure	S2S3	12 ±10

Table 3 Rare and Sensitive Vascular Plants Identified by the Modelling Exercise as Being Potentially Present in the LAA and Information on Their Preferred Habitat, Phenology, and Population Status

Common Name	Scientific Name	Preferred Habitat	Phenology	SARA/ COSEWIC	NS ESA	NSDNR Rank	AC CDC Rank	Distance from LAA Center (km)
White Sea-blite	*Suaeda maritima ssp. richii*	Salt marshes, muddy saline shores, along running dykes and in low-lying areas on marshes and dykelands, also around salt ponds or springs.	August and early September	na	na	Undetermined	S1	89 ±0.1
Boreal Aster	*Symphyotrichum boreale*	Gravelly soil of lake beaches, along streams and the edges of bogs.	August and September	na	na	Sensitive	S2?	41 ±10
Fringed Blue Aster	*Symphyotrichum ciliolatum*	Open fields, lawns and the edges of woods.	August and September	na	na	Sensitive	S2S3	83 ±10
Pale False Manna Grass	*Torreyochloa pallida var. pallida*	Boggy swales and savannas.	June to August.	na	na	Extirpated	S1	56 ±10
Yellowish-white Bladderwort	*Utricularia ochroleuca*	Note: Usually regarded as a hybrid between U. intermedia and U. minor, and occurs throughout the range of those species.	na	na	na	Undetermined	S1	64 ±1
Inverted Bladderwort	*Utricularia resupinata*	Ponds, lakes and river shores.	Flowers July to September, likely little noticable or identifiable out of flower	na	na	May Be At Risk	S1S2	70 ±0.1