Sisson Project:

Baseline Vegetated and Wetland Environments Technical Report

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1.0 INTRODUCTION

This document is the Baseline Vegetated and Wetland Environments Technical Report prepared by Stantec Consulting Ltd. (Stantec) as background information for the Environmental Impact Assessment (EIA) of the Sisson Project (the Project), proposed by Northcliff Resources Ltd. (Northcliff).

The Project consists of a conventional open pit tungsten and molybdenum mine, ore processing plant, and associated facilities and infrastructure located on provincial Crown land approximately 10 km southwest of the community of Napadogan, New Brunswick, and approximately 60 km directly northwest of the city of Fredericton (see Figure 1.1 for a map of the Project area).

1.1 PURPOSE OF TECHNICAL REPORT

The Vegetated Environment is defined as the physical area where vegetation is found, and includes terrestrial vascular plants (including invasive species) and the soil, climatic, and hydrological conditions that support them in upland, wetland, and aquatic habitats. The Wetland Environment is defined as land permanently or temporarily submerged or permeated by water near the soil surface and characterized by plants adapted to saturated-soil conditions, and includes soils, biotic community, surface hydrology, and the hydrological, ecological, recreational and other functions that wetlands can provide. The Vegetated and Wetland Environments have been identified as valued environmental components (VECs) to be assessed as part of the EIA for the Project. Both the Vegetated Environment and the Wetland Environment are part of the larger Terrestrial Environment, but they have been addressed in this report, separately from other components of the Terrestrial Environment, due to their importance in supporting terrestrial wildlife, ecosystems, and biological diversity in the area surrounding the Project. A separate Baseline Wildlife and Wildlife Habitat Technical Report (Stantec 2012a) has been developed to describe these remaining components of the Terrestrial Environment, including terrestrial wildlife, wildlife habitat, and birds.

The purpose of the Baseline Vegetated and Wetland Environments Technical Report is to describe the baseline conditions of the vegetation and wetland components of the terrestrial environment in the vicinity of the Project, to assist in the later characterization of environmental effects of the Project in the EIA Report. This report provides:

- a description of the vegetated environment within the Study Area (defined below) in terms of species composition and the various communities present; and
- the characterization, delineation, and functional assessment of wetlands that could be affected by the Project either directly by construction or operation activities, or indirectly as a result of potential alteration to drainage patterns or to the water table that could result from the presence of the Project.

1.2 SPATIAL BOUNDARIES

The spatial boundaries for the characterization of the existing conditions for the Vegetated and Wetland Environments are based on the following terms, and as illustrated in Figure 1.2.

The **Project Development Area (PDA)** is the most basic and immediate area of the Project. The PDA is limited to the area of physical disturbance associated with the construction and operation of the Project. For this Project, the PDA consists of an area of approximately 1,200 hectares (ha) that includes the area of physical disturbance associated with the open pit, processing facility, storage areas, and tailings storage facility (TSF). The PDA also includes access roads and a transmission line, the specific area of which will be determined and assessed in the EIA Report.

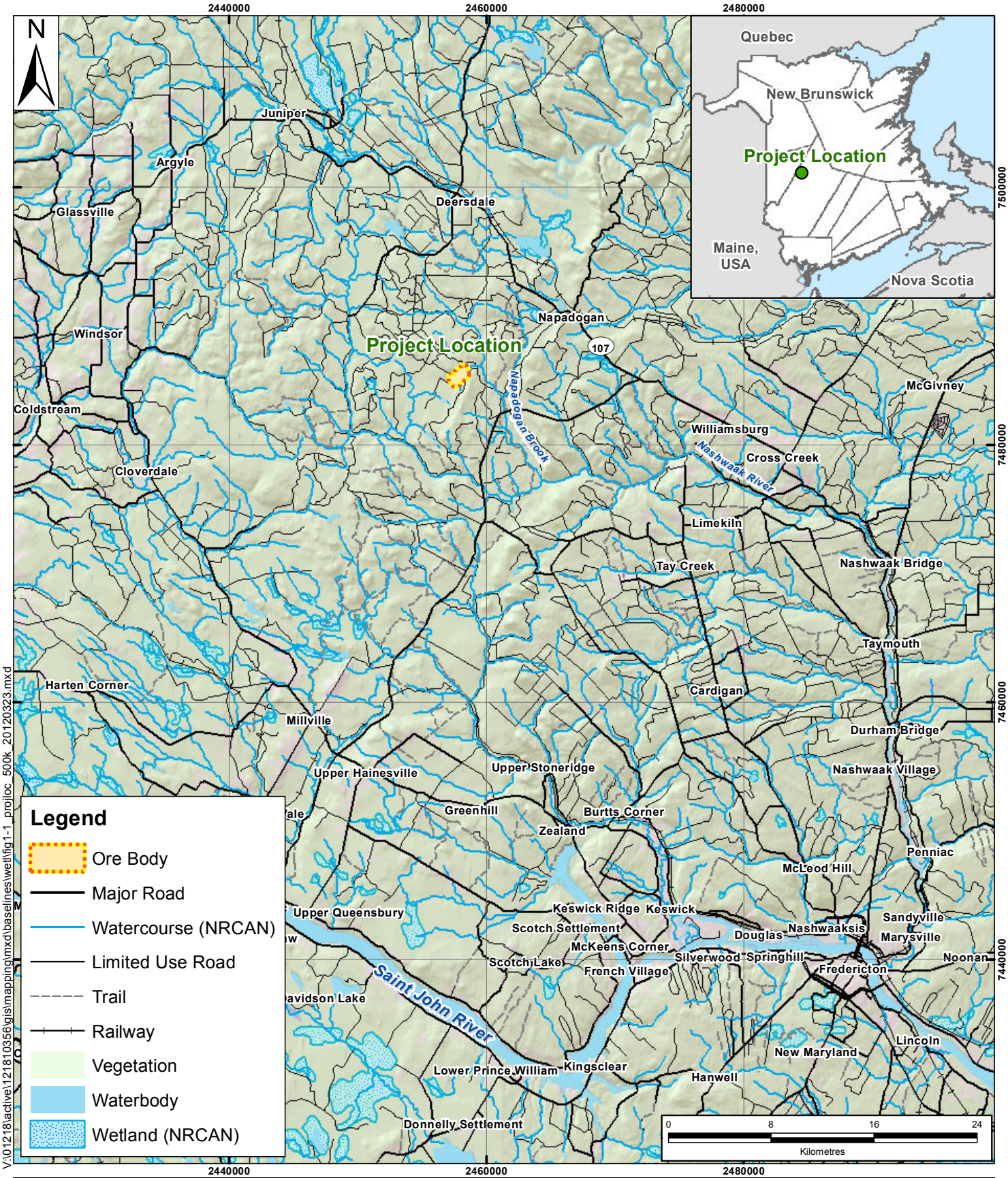
For both the Vegetated and Wetland Environments, the **Study Area** is the area surrounding the PDA within which the field studies described in this report focus. The Study Area encompasses the entire PDA, as well as contiguous wetlands downstream of the PDA to the point where they converge with a larger receiving watercourse/wetland system (encompassing the likely zone of influence of the Project for the Vegetated and Wetland Environments). The Study Area also included a minimum buffer area of 45 metres (m) (*i.e.,* 1.5 times the standard 30 m wetland buffer as prescribed in the provincial *Watercourse and Wetland Alteration Regulation*) from the perimeter of the PDA, as an added precaution to allow for the identification and assessment of indirect environmental effects on wetlands in the EIA report. Additional areas around Trouser Lake and Christmas Lake to the south of the PDA were also included as part of the Study Area due to their potential for harbouring plant species of conservation concern. The Study Area comprises an area of approximately 1,695 ha.

1.3 ORGANIZATION OF THIS TECHNICAL REPORT

The remainder of this Technical Report is presented in five sections, as follows.

- Section 2.0 provides an overview of the vegetated and wetland environments in the vicinity of the Project, as documented from literature sources and existing information.
- Section 3.0 provides a summary of the field studies and background research conducted by Stantec to fill gaps in available information required to characterize the existing conditions of the vegetated and wetland environments in the Study Area for the Project.
- Section 4.0 provides an assessment of wetland function at multiple scales.
- Section 5.0 provides an overall summary of this Technical Report.
- Section 6.0 provides references consulted as part of the work as well as personal communications.

Additional supporting documentation is provided in the appendices to this report.



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Project Location

Sisson Project: Baseline Vegetated and Wetland Environments Technical Report

Napadogan, N.B.

Client: Northcliff Resources Ltd.

Scale:	Project No.:	Data Sources:	Fig. No.:
1:400,000	121810356	SNB NRCAN, ESRI	1.1

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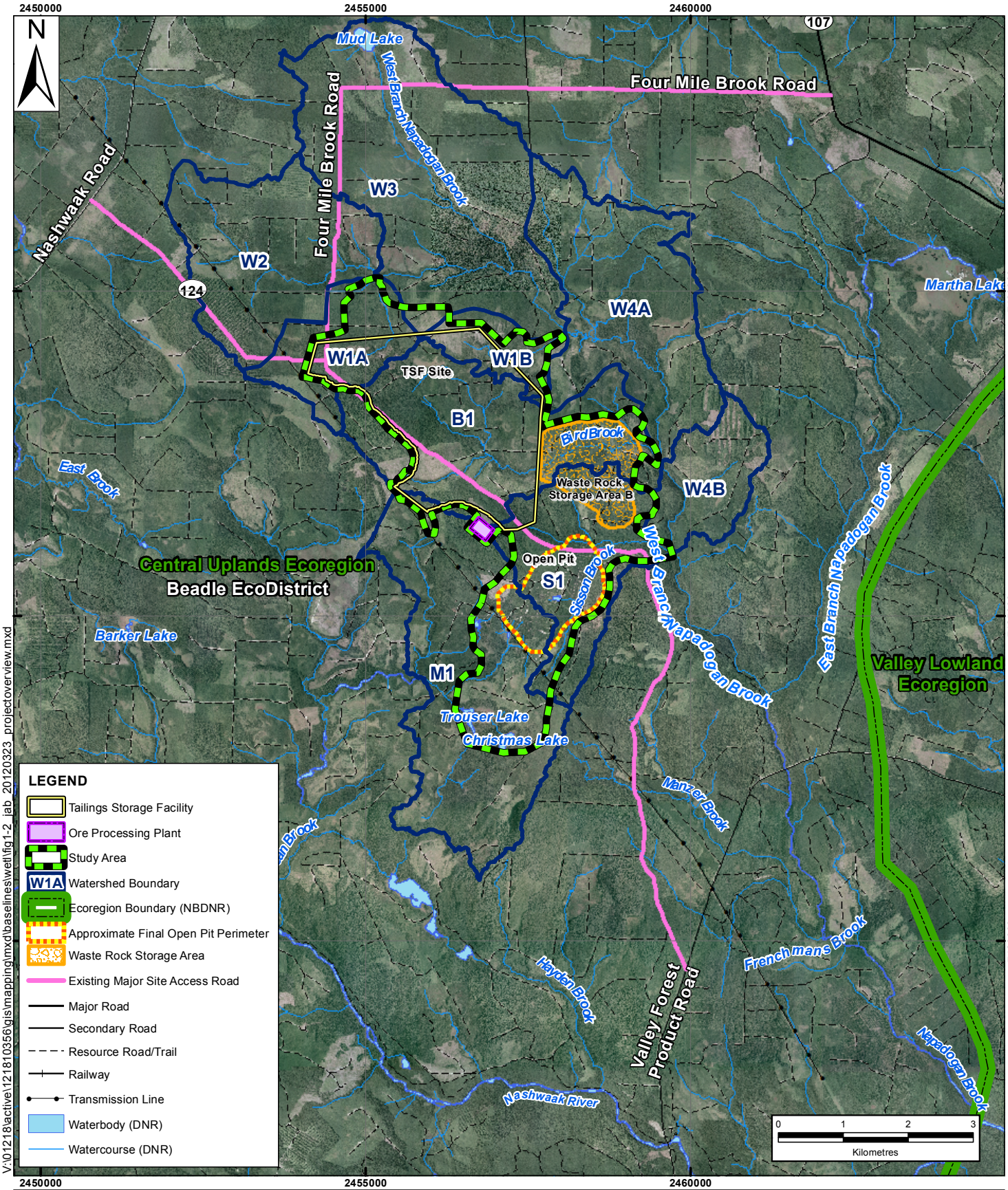
23/03/2012	JAB	DLM

Stantec

Map: NAD83 CSRS NB Double Stereographic



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Study Area

Sisson Project: Baseline Vegetated and Wetland Environments Technical Report

Napadogan, N.B.

Client: Northcliff Resources Ltd.

Scale:	Project No.:	Data Sources:	Fig. No.:
1:80,000	121810356	NBDNR, SNB Imagery Provided By: NBDNR Google Earth Pro	1.2

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2.0 OVERVIEW OF THE VEGETATED AND WETLAND ENVIRONMENTS

This section provides an overview of known information on baseline conditions for the vegetated and wetland environments in the Study Area as compiled from literature sources, and includes:

- ecological land classification;
- information from provincial government sources;
- data gathered during 2008 field studies; and
- available information on species at risk (abbreviated SAR) and species of conservation concern (abbreviated SOCC) from the Atlantic Canada Conservation Data Centre (AC CDC).

The terms SAR and SOCC are referred to frequently in this report. These are defined as follows.

- Species at risk (abbreviated SAR) include species that are listed under Schedule 1 of the *Species at Risk Act (SARA)* as "Extirpated", "Endangered", or "Threatened" and/or listed under the New Brunswick *Endangered Species Act* (NB *ESA*) as "Endangered" or "Regionally Endangered".
- Species of conservation concern (abbreviated SOCC) include those species that are listed by, but not under the protection of *SARA* (*i.e.,* species listed as "Special Concern" in Schedule 1 of *SARA*; listed in Schedule 2 or 3 of *SARA*; or listed as "Special Concern", "Threatened" or "Endangered" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) but not listed in Schedule 1 of *SARA*); or ranked as "S1", "S2", or "S3" in New Brunswick by AC CDC; and/or ranked as "May Be At Risk" or "Sensitive" in New Brunswick by the Canadian Endangered Species Conservation Council (CESCC).

The various rankings under *SARA*, NB *ESA*, COSEWIC, and other conservation authorities are listed in Appendix A (Glossary and List of Acronyms and Units).

2.1 ECOLOGICAL LAND CLASSIFICATION

The New Brunswick Ecological Land Classification (NBELC) is part of a national ELC system, which classifies ecological units at various spatial scales (NBDNR 2007). At the national scale the Project is within the Atlantic Maritime Ecozone, which encompasses the Maritime Provinces of Canada and the Gaspé Peninsula and southeastern Quebec (Marshal *et al.* 1999).

The NBELC divides the province into seven ecoregions, which are defined primarily by climate, but are also differentiated by other features, such as geology and soils, forest cover and vegetation, and wetlands (Figure 2.1). Each of these ecoregions is further divided into ecodistricts, which are delineated by features such as elevation or rock types. Ecosites are a fine-scale of classification within the NBELC, encompassing landforms such as hilltops and valleys. Features such as topoclimate, moisture, and nutrient regime are typically uniform within a single ecosite. As well, ecosites are generally represented by one or several related plant communities.

Within New Brunswick, there are three forest regions: Boreal, Great Lakes-St. Lawrence, and Acadian (CCFM 2012). The Boreal and Great Lakes-St. Lawrence forest regions are found in relatively small northern sections of the province. The majority of New Brunswick, including the PDA and Study Area, is within the Acadian forest region (Wiken *et al.* 1996). The Acadian forest is a transition zone between boreal forests to the north and temperate deciduous forests to the south, and contains species from both regions. The Acadian forest contains a wide variety of forest stands that are characterized by the presence of species such as red spruce, balsam fir, yellow birch, and sugar maple (Wiken *et al.* 1996; Hinds 2000).

The PDA and the Study Area are located within the Beadle Ecodistrict, in the south of the Central Uplands Ecoregion (Madawaska Uplands), however they are also close to the adjacent Valley Lowlands Ecoregion to the east (Figure 2.1). The following sections describe these ecoregions and the Beadle Ecodistrict in more detail.

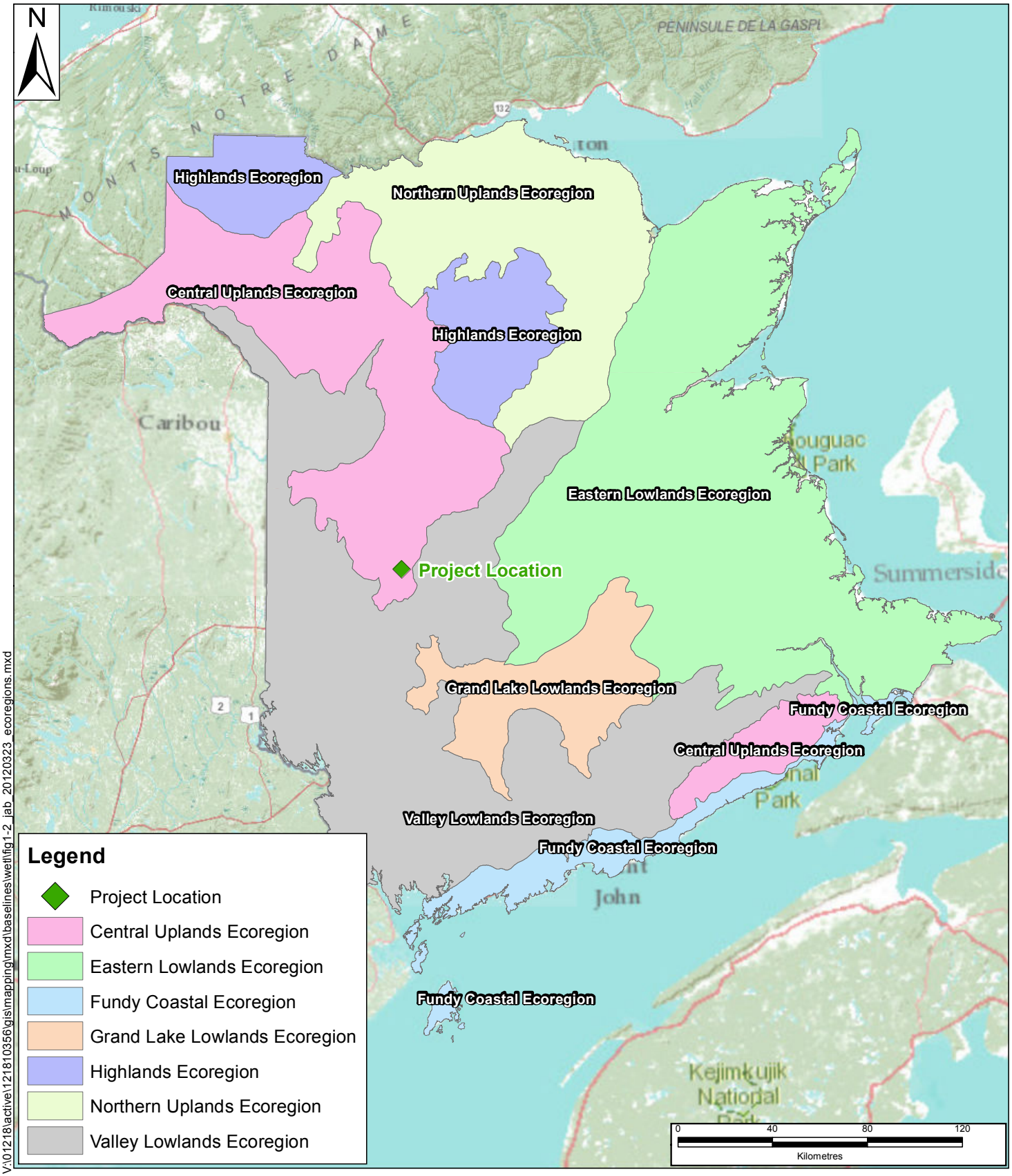
2.1.1 Central Uplands Ecoregion

The Central Uplands Ecoregion includes two geographically separate but ecologically similar areas: the Madawaska Uplands in northwestern New Brunswick and the Caledonia Uplands in the southeast part of the province near the Bay of Fundy. The Caledonia Uplands area is located approximately 140 km to the southeast of the Madawaska Uplands. The PDA and the Study Area are located in the southern portion of the Madawaska Uplands.

The plateaus of the southern part of the Madawaska Uplands differ from the steeper slopes found in the northern portion of the ecoregion. Generally, watercourses in the northern part of this region flow into the Saint John River whereas those in the southern part of the region primarily flow east and eventually into the Miramichi River. Rivers in the extreme south of the Madawaska Uplands are an exception; these flow into the Nashwaak River, which empties into the Saint John River and include the Study Area. This ecoregion is at a relatively higher elevation than other ecoregions in New Brunswick, resulting in a somewhat cooler climate that is mediated somewhat by primarily south-facing slopes. The higher elevation and cooler temperatures lead to a lower saturation vapour pressure and higher precipitation amounts than are generally found in neighbouring regions (NBDNR 2007).

Warmer south-facing slopes support some southern tree species not seen in nearby colder ecoregions, such as balsam fir (*Abies balsamea)*; red, white, and black spruce (*Picea rubens*, *P. glauca*, and *P. mariana*); and tolerant hardwoods such as sugar maple (*Acer saccarum*), yellow birch (*Betula alleghaniensis*), and beech (*Fagus grandifolia*) (NBDNR 2007). Eastern white cedar (*Thuja occidentalis*) is common in calcareous soils, where they occur, in particular in the Little Main Restigouche and Grand River watersheds in the northern part of the Madawaska Uplands. Common understory shrub species include mountain maple (*Acer spicatum*), striped maple (*A. pensylvanicum*), and hobblebush (*Viburnum lantanoides*).

The Central Uplands Ecoregion contains many different wetland types, particularly in southern areas where the landscape is less constrained by steep slopes. Common wetland types include shrub riparian wetlands dominated by alder (*Alnus* spp.), open water wetlands, and peatlands (NBDNR 2007).



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NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC PROJECT AND SHOULD NOT BE USED FOR OTHER PURPOSES.

Ecoregions of New Brunswick Sisson Project: Baseline Vegetated and Wetland Environments Technical Report Napadogan, N.B.	Scale: 1:2,200,000	Project No.: 121810356	Data Sources: SNB, NRCAN, ESRI	Fig. No.: 2.1	Stantec
Client: Northcliff Resources Ltd.	Date: (dd/mm/yyyy) 23/03/2012	Dwn. By: JAB	Appd. By: DLM		

Map: NAD83 CSRS NB Double Stereographic

2.1.1.1 Beadle Ecodistrict

The Beadle Ecodistrict, which encompasses the PDA and the Study Area, is characterized by broad valleys and rolling hills, and contains many lakes. Like the Central Uplands Ecoregion as a whole, the Beadle Ecodistrict has a cool, wet climate, and an elevation gradient ranging from 300 metres above sea level (masl) in the south to 600 masl in the north (NBDNR 2007).

Bedrock within the ecodistrict is primarily granitic, with relatively few fractures and low porosity causing poor drainage (Colpitts *et al.* 1995). This poor drainage has resulted in more lakes, ponds, and wetlands in the ecodistrict (NBDNR 2007). Watercourses in the north of the Beadle Ecodistrict generally flow eastward, eventually into the Miramichi River; those in the south including all of the Study Area generally flow southward into the Saint John River.

Approximately 92% of the Beadle Ecodistrict is forested, including forested wetlands (NBDNR 2007). Forests in the ecodistrict transition from coniferous to tolerant hardwood stands. Granite-derived soils with imperfect to poor drainage are typically dominated by black spruce and balsam fir; slopes and hilltops are dominated by sugar maple, yellow birch, and beech. Mixedwood stands are found in transition zones. Calcareous soils are not indicated in the ecodistrict. Correspondingly, species such as eastern white cedar and white spruce are scarce (Colpitts 1995; NBDNR 2007).

Forests in the Beadle Ecodistrict have been logged since the late 1700s (NBDNR 2007) which has led to a mosaic of young forest stands within the Study Area. Forestry is still the main economic industry for the region despite the recent closures of sawmills in the communities of Juniper and Deersdale. In addition to the Project, other mineral occurrences and prospects have been found in the ecodistrict, including the small Burnthill tungsten-molybdenum deposit north of Napadogan that was mined for a few years in the mid-1950s (Stewart *et al.* 2011; Lang, J. Personal communication, February 24, 2012).

2.1.2 Valley Lowlands Ecoregion

Although the Study Area is entirely within the Central Uplands Ecoregion, it is within 3 km of the Valley Lowlands Ecoregion. The Valley Lowlands Ecoregion is the largest ecoregion in the province. It is associated with several large river systems, including Saint John River and Kennebecasis River (NBDNR 2007). Because this ecoregion is associated with large river systems that are removed from the mediating influence of the ocean, winters are colder and summers are warmer compared to most of the province. Because of its large area and provincial coverage, this ecoregion has 12 ecodistricts, with variable geology and diverse types of forest and wetland.

2.2 VEGETATED AND WETLAND ENVIRONMENTS IN THE STUDY AREA: REVIEW OF EXISTING INFORMATION SOURCES

Available information is outlined in this section that was obtained from a variety of sources in order to characterize the Study Area and to identify the information needed to be collected through field studies. These information sources include the New Brunswick Department of Natural Resources (NBDNR) forest stand data (2008); aerial imagery (2008); LiDAR (Light Detecting and Ranging) data collected for the Project; wetlands information documented by the New Brunswick Department of Environment and Local Government (NBDELG); NBDNR soils data; data collected in the Study Area during field surveys conducted in 2008; and information from AC CDC.

Further details on these data sources and the information they contain in respect of the Study Area are provided in the sub-sections that follow.

2.2.1 Information Sources

2.2.1.1 NBDNR Forest Cover Inventory Data

The most current available data for forest cover classification were compiled by NBDNR based on their interpretation of aerial photos taken in 2008. Forest inventory data in the Study Area were updated using LiDAR data collected for Northcliff and in conjunction with habitat data collected as part of field surveys. The methods used to update the forest cover inventory data and the resulting classification of the vegetation communities present within the Study Area are described in Section 3.1.

2.2.1.2 Aerial Imagery

Aerial imagery collected by NBDNR in 2008 was used to assist in wetland interpretation and classification of both upland and wetland habitat. This imagery was available for the entire Study Area.

2.2.1.3 LiDAR Data

LiDAR data were collected for the Study Area on December 18, 2010 by Leading Edge Geomatics on behalf of Northcliff. These data were used to:

- update the 2008 NBDNR forest cover data with areas that had been harvested for timber since the 2008 data year, based on the creation of a first return above ground grid with comparison to the ground digital elevation model (DEM);
- visually assess the created intensity image;
- interpret watercourse locations and extents for the development of a hydrograph;
- develop a wetland model using the hydrograph;
- guide and assist in the planning of field efforts; and
- assist in the interpretation of wetland boundaries.

The use of these data is described in Section 3.1.

2.2.1.4 NBDELG Wetland Data

The New Brunswick Department of Environment and Local Government (NBDELG, formerly the New Brunswick Department of Environment or NBENV) maintains the official mapping data that identify designated wetlands in the province. NBDELG maintains a map of known wetlands within the province which is available to the public on the GeoNB website (www.geonb.snb.ca, SNB 2011). As of November 2011, the GeoNB map is considered by NBDELG to represent the extent of “regulated” wetlands within the province, although there are unspecified plans to improve the resolution of this map in 2012. The Minister of Environment and Local Government has stated that wetlands shown on the

GeoNB layer currently require a Watercourse and Wetland Alteration Permit for an alteration occurring within 30 m of their boundaries, and compensation is required if an alteration is permitted. Any wetlands labelled as “Provincially Significant Wetlands” in this layer are subject to a greater level of protection.

2.2.1.5 Soils Data

Soils data as defined by Colpitts *et al.* (1995) are used to assess the general potential for plant SAR and SOCC and to assist in identifying richer sites that may support unusual communities or SAR and SOCC. As plant communities and wetland characteristics are largely a product of the underlying soil conditions, this information can be used to predict and better understand the vegetation and wetland conditions on the landscape. ..

2.2.1.6 2008 Survey Results

In 2008, field biologists conducted biological surveys (including ecosystem mapping), rare plant and ecosystem surveys, and wetland surveys, and observations of vegetation were recorded during these surveys. The information was collected by Rescan™ Environmental Services Ltd. on behalf of Geodex Minerals and results were summarized in the report entitled “Sisson Brook Project: Review of Existing Sisson Brook Information” (Rescan™ 2010).

2.2.1.7 AC CDC Data

Information on the potential presence of SAR or SOCC within a specified area of New Brunswick is maintained by AC CDC. An AC CDC data request was made in 2010 for an area that includes at least within 5 km of the Study Area (*i.e.,* the radius from the Project site for which AC CDC typically supplies information when requested). The original request made to AC CDC in 2010 (AC CDC 2010) was updated in 2012 (AC CDC 2012).

2.2.2 Summary of Existing Knowledge from Reviewed Information Sources

2.2.2.1 Wetlands

Based on mapping provided by NBDELG in the GeoNB website, there are 45 NBDELG wetlands within the Study Area, consisting of a combined area of 69.45 ha, or 4.1% of the Study Area. These wetlands do not typically represent the full extent of wetlands within a particular area, and field delineation was necessary to determine the actual locations and extents of wetlands within the Study Area. Table 2.1 summarizes the area of NBDELG wetland that falls within the Study Area by wetland type. The classifications used are as designated by NBDNR (2006). For comparison, the equivalent wetland type discussed in this report (Section 3.3.2) is also provided.

Table 2.1 Summary of NBDELG Wetlands Present Within the Study Area

NBDELG Wetland Type	Equivalent Stantec Type	Number of Wetlands in the Study Area	Total Area (ha) of Wetlands Within the Study Area
Aquatic bed	Lacustrine Shallow Water Wetland	1	3.05
Bog	Bog	5	7.88
Freshwater Marsh	Beaver Impoundment Wetland, Fen	22	31.57
Forested Wetland	Oligotrophic Forested Wetland, Mesotrophic Forested Wetland	2	1.66
Shrub Wetland	Shrub Riparian Wetland	17	25.30
Total		**45**	**69.46**

2.2.2.2 Soils

The Study Area contains five different soil units, as defined by Colpitts *et al.* (1995), which are described below and illustrated on Figure 2.2.

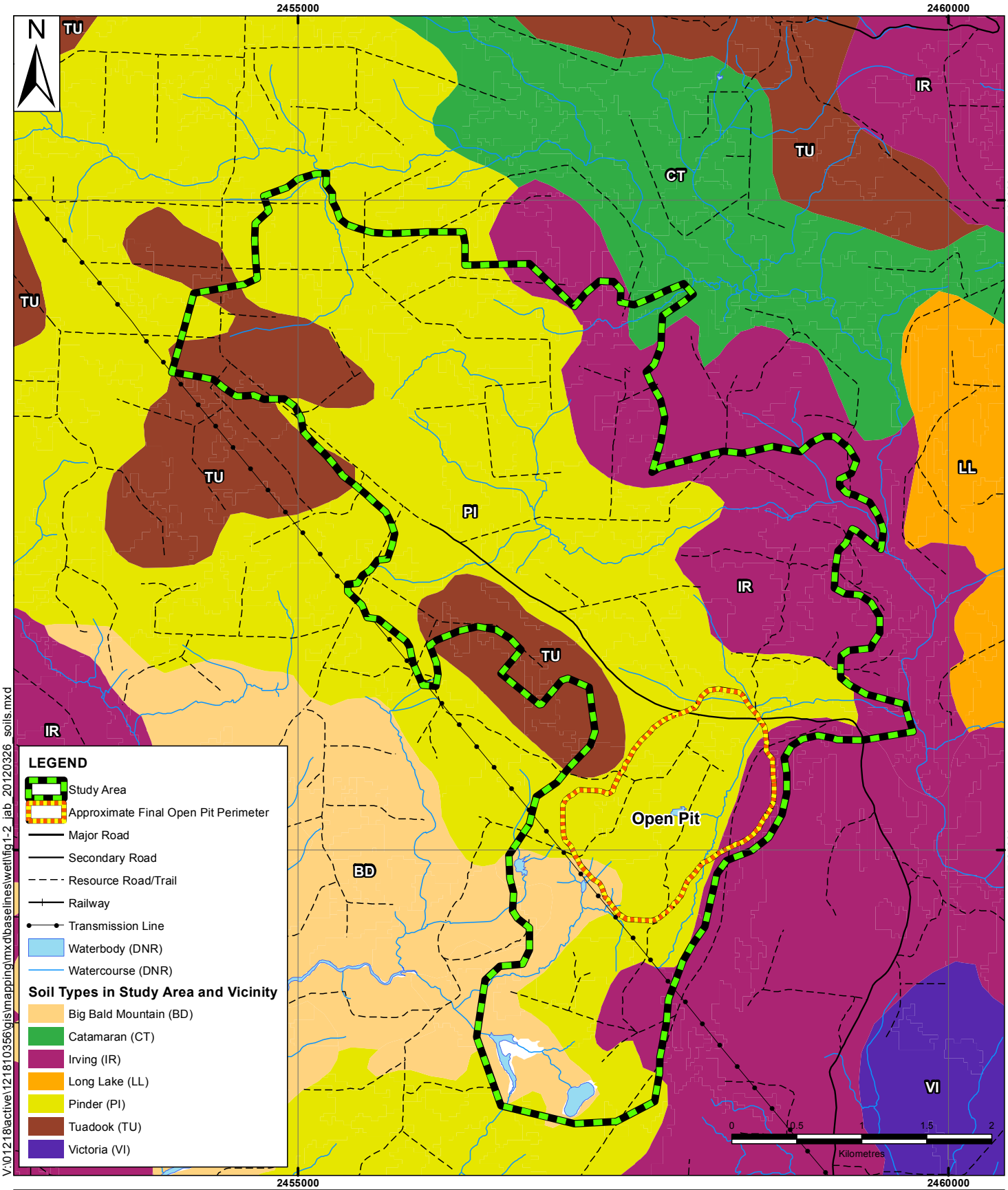
The majority of the Study Area is composed of the Pinder soil unit, which is derived primarily from parent rock of igneous origin, with lesser amounts of meta-sedimentary rocks. Pinder soils are typically coarse-textured, and formed in highly stony residual materials. Elevated areas such as hillcrests and upper slopes demonstrate colluvial or till material.

The eastern portion of the Study Area, which gradually slopes down to the West Branch Napadogan Brook, is composed of the Irving soil unit which, like the Pinder soil unit, is derived primarily from parent rock of igneous origin, with lesser amounts of meta-sedimentary rocks. Irving soils have a silt loam texture and are composed of well- to imperfectly-drained non-compacted till.

High elevation areas in the western part of the Study Area are composed of the Tuadook soil unit. Parent material formed from slow-cooling molten lava. This soil type developed on lodgement till, and has a texture from loam to silt loam, with some coarse fragments. Tuadook soil parent material composition and structure, high in quartz and feldspars, is slow weathering, with slow nutrient release, and rugged topography. Soils are typically compact to a depth of 30 to 65 cm.

The Big Bald Mountain soil unit is found in a small southwestern portion of the Study Area. This soil unit formed from the same parent material as the Tuadook soil unit, and thus has similar slow weathering and nutrient release, and rugged topography. Big Bald Mountain soils are rocky residual, and shallow, formed from the *in situ* weathering of granitic rocks, typically in areas where bedrock outcrops are common, such as hill crests and upper slopes. Soil texture is coarse, including sandy loam, gravel, and stones.

One small area in the northeastern portion of the Study Area, where a small tributary flows into West Branch Napadogan Brook, is composed of the Catamaran soil unit. The Catamaran soil unit, like the Pinder and Irving soil units, is derived primarily from parent rock of igneous origin, with lesser amounts of meta-sedimentary rocks. Catamaran soils are coarse-textured lodgment tills, occurring in mid-slope positions with low to moderate amounts of coarse fragments, and are compact to a depth of 30 to 65 cm.



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Major Soil Units in the Study Area Sisson Project: Baseline Vegetated and Wetland Environments Technical Report Napadogan, N.B. Client: Northcliff Resources Ltd.	Scale: 1:40,000	Project No.: 121810356	Data Sources: NBDNR, SNB Imagery Provided By: NBDNR Google Earth Pro	Fig. No.: 2.2	Stantec
	Date: (dd/mm/yyyy) 26/03/2012	Dwn. By: JAB	Appd. By: DM		

Map: NAD83 CSRS NB Double Stereographic

Overall, the soils within the Study Area are derived from granitic rock, and there is little evidence of the presence of calcareous soils. The richness varies from moderate to poor, and likewise drainage is moderate to poor. The well-drained soils on higher slope positions support tolerant hardwood stands, although they are lacking in many of the species indicative of rich sites that are found in more northerly ecodistricts of the Madawaska Uplands. Low lying areas are poorly drained, and typically support black spruce-dominated wet forest communities with some peat accumulation, and an abundance of ericaceous shrub ground cover. There are no eastern white cedar fens found in the Study Area, as might be typical in more northerly ecodistricts of the Madawaska Uplands, where calcareous influences are present.

While the poor drainage in lower slope positions support relatively simple black spruce communities, these conditions are also conducive to wetland formation which have elevated potential for SOCC and SAR and require delineation and functional assessment. Based on existing soil data, the overall site would not be expected to have high potential for vascular plant SOCC and SAR, but the anticipated abundance of wetlands, the high drainage density, presence of waterbodies, and location in the Central Uplands Ecodistrict necessitate a broad spatial scope for wetlands and plants surveys within the Study Area.

2.2.2.3 2008 Survey Results

Plant data are available from the wetland surveys conducted in 2008 by Rescan™, including 20 plant records totaling 13 different species from four wetlands within the Study Area (see Appendix B for a list of plant species). A list of vascular plant species is unavailable from the rare plant and ecosystem surveys; however, samples of unknown plant specimens taken during the surveys were identified or verified by provincial botanical experts, including Mr. Gart Bishop (a recognized provincial expert of B&B Botanicals) and staff at the University of New Brunswick. No SAR or SOCC vascular plants were identified during the 2008 surveys.

Some of the NBDELG mapped wetlands were visited and described during 2008 field work, although the methodology employed during the 2008 did not strictly follow the methods prescribed by NBDELG at that time (*e.g.,* actual wetland boundaries were not delineated or interpreted, wetland descriptions were not provided, and wetland functions were not evaluated). These wetlands were revisited during the 2011 field work conducted by Stantec and re-evaluated to maintain consistency. These results are described in Section 3.0 of this Technical Report.

2.2.2.4 SAR and SOCC

Based on the 2012 AC CDC request, no vascular plant SAR or SOCC were recorded within this area (AC CDC 2012). This can likely be attributed to lack of suitable habitat in the area for SOCC, the relative isolation of the Study Area and surrounding area, and limited data available due to a lack of field surveys having been previously done in the area.

AC CDC data indicate that five vascular plant SAR may be found in the Study Area based on predictive range maps (AC CDC 2012). These are included in Table 2.2, along with their respective designations and/or conservation rankings.

Table 2.2 Vascular Plant Species at Risk Linked to the Study Area by Predictive Range Maps (AC CDC 2012)

Common Name	Scientific Name	*SARA* Designation	COSEWIC Designation	AC CDC S-Rank	NB *ESA* Designation	NBDNR Status	Range Rank[1]
Prototype Quillwort	*Isoetes prototypus*	Special Concern, Schedule 1	Special Concern	S2	Endangered	At Risk	1
Butternut	*Juglans cinerea*	Endangered, Schedule 1	Endangered	S3		At Risk	1
Southern Twayblade	*Listera australis*			S2	Endangered	At Risk	1
Furbish's Lousewort	*Pedicularis furbishiae*	Endangered, Schedule 1	Endangered	S1	Endangered	At Risk	2
Giant Pinedrops	*Pterospora andromedea*			S1	Endangered	At Risk	2

Notes:
1. Source: AC CDC (2012).

Legend:
1 = possible occurrence; and 2 = less probable occurrence.

It is noted that AC CDC data indicated that an aster (*Symphotrichum* sp.) had been previously recorded at four locations along the banks of the Nashwaak River, ranging from 100 to 300 m downstream (*i.e.*, east) of its confluence with Napadogan Brook (AC CDC 2010), and approximately 10 km from the Study Area. These records were initially believed by AC CDC to be Anticosti aster (*Symphotrichum anticostense*), which is designated "Threatened" on Schedule 1 of the *SARA*, ranked "S3" by AC CDC, designated "Endangered" under the NB *ESA,* and "At Risk" by the province of New Brunswick (AC CDC 2011; CESCC 2011). However, based on genetic testing, it is no longer believed that these specimens are Anticosti aster. It is also no longer clear whether other specimens in New Brunswick are Anticosti aster or some other aster species. It has recently been determined that morphological features of Anticosti aster are not effective for identification in New Brunswick (Blaney, S. Personal communication, February 1, 2012).

Further information on the species at risk identified in the AC CDC request follows.

Prototype quillwort (*Isoetes prototypus*) is an aquatic fern ally in the quillwort family (Isoetaceae). It is found at a depth of 1.5 to 2.5 m in lakes that are small, oligotrophic, cold, and spring-fed, with relatively clear water (COSEWIC 2005). Prototype quillwort has typically been found in soft, unconsolidated sediment over a sandy, gravelly, or rocky bottom (COSEWIC 2005). Prototype quillwort is endemic to the Maritimes, known worldwide from only nine lakes in Nova Scotia, three in New Brunswick, and one in Maine. One of the New Brunswick lakes where prototype quillwort has been found is approximately 45 km NNE of the Study Area (COSEWIC 2005). The Study Area contains one small lake that has potential to provide habitat for prototype quillwort (*i.e.,* Christmas Lake).

Butternut (*Juglans cinerea*), a member of the walnut family (Juglandaceae), is an intolerant deciduous tree of small to medium size, typically less than 30 m in height (COSEWIC 2003; Environment Canada 2010a). Butternut is typically found in forest stands with rich, moist, often riparian soils; in New Brunswick typically along the St. John River valley and the upper Southwest Miramichi River valley (Gleason and Cronquist 1991; Hinds 2000), but can also be found on well-drained friable calcareous soils (COSEWIC 2003). Despite being shade intolerant, butternut is often associated with tolerant

hardwood species such as basswood (*Tilia americana*), black cherry (*Prunus nigra*), sugar maple, beech, yellow birch, and white ash (*Fraxinus americana*), among others (COSEWIC 2003; Loo and Ives 2003). Tolerant hardwood stands with various amounts of sugar maple, beech, and yellow birch are somewhat common within the Study Area, although the Study Area is not in a location that is typically associated with the known range of this species.

Southern twayblade (*Listera australis*) is a small plant in the orchid family (Orchidaceae), typically ranging in height from 10 to 30 cm, including a flower stalk that makes up over half the total height of the plant (Gleason and Cronquist 1991; Holmgren 1998). The species is easily overlooked as it does not produce above-ground organs every year; has only two sessile, opposite to sub-opposite leaves that are from 1.3 to 4 cm in length; and is only visible above ground from mid-June to mid-July (Hinds 2000; Hoy 2003; NBDNR 2012a). Southern twayblade is generally known from wet forests and shaded black spruce bog edges, in areas without heavy ericaceous shrub cover (Gleason and Cronquist 1991; Hinds 2000). NBDNR has led searches for additional southern twayblade locations within the province. Local experts have refined typical southern twayblade habitat as the perimeters of red maple (*Acer rubrum*) and black spruce-dominated forested wetlands and peatlands where hydrology is stable. Dominant species in the understory typically include species such as mountain holly (*Nemopanthus mucronata*), common winterberry (*Ilex verticillata*), and cinnamon fern (*Osmunda cinnamomea*). Canopy closure of both trees and shrubs in these stands is not complete. The Study Area contains many forest stands dominated by black spruce that may have additional habitat characteristics associated with southern twayblade habitat.

Furbish's lousewort (*Pedicularis furbishiae*) is a hemiparasitic, perennial, herbaceous dicot in the figwort family (Scrophulariaceae). Growth is restricted to a basal rosette for the first two years, after which the plant averages 75 cm in height. Furbish's lousewort is endemic to the upper Saint John River Valley in New Brunswick and Maine, and aside from one record along an abandoned railway, is currently known only from banks of the St. John River (Environment Canada 2010b). It is highly unlikely to be present in the Study Area. It is typically found along terraced transition zones of the banks of the river, where shrubs dominate. Preferred soils are calcareous, sandy, well-drained, and subject to periodic destruction from natural events such as ice scour, high water events, and landslides (Hinds 1998). These events can destroy individual Furbish's lousewort plants, but also reduce competition from shrubs and prevents establishment by tree species, while providing colonization locations for new Furbish's lousewort individuals. Change in river dynamics, such as those resulting from the construction of hydroelectric dams, has been identified as a potential cause in the past reduction of the distribution of this species, and could affect populations in the future (Furbish's Lousewort Recovery Team 2006). Most of the watercourses in the Study Area likely do not contain the habitat features (such as banks with calcareous soils) that are associated with Furbish's lousewort and the Study Area is not in a location associated with the known range of this species.

Giant pinedrops (*Pterospora andromedea*), of the Indian pipe family (Monotropaceae), is a strongly mycotrophic herbaceous perennial that lacks chlorophyll (Gleason and Cronquist 1991). Giant pinedrops is easily identified by its distinct characteristics: unbranched pink to rust/dark red coloured stems ranging in height from 30 cm to 1 m, white, downward-facing white to red coloured flowers produced on the upper 10 to 30 cm of the plant, and small scale-like leaves found on the lower portion of the stem (Gleason and Cronquist 1991; NBDNR 2012b). In New Brunswick, the species appears to be limited to mature white pine (*Pinus strobus*) and mature white pine-hemlock (*Tsuga canadensis*)

stands, often on steep slopes on rich, calcareous soil (Lautenschlager and Blaney 2010; NBDNR 2012b) and is therefore not likely to be found in the Study Area. Mycotrophic plants form an association with a fungus which is in turn associated with a photosynthetic plant; in this relationship, both the fungus and the myco-heterotroph receive fixed carbon from a photosynthetic host. Giant pinedrops is associated with a specific fungal symbiont in the *Rhizopogon* genus (Bidartondo and Bruns 2002; Hazard *et al.* 2011). The limited distribution of giant pinedrops is likely a function of the rarity of the fungal symbiont (Hazard *et al.* 2011). Habitat characteristics associated with giant pinedrops, such as white pine- and hemlock-dominated stands and rich calcareous soils, are not found within the Study Area.

2.3 IDENTIFIED GAPS IN DATA

Based on the existing information gathered for this Project, including desktop research and a review of field studies conducted in 2008, a number of data gaps in the coverage of baseline information for the vegetated and wetland environments in the Study Area were identified, including:

- limited data on vegetation and plant communities within the Study Area;
- limited data on wetland locations and boundaries within the Study Area;
- limited data on wetland descriptions within the Study Area; and
- limited data on function of wetlands within the Study Area.

Follow-up studies were conceived and carried out in the 2011 field season to fill these data gaps. These included vegetation and habitat surveys, wetland modelling and field investigations (including field delineation and descriptions), and functional assessments of wetlands and wetland complexes.

3.0 2011 FIELD STUDIES

Stantec conducted vegetation and wetland field studies in 2011 that were designed to supplement the existing information summarized in Section 2.0 of this report. The key focus of these field studies was on vascular plant SAR and SOCC, and wetlands.

This section describes the planning, implementation and results of the 2011 field studies used to describe the Vegetated and Wetland Environments within the Study Area.

3.1 REMOTE SENSING AND MODELLING

Stantec determined the existing conditions for Vegetated and Wetland Environments using a combination of remote sensing, modelling, and field surveys.

Prior to field surveys, Stantec field staff used remote sensing to predict the locations and extent of wetlands and to determine the locations where field surveys would be conducted so that efforts could be focused on wetland areas as well as areas of high potential for rare plants.

3.1.1 Wetland Modelling

LiDAR data were used to create a bare earth digital elevation model (DEM) at 2 m resolution for the Study Area and surrounding area. A Stantec GIS analyst reviewed the DEM for quality and any obvious errors were corrected to improve the accuracy of the drainage modelling. Stantec then created an initial “hydrograph” layer based on NBDNR mapped water bodies, watercourses, NBDELG wetlands, and interpreted streams based on flow accumulation and direction grids created from the DEM.

The Stantec GIS analyst assigned elevation differences to nearest water feature for each 2 m cell in the Study Area (using a Euclidean allocation), creating a wetland model that showed those areas that likely had water table within 25 cm of the ground surface. This model was updated using data collected from initial field delineations of wetlands (described in sub-section 3.3.2) at various locations in the Study Area. A predicted water table depth of within 50 cm below the ground surface was used to predict wetland extents, as this was shown to result in modeled wetland boundaries that best aligned with field delineations.

The final wetland and watershed model resulting from this work is shown in Figure 3.1. The wetland boundaries shown in Figure 3.1 have been refined based on field work and aerial photo and DEM interpretation. The wetland areas have been divided into wetland types based on field habitat data, photos, and interpretation of aerial photos. The different wetland types and their typical characteristics are described in sub-section 3.3.2.

Watershed boundaries were modelled for each of the watercourse outlets from the Study Area using GIS software and a flow direction raster derived from a 2 m DEM. These watersheds are named for the watercourse that they drain into and are shown on Figure 3.1. The watersheds in the Study Area are: Tributaries to West Branch Napodagan Brook (W1A, W1B, W3), Sisson Brook (S1), McBean Brook (M1), and Bird Brook (B1).

3.1.2 Identification of Habitats with Elevated Potential for SAR and SOCC

Vascular plant SAR and SOCC are plants that are limited in their distribution or occurrence and have either been afforded protection through *SARA* or the NB *ESA* (for SAR), or have been listed by conservation authorities for further monitoring and study due to their limited abundance (for SOCC). Two main factors influencing the rarity of SAR or SOCC are low competitive ability and narrow ecological niche occupancy (Grime 2001). Species with low competitive ability are often outcompeted by species with higher competitive ability, and are thus found in fewer locations than they would be in the absence of a stronger competitor. Species with narrow ecological niches have limited ranges of tolerance for one or any number of environmental or habitat features, ranging from climate or soil characteristics, to substrate or fungal associates. Accordingly, such species typically have very specific habitat requirements, often for habitats that are themselves rare or uncommon. Because uncommon species are often found in uncommon habitats, these unique habitats are targeted for rare plant surveys as they often result in an elevated potential for harbouring plant SAR or SOCC. Uncommon habitats, as well as specific habitats required by SAR identified by AC CDC as potentially being present in the area (sub-section 3.1.2.1), were identified by the Study Team as areas in which field surveys for plant SAR and SOCC were warranted.

Vegetation communities were identified using GIS and digital data sources, including NBDNR forest cover, Service New Brunswick (SNB) watercourse and waterbody data, NBDELG wetland data, and 2008 aerial imagery. Vegetation communities identified in the Study Area and surrounding areas as having elevated potential for SAR and SOCC are described below.

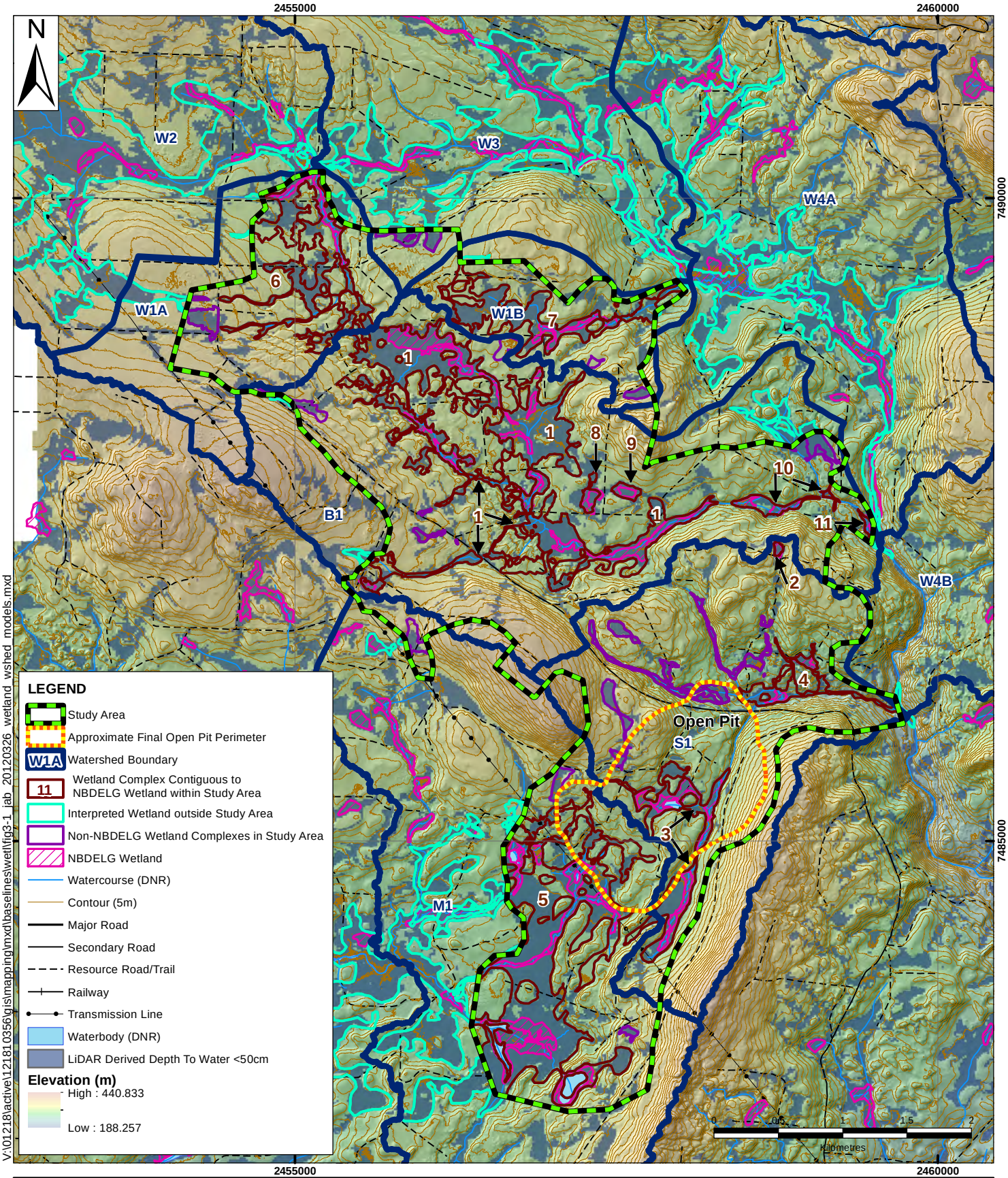
3.1.2.1 Vegetation Communities with Elevated Potential for SAR or SOCC

3.1.2.1.1 Wetlands

Wetlands, although not uncommon at a provincial scale, include many uncommon sub-types and microhabitats and are well known for providing important habitat to a number of rare and uncommon species (Flather *et al.* 1998; NBDNRE 2002). In particular, wetland margins represent a low percentage of total available habitats. Field surveys for this Project initially targeted NBDELG wetlands appearing on the GeoNB wetland layer maintained by the Province (4.1% of the Study Area), but were augmented to include field-identified wetlands. Field-identified wetlands were surveyed for plant SAR, SOCC, and dominant plant species during wetland surveys.

3.1.2.1.2 Eastern White Cedar Dominated Forest Stands

Eastern white cedar dominated forest stands, particularly in wet areas, are known habitat for a number of species in the orchid family, many of which are SAR, SOCC, or uncommon (Hinds 2000). Eastern white cedar has a limited distribution in the ecodistrict as a result of a lack of calcareous soil units. Additionally, the “site indicator” classification of forest stands is not an accurate predictor of wet soil conditions. As such, habitat targeted for surveys included forest stands where eastern white cedar was a dominant species (40% or greater) in the overstory, as indicated by the NBDNR forest cover map.



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Wetland and Watershed Models

Sisson Project: Baseline Vegetated and Wetland Environments Technical Report

Napadogan, N.B.

Client: Northcliff Resources Ltd.

Scale:	Project No.:	Data Sources:	Fig. No.:
1:40,000	121810356	NBDNR, SNB Leading Edge Geomatics	3.1

Date: (dd/mm/yyyy)	Dwn. By:	Appd. By:
11/04/2012	JAB	DM

Stantec

Map: NAD83 CSRS NB Double Stereographic

3.1.2.1.3 Watercourses

Watercourses provide important habitat for SAR and SOCC, including Anticosti aster, which unconfirmed records indicate may have been found near the Study Area (sub-section 2.2.2.4). Since the specific habitat characteristics of watercourses cannot be determined from available data or aerial imagery, all watercourses within the Study Area were assumed to have potential for SAR and SOCC.

3.1.2.1.4 Lake Margins

Also known as lacustrine shallow water wetlands (National Wetlands Working Group 1997), lake margins provide uncommon habitat for SAR and SOCC aquatic and semi-aquatic plants, including prototype quillwort, which AC CDC predictive range maps indicate may be found in the Study Area (sub-section 2.2.2.4). Aquatic and semi-aquatic plants can be rooted or have free floating roots, and be completely submerged, floating on water, or with only lower plant parts submerged. Christmas and Trouser lakes, the only lakes in the Study Area, are possible habitat for prototype quillwort and other aquatic and semi-aquatic plants, and were subjected to field surveys. Other mapped open water habitats within the Study Area are largely the result of beaver activity, and were not included in the field surveys. Beaver-formed open water habitats are subject to frequent and sometimes large changes in hydrology. As a result, these habitats tend to be unstable, and typically contain uneven communities strongly dominated by common pioneer species adapted to these conditions (*e.g.,* blue-joint reedgrass (*Calamagrostis canadensis*), bulrushes (*Scirpus* spp.)).

3.1.2.1.5 Wet, 40+ Year Old Black Spruce- Or Red Maple-Dominated Forest Stands

Wet forest stands that are at least 40 years old and dominated by black spruce or red maple were targeted for field surveys as they are potential habitat for southern twayblade (*Listera australis*). Surveys for southern twayblade were conducted based on methods used by AC CDC, and previously used by Stantec biologists (Stantec 2010). “Wet” forest was defined as those stands with a “W” or “P” site indicator on the NBDNR forest cover map and as relatively flat stands (determined by the DEM). Wetland modelling maps produced for the Study Area and surrounding areas typically identified these stands as wetland.

3.1.2.1.6 Mature Tolerant Hardwood Stands

Mature tolerant hardwood stands (*i.e.* characterized by a dominance of tree species that grow well in shade) are relatively uncommon in New Brunswick, and are a known habitat for several SAR and SOC. They are the preferred habitat of butternut, a SAR with a range overlapping the Study Area as indicated by AC CDC predictive range maps. Mature tolerant hardwood stands located in the Study Area were included in the field surveys to confirm their potential to contain plant SAR or SOCC.

3.2 BOTANICAL FIELD INVESTIGATIONS

This section describes the methods and results of field studies conducted to describe the Vegetated Environment within the Study Area.

3.2.1 Methods

Stantec conducted vegetation surveys from early June to mid-September 2011 to identify vascular plant species present and to describe major vegetation communities in the Study Area. Species composition and abundance were recorded and photos were taken for each of three strata (*i.e.*, tree canopy, woody understory, and herbaceous ground cover), at points distributed among the various vegetation communities throughout the Study Area. Floristic habitat sampling (Newmaster *et al.* 2005) was completed by random meandering throughout the major vegetation communities. Hinds (2000) and Gleason and Cronquist (1991) were consulted for identification of unknown species, and nomenclature followed AC CDC (2011).

Surveys for plant SAR and SOCC used floristic habitat sampling focused on targeted areas identified through desktop analyses (Section 3.1.2). The geographical coordinates were recorded for the first encounter with all vascular plant species, dominant vascular plant species in each habitat type, and all SAR or SOCC vascular plant species.

3.2.2 Results

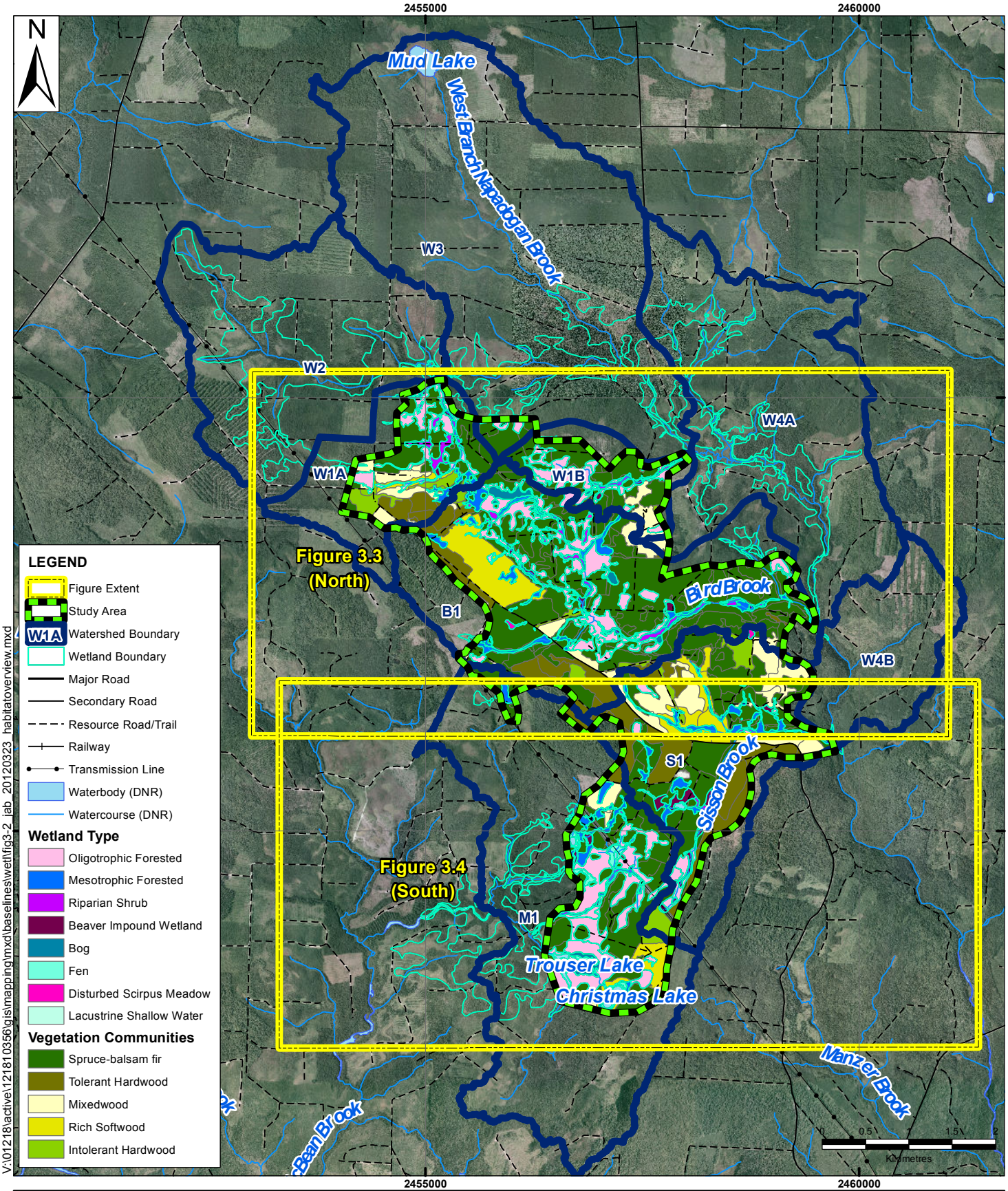
A total of 315 vascular plant species (Appendix B) was identified in the Study Area during the vegetation surveys. The complete listing of vascular plant species identified in the field surveys is provided in Appendix B. Surveys were conducted in all major vegetation communities in the Study Area, with additional field effort in uncommon habitats or in those identified as having elevated potential for plant SAR and/or SOCC (Section 3.1.2). The following sections provide the descriptions of the major habitats found within the Study Area, the results of surveys in habitats with high potential for plant SAR or SOCC, and a summary of the plant SOCC and other uncommon species recorded.

3.2.2.1 Major Vegetation Communities Within the Study Area

This section describes each habitat type and their distribution within the Study Area. These vegetation communities were initially generated from NBDNR forestry and NBDELG wetland data, and then updated with field survey observations and interpretation of LiDAR data and aerial imagery.

A summary of vegetation communities found in the Study Area, including total area of habitat type in the Study Area and their associated percentage of the Study Area, is provided below (Table 3.1), and the vegetation communities are mapped in Figures 3.2 to 3.4.

The condition of the vegetation communities (particularly the forest overstory), has been shaped by many decades of logging activity including harvesting (mostly clear-cutting with some partial cutting in tolerant hardwood stands), pre-commercial thinning, and road construction. These activities have created a landscape that is dominated by young forest stands and in some mixedwood forest areas, a stronger presence of early successional tree species such as pin cherry (*Prunus pensylvanica*) and blue birch (*Betula xcaerulea*). Frequent and severe disturbances associated with logging may also have contributed to the displacement of some plant species that are sensitive to disturbance (*e.g.,* some species of orchids) from the area, if they were once present.



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Vegetation Commmunities Overview

Sisson Project: Baseline Vegetated and Wetland Environments Technical Report

Napadogan, N.B.

Client: Northcliff Resources Ltd.

Scale:	Project No.:	Data Sources:	Fig. No.:
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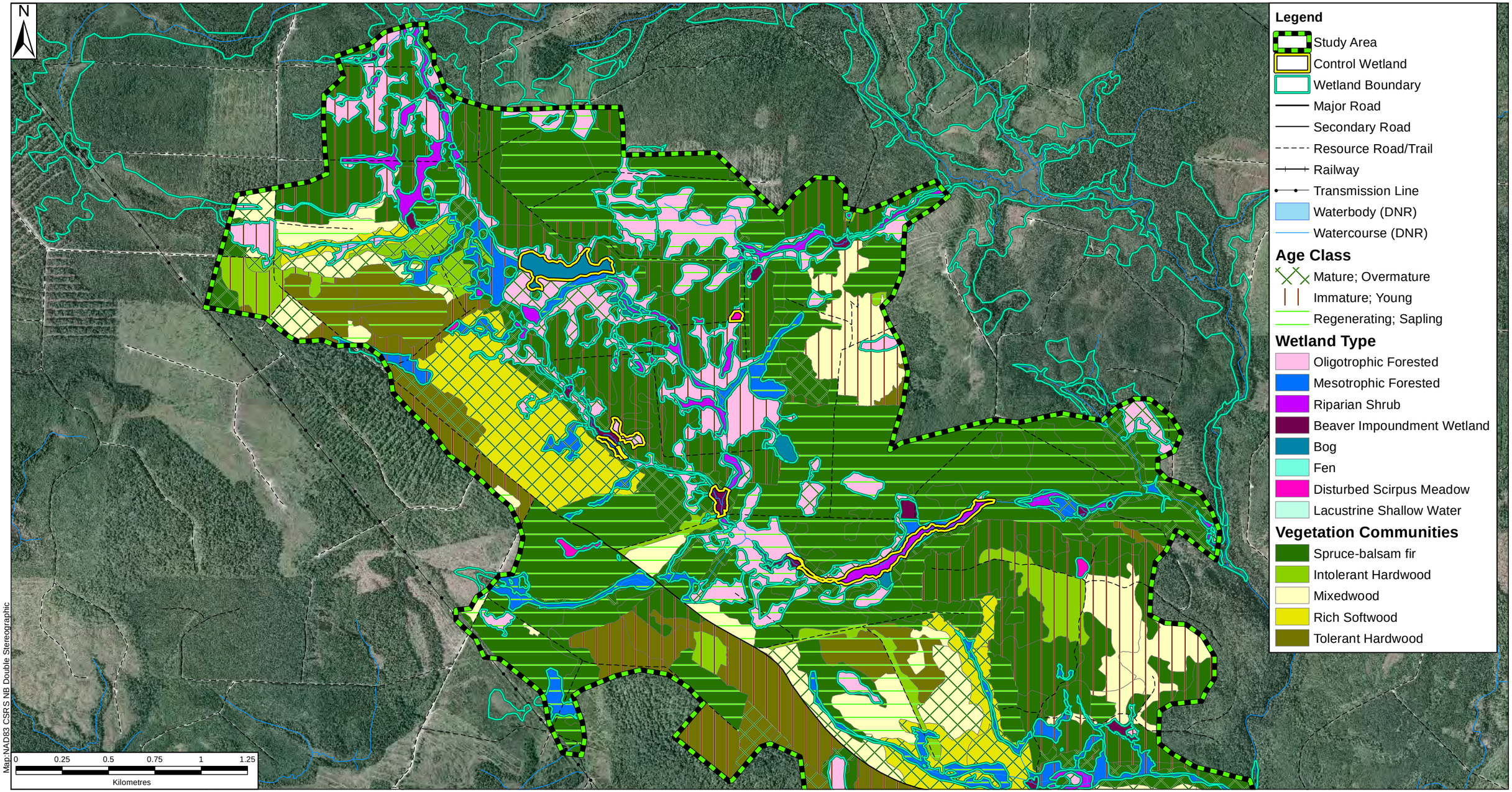
Date: (dd/mm/yyyy)	Dwn. By:	Appd. By:
23/03/2012	JAB	DM

Stantec

Map: NAD83 CSRS NB Double Stereographic



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Vegetation Communities (North)

Sisson Project: Baseline Vegetated and Wetland Environments Technical Report

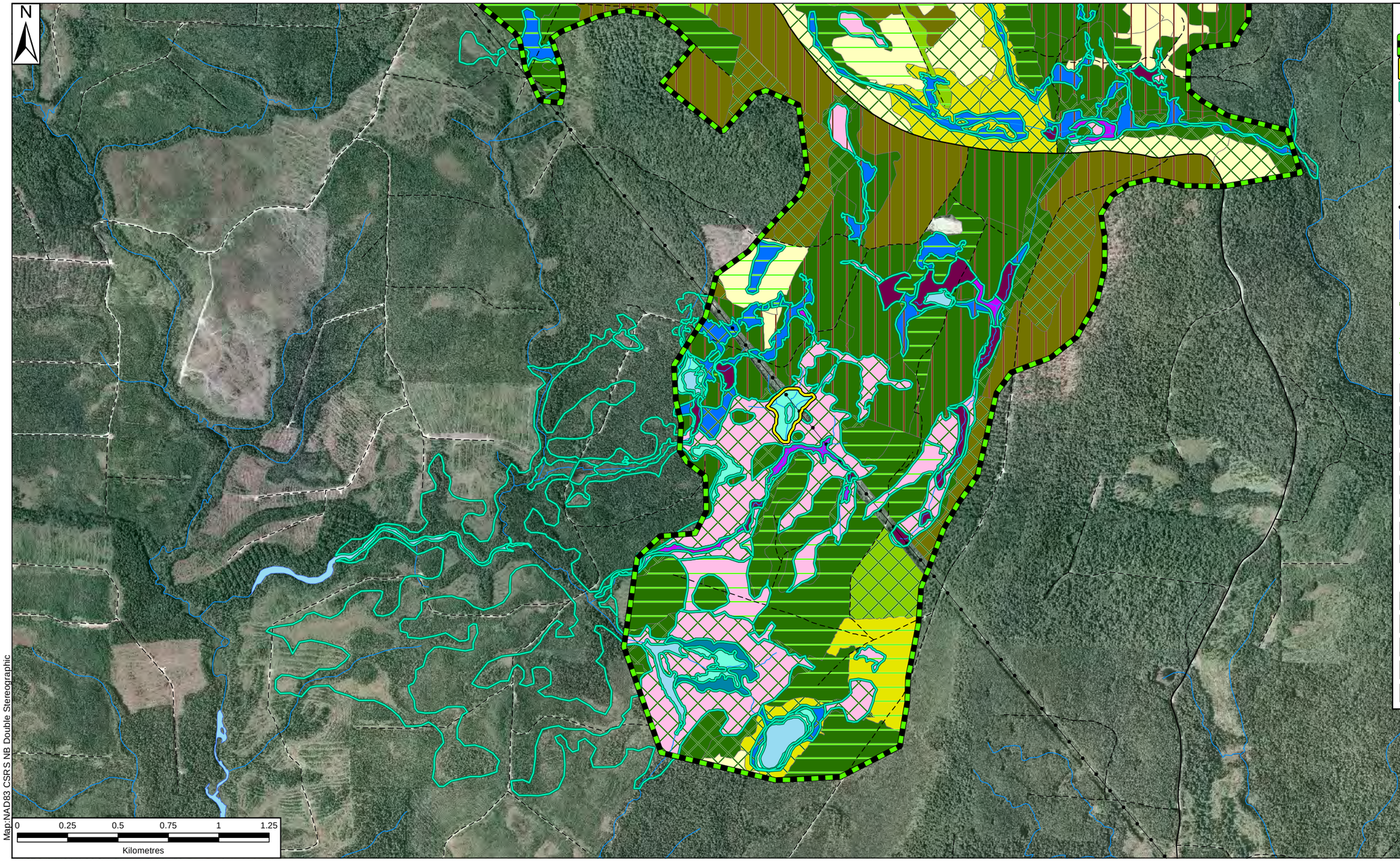
Napadogan, N.B.

Client: Northcliff Resources Ltd.

Scale:	Project No.:	Data Sources:	Fig. No.:
1:20,000	121810356	NBDNR Imagery Provided By: NBDNR	3.3

Date: (dd/mm/yyyy):	Fig. By:	Appd. By:
23/03/2012	JAB	DM

Stantec



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Vegetation Communities (South)

Sisson Project: Baseline Vegetated and Wetland Environments Technical Report

Napadogan, N.B.

Client: Northcliff Resources Ltd.

Scale:	Project No.:	Data Sources:	Fig. No.:
1:20,000	121810356	NBDNR Imagery Provided By: NBDNR	3.4

Date: (dd/mm/yyyy):	Fig. By:	Appd. By:
26/03/2012	JAB	DM

Stantec

Table 3.1 Areas and Percentages of Vegetation Communities Within the Study Area

Habitat type	Area of Habitat Type within the Study Area (ha)	Percentage of Total Area of the Study Area
Upland Habitats		
Spruce-Balsam Fir	822.9	48.6
Tolerant Hardwood	189.2	11.2
Mixedwood	133.8	7.9
Rich Softwood	98.7	5.8
Intolerant Hardwood	55.1	3.3
Wetland Habitats		
Oligotrophic Forested Wetland	229.7	13.6
Mesotrophic Forested Wetland	72.2	4.3
Shrub Riparian Wetland	32.3	1.9
Beaver Impoundment Wetland	21.2	1.2
Bog	12.0	0.7
Fen	9.1	0.5
Disturbed Scirpus Meadow	2.6	0.2
Lacustrine Shallow Water Wetland	0.9	0.1
Other		
Non-forested (transmission line, waterbodies, industrial/mining areas)	15.4	0.9
Total	1,694.8	--

3.2.2.1.1 Spruce-Balsam Fir

Spruce-Balsam Fir upland habitat is the most common habitat type in Study Area, comprising 48.6% of the Study Area. This habitat type is composed of stands ranging in age from recently harvested to mature, with the majority of stands approximately 20 to 35 years old, and pre-commercially thinned (PCT) from recently to 15 years ago. The overstory in these stands is dominated by balsam fir and red or black spruce, with some red maple (*Acer rubrum*), and white birch (*Betula papyrifera*). The woody understory, depending on the age and openness of a stand (*i.e.,* how recently PCT occurred), is typically dominated by regenerating balsam fir, red spruce, red maple, and some mountain paper birch, with pin cherry (*Prunus pensylvanica*), and red raspberry (*Rubus idaeus*). The herbaceous ground layer is dominated by bryophytes (such as Schreber's feathermoss (*Pleurozium schreberi*), a moss (commonly known as broom moss, *Dicranum scoparium*), waxyleaf moss (*Dicranum polysetum*), and stairstep moss (*Hylocomium splendens*)), bunchberry (*Cornus canadensis*), wood ferns (primarily evergreen woodfern (*Dryopteris intermedia*)), velvet-leaved blueberry (*Vaccinium myrtilloides*), and wild lily-of-the-valley (*Maianthemum canadense*).

3.2.2.1.2 Tolerant Hardwood

Tolerant hardwood habitat (characterized by a dominance of tree species that grow well in shade) is the second most prevalent upland habitat within the Study Area, representing 11.2% of the Study Area. Tolerant hardwood is restricted to higher slopes mostly in the southern and western portions of the Study Area where soils are richer and drainage is good. Much of this habitat has been partially harvested within the last 20 years, leaving approximately one-third of the residual overstory canopy, often in a linear strip pattern. Tolerant hardwood stands in the Study Area are dominated in the

overstory layer by sugar maple, yellow birch, and beech (*Fagus grandifolia*), with scattered amounts of white birch, red spruce, and balsam fir. On more southerly exposures, recently harvested, regenerating stands are often dominated by dense regrowth of red raspberry, and sapling-sized pin cherry, beech, and/or white birch, with shade tolerant species scattered throughout. Tolerant hardwood stands in the southern portion of the Study Area contain small amounts of hemlock. The woody understory is primarily dominated by immature or stunted beech (beech canker is quite advanced in the Study Area and surrounding area), hobblebush, striped maple, or other immature overstory species. The herbaceous ground cover community is dominated by wood ferns (primarily evergreen woodfern (*Dryopteris intermedia*)), shining firmoss (*Huperzia lucidula*), common wood sorrel (*Oxalis montana*), and uncommon members of the lily family (Liliaceae), such as painted trillium (*Trillium undulatum*), yellow trout lily (*Erythronium americanum*), Indian cucumber root (*Medeola virginiana*), and rose twisted-stalk (*Streptopus lanceolatus*).

The tolerant hardwood stands in the Study Area are representative of moderately rich sites, with few rich site indicator species such as ironwood (*Ostrya virginiana*), white ash, beaked hazel (*Corylus cornuta*), and baneberry (*Actaea* spp.), which are common in tolerant hardwood stands with more calcareous soils in the province.

3.2.2.1.3 Mixedwood

Mixedwood habitat is scattered throughout the Study Area; representing 7.9% of the Study Area. These stands are typically transitional between hardwood stands on upper slopes, and softwood stands at lower elevations. Some mixedwood stands have been recently harvested, while others are in a young or regenerating state; there are only a few mature-overmature mixedwood stands in the Study Area. The tree canopy stratum, when present, is typically dominated by red spruce, yellow birch, balsam fir, red maple, and/or white birch. The woody understory includes species such as regenerating balsam fir, red maple, yellow birch, and/or red spruce, hobblebush, and striped maple. The herbaceous understory is usually dominated by wood sorrel, evergreen woodfern, goldthread (*Coptis trifolia*), wild sarsaparilla (*Aralia nudicaulis*), and hay-scented fern (*Dennstaedtia punctilobula*).

3.2.2.1.4 Rich Softwood

Rich softwood habitat is characterized by the presence of more nutrient demanding species that are present in the typical oligotrophic black spruce stands that are widespread within the Study Area. This habitat is uncommon within the Study Area, with only four contiguous areas totalling 5.8% of the Study Area. These stands are generally on slopes that lead to mapped watercourses or waterbodies with narrow fringing wetland. The largest of these areas is near the centre of the Study Area, on the northeast side of Fire Road, sloping downhill toward Bird Brook. Another rich softwood habitat surrounds two tributaries of Sisson Brook and their confluence. A third surrounds Christmas Lake and associated wetlands. The fourth, smallest rich softwood stand surrounds a tributary to West Branch Napadogan Brook. All but one of the rich softwood stands is mature and the majority of area has been subject to some form of forest management, primarily partial cuts and two-pass cuts. These rich softwood habitats are dominated in the tree canopy layer by red spruce, with smaller amounts of yellow birch, red maple, and/or balsam fir. The woody understory layer is dominated by regenerating red spruce, balsam fir, and/or yellow birch. The herbaceous ground cover is typically sparse, but contains scattered amounts of species such as mountain wood fern (*Dryopteris campoptera*), flat-branched tree-clubmoss (*Lycopodium obscurum*) and round-branched tree-clubmoss (*Lycopodium dendroidium*),

goldthread, creeping snowberry (*Gautheria hispidula*), and wild lily-of-the-valley, with some bryophyte species (such as Schreber's feathermoss, broom moss, waxyleaf moss and stairstep moss).

3.2.2.1.5 Intolerant Hardwood

Intolerant hardwood (characterized by a dominance of tree species that do not grow well in shade) is the least common upland habitat type within the Study Area, comprising 3.2% of the Study Area. Some intolerant hardwood stands are located in northwest portion of the Study Area near the junction of Fire Road and Four Mile Brook Road. Other stands are scattered throughout the Study Area. Most of the intolerant hardwood habitat in the Study Area is in a regenerating stage; the oldest intolerant hardwood stand is less than 50 years old. There are two main intolerant hardwood stand types within the Study Area. One of these types has an overstory canopy layer that is strongly dominated by red maple, with smaller amounts of yellow birch, balsam fir, red spruce, and white birch. The other type of intolerant hardwood stand within the Study Area has an overstory layer dominated by trembling aspen. Both of these intolerant hardwood stands have a woody understory layer dominated by a combination of red maple, striped maple, mountain maple, yellow birch, and/or sugar maple. The herbaceous understory is dominated by common forest species such as bunchberry, wood sorrel, and wood ferns.

3.2.2.1.6 Wetland Habitats

Wetland habitats are described in detail in Section 3.3.2.

3.2.2.2 Habitats with Elevated Potential for SOCC

As described in Section 3.1.2, several vegetation communities were identified as having elevated potential for plant SAR and SOCC based on existing data for the site. Figure 3.5 shows the extent of these habitats in the Study Area.

3.2.2.2.1 Wetlands

Wetlands were identified through field surveys, and are common in the Study Area, comprising 22.6% of its total area. Individual wetland types, however, were not all common. Four of the eight wetland types identified each account for less than 1% of the Study Area. Although no SAR or SOCC were found in wetlands within the Study Area, many of the uncommon species described in sub-section 3.2.2.4 below were found in wetlands.

3.2.2.2.2 Eastern White Cedar Dominated Forest Stands

Eastern white cedar dominated forest stands, included for their potential to provide habitat for a number of SAR and SOCC (particularly in the orchid family), are not found in the Study Area based on modelling results. Only 10 such stands are located within 2 km of the Study Area. Several of these stands were surveyed opportunistically despite being outside the Study Area, and one plant SOCC was identified, spotted coralroot (*Corallorhiza maculata* var. *occidentalis*, ranked by AC CDC as "S2S3" and by CESCC as "Sensitive"), but this species was not found within the Study Area.

3.2.2.2.3 Watercourses

Watercourses in the Study Area were surveyed for plant SAR and SOCC, including Furbish's lousewort and Anticosti aster. Watercourses in the Study Area are generally first to third order and associated with wetlands, and did not provide the type of habitat associated with Furbish's lousewort and Anticosti aster (namely, fast-flowing, seasonally-flooded watercourses with banks of calcareous, sandy or gravelly, well-drained soils, or limestone outcrops). No SAR or SOCC were found on or adjacent to watercourses within the Study Area.

3.2.2.2.4 Lake Margins

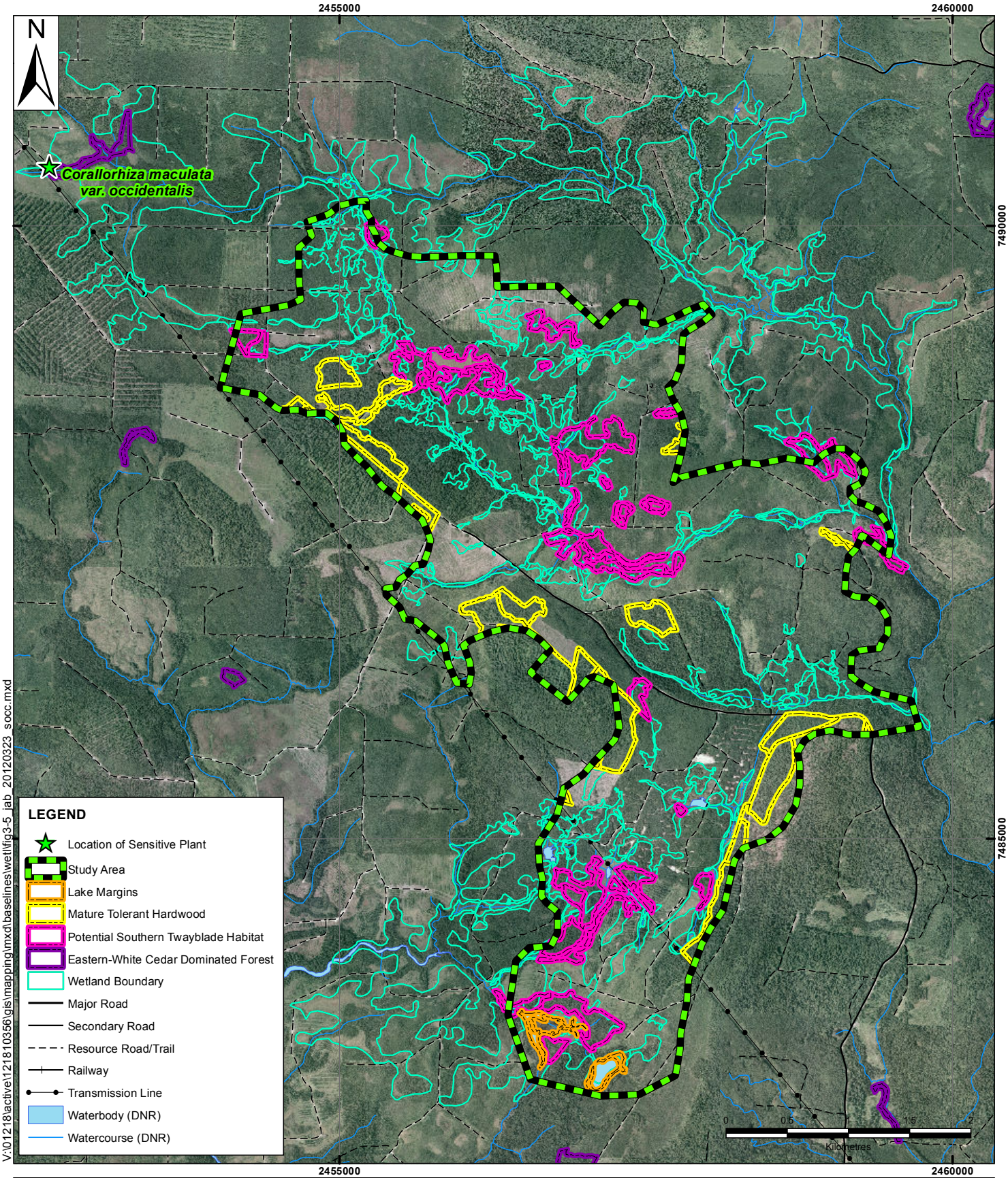
Two lakes exist within the Study Area, both near the southern extent. Trouser Lake was not surveyed for prototype quillwort as the fen wetland adjacent to Trouser Lake transitioned directly into deep water lake habitat, making it unsuitable wetland habitat for that species. The lacustrine shallow water wetland of Christmas Lake was surveyed, but prototype quillwort was not discovered. Stantec determined through these surveys that conditions were not suitable for this plant, as the lake substrate and water column are silted.

3.2.2.2.5 Wet, 40+ Year Old Black Spruce- Or Red Maple-Dominated Forest Stands

Wet, black-spruce or red maple-dominated forest stands greater than 40 years old, along with bogs or peatlands, were surveyed to target potential southern twayblade habitat. This habitat type is extensive within the Study Area, covering 126.0 ha. As these sites were selected using high-level forest cover data, Stantec further evaluated these habitats on-site for their potential to provide habitat for southern twayblade, and those habitats with suitable conditions were surveyed during the optimal detection time of mid-June to mid-July. Southern twayblade was not found in the Study Area, but two other non-SAR or SOCC twayblade species with overlapping habitat requirements, heart-leaved twayblade (*Listera cordata*) and broad-leaved twayblade (*L. convallarioides*), were found within the Study Area. Heart-leaved twayblade was found in a mesotrophic forested wetland adjacent to Bird Brook. Broad-leaved twayblade was found in an oligotrophic forested wetland adjacent to Trouser Lake.

3.2.2.2.6 Mature Tolerant Hardwood Stands

Mature tolerant hardwood stands identified through NBDNR forestry data were surveyed. Generally, these stands had moderate species richness, and were not as rich as tolerant hardwood stands in other areas of New Brunswick. Many of the mature tolerant hardwood stands in the Study Area have been partially harvested in the last 20 years. No SAR or SOCC were found in mature tolerant hardwood habitat within the Study Area.



NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC PROJECT AND SHOULD NOT BE USED FOR OTHER PURPOSES.

Potential Habitat for Species at Risk and/or Species of Conservation Concern Sisson Project: Baseline Vegetated and Wetland Environments Technical Report Napadogan, N.B.	Scale: 1:42,000	Project No.: 121810356	Data Sources: NBDNR, Imagery Provided By: NBDNR Google Earth Pro	Fig. No.: 3.5	Stantec
	Date: (dd/mm/yyyy) 23/03/2012	Dwn. By: JAB	Appd. By: DM		
Client: Northcliff Resources Ltd.					

Map: NAD83 CSRS NB Double Stereographic

3.2.2.3 SAR or SOCC

No plant SAR or SOCC were found within the Study Area.

One plant SOCC, spotted coralroot (*Corallorhiza maculata* var. *occidentalis*, ranked by AC CDC as "S2S3" and ranked by CESCC as "Sensitive") was found outside the Study Area in a mature mixedwood stand on the edge of a riparian eastern white cedar and black spruce dominated forested wetland with sparse understory, approximately 2.0 km northwest of the Study Area.

Spotted coralroot is a non-photosynthetic mycotrophic orchid in the orchid family that forms a dependent relationship with a very small group of fungi in the Russulaceae family. The habitat of spotted coralroot is described broadly as woods, or dry, older coniferous, deciduous, or mixedwood stands with little other herbaceous cover (Gleason and Cronquist 1991; Hinds 2000). Although many of the mature forested habitats within the Study Area were surveyed, spotted coralroot was not found within the Study Area.

3.2.2.4 Uncommon Secure Species

Although no SAR or SOCC were found within the Study Area during vegetation surveys conducted in support of the Project, 315 vascular plant species were recorded during the field surveys. Of these, eight uncommon species were identified with an AC CDC S-rank of S3 (defined as "Uncommon, or found only in a restricted range, even if abundant at some locations," with only 21 to 100 known occurrences in the province; AC CDC 2011). These species, though ranked S3 by AC CDC, are ranked "Secure" by CESCC and are not considered SOCC. These species are discussed below.

Pickering's reed grass (*Calamagrostis pickeringii*) is a rhizomatous perennial grass (grass family, Poaceae) found primarily in bogs, wet shores, and wet, open woods. This species was found in a bog near the centre of the Study Area, surrounded by oligotrophic forested wetland.

Michaux's sedge (*Carex michauxiana*) is a sedge (sedge family, Cyperaceae) found in bogs and boggy meadows. This species was found in a small fen wetland bordering the lacustrine shallow water wetland in Christmas Lake, near the southern extent of the Study Area.

Necklace spike sedge (*Carex ormostachya*) is a caespitose, perennial sedge typically found in rich hardwoods. This species was identified in a mature tolerant hardwood stand located on a hillside near the western boundary of the Study Area.

Ground-fir (*Diphasiastrum sabinaefolium*) is a fern ally (club-moss family, Lycopodiaceae) found in dry, open forest stands. It was found in an open, upland, sapling-aged stand dominated by black spruce and balsam fir, located near the centre of the Study Area.

White fringed orchid (*Platanthera blephariglottis*) is an orchid (Orchidaeceae family) and is found primarily in open, sphagnous bogs. It was identified in the transition between a mesotrophic forested wetland and a small fen fringing Christmas Lake, near the southern extent of the Study Area.

Dotted smartweed (*Polygonum punctatum*), an annual herbaceous dicot (buckwheat family, Polygonaceae), is typically found on gravelly or muddy shores. This species was found in muddy soil in a beaver meadow wetland on the edge of Bird Brook.

Brown beakrush (*Rhyncospora fusca*) is a rhizomatous, perennial monocot (sedge family, Cyperaceae) most often found in bogs, marshes, and other wetland habitats. It was found in a small fen bordering the lacustrine shallow water wetland in Christmas Lake, near the southern extent of the Study Area.

Bog willow (*Salix pedicellaris*), a deciduous shrub (willow family, Salicaceae), is found primarily in bogs and acidic shrubby wet meadows (Hinds 2000; Mittelhouser *et al.* 2010). It was identified in a disturbed mesotrophic forested stand in the southern portion of the Study Area.

3.2.3 Summary

Botanical field investigations were conducted in the Study Area and vicinity, to characterize the baseline vegetated environment and to determine the presence of vascular plant SOCC and SAR in and around the Study Area. Major vegetation communities were determined, described, and mapped, including upland and wetland habitats. Five upland vegetation communities were found within the Study Area, including balsam fir- spruce, tolerant hardwood, mixedwood, rich softwood, and intolerant hardwood. A total of 315 plant species (Appendix B) were identified in the Study Area and surrounding area. One SOCC (spotted coralroot) was found outside the Study Area, but none were identified within the Study Area. The study identified no plants that are SAR within or outside the Study Area.

3.3 WETLAND FIELD INVESTIGATIONS

Stantec conducted field work to verify the accuracy of the wetland model described in Section 3.1.1, and to collect field data to assist in the delineation and functional assessment of wetlands in the Study Area. The field work involved the collection of various data including paired sample plots, plant species (secure, uncommon, SOCC and SAR, as the case may be), habitat photographs and observational notes on wetland features in order to characterize the function of wetlands within the Study Area. All major wetland complexes in the Study Area were at least partially delineated in the field, and functional assessments were conducted for all of those wetlands or wetland complexes that are provincially mapped. Field delineation was conducted wherever the accuracy of the wetland model was uncertain or required verification, and wherever habitat information gaps warranted field investigation (for collection of information on plants, habitat, wildlife, or other wetland functions). The relationship between wetlands and surface water drainage was determined.

3.3.1 Methods

3.3.1.1 Field Delineation of Wetlands

Stantec wetland biologists carried out the field work for the purpose of delineating wetlands in the Study Area between June and September 2011, coinciding with the botanical field investigations.

Wetland delineation was conducted in accordance with the Corps of Engineers Wetland Delineation Manual (Environmental Laboratory 1987) and the Draft Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (U.S. Army Corps of Engineers 2008). Stantec surveyed all wetlands for rare plants and the dominant vegetation was recorded. Field data were recorded using hand-held GIS-equipped global positioning system (GPS) units (*i.e.,* Trimble Nomad GPS Unit in conjunction with an SXBlue GPS receiver, which is capable of providing sub-metre accuracy). These units were equipped with the LiDAR-based wetland model and other base data for the site (*i.e.*, roads, waterbodies, forest cover) so that the wetland model could be verified and adjusted based on actual boundaries of wetlands as determined in the field.

Near the completion of the field program, representative wetlands of each type encountered were selected to record data vegetation, hydrology, and soils to illustrate the typical conditions for those parameters for wetlands in the Study Area. These Control Wetlands are considered typical to others of the same type in the Study Area. Stantec collected data at paired point locations at the boundary of each Control Wetland on vegetation, hydrology, and soil data and to support a determination of wetland or upland status, in accordance with the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987). The locations of these data points, as well as the wetland boundaries, were recorded. Wetland data were recorded on NBDELG Wetland Delineation Data Sheets (Appendix C). Munsell Soil Color Charts (Kollmorgen Instruments Co. 1990) were used to identify hydric soils within the Study Area. Information was also collected pertaining to basic landscape features such as nearby upland habitat and hydrological features such as small streams or watercourses.

Identification and delineation of non-control wetlands was conducted using one, two or three parameters (*i.e.,* vegetation, hydrology, and/or soils). Habitat points and transitions were recorded to assist in differentiating between wetland types within complexes.

3.3.2 Results

3.3.2.1 Wetland Types within the Study Area

The wetland classification system used by Stantec was developed to characterize the wetlands within the Study Area from both a functional and physical perspective. The basis for wetland classification system is the current New Brunswick naming convention used by NBDNR and NBDELG, with additional descriptive qualifiers based on the Canadian Wetland Classification System.

Stantec identified a total of 380 ha of wetland within the Study Area (22.4% of Study Area) that was distributed among eight types of wetland (Table 3.2). Boundaries and classifications were determined based on a combination of field delineation, habitat data, wetland model and interpretation of remote sensing data.

Table 3.2 Summary of Wetland Types Within the Study Area

Wetland Type	Number of Wetland polygons	Total Area of Wetland Type in the Study Area (ha)	Area of Wetland Type as a Percentage of the Study Area	Dominant Vegetation	Primary Water Source
Oligotrophic Forested Wetland (OFW)	139	229.7	13.6	black spruce over ericaceous shrub	rain with some surface runoff
Mesotrophic Forested Wetland (MFW)	30	72.2	4.3	balsam fir, black spruce, red maple, and blue birch	watercourses and seepages
Shrub Riparian Wetland (SRW)	44	32.3	1.9	speckled alder, with understory of tall meadow rue, spotted touch-me-not, sensitive fern, and blue-joint reed grass	watercourses, seepages, and other surface flow
Beaver Impoundment Wetland (BIW)	34	21.2	1.2	blue-joint reed grass, black gridle wool grass; and sometimes leatherleaf and bayberry	watercourses
Bog	10	12.0	0.7	boreal bog sedge, tussock cottongrass, three-leaved false Solomon's seal, northern pitcher plant, black spruce and larch	rain
Fen	5	9.1	0.5	few-flowered sedge, few-seeded sedge, northern arrowhead, Michaux's sedge, and three-leaved Solomon's seal	groundwater and watercourses
Disturbed Scirpus Meadow (DSM)	11	2.6	0.2	wooly bulrush	stormwater from roadside ditches and other surface runoff
Lacustrine Shallow Water Wetland (LSW)	1	0.9	0.1	white buttons	groundwater
Total	**274**	**380**	**-**		

Further details on each of these wetland types are provided in the sub-sections that follow.

3.3.2.1.1 Oligotrophic Forested Wetland

Oligotrophic forested wetland (OFW), a typical one of which is shown in Photo 1, is the most abundant wetland type with the Study Area, occupying approximately 230 ha (13.6% of the Study Area). This wetland type does not have great peat accumulation, typically less than 30 cm. They are prone to partially drying out during droughty periods and to forest fires under such conditions, although fire suppression and forest management in recent decades have arrested that cycle in the Study Area. Data on soils, vegetation and hydrology for the OFW Control Wetland and adjacent upland are included in Appendix C.

Photo 1 Young oligotrophic forested wetland dominated by pre-commercially thinned black spruce with ericaceous and wild raisin shrub understory.

Vegetation

OFWs typically have a forest cover dominated by black spruce with lesser components of balsam fir. The understory is dominated by ericaceous shrubs including northern wild raisin (*Viburnum nudum*), sheep laurel (*Kalmia angustifolia*), velvet-leaved blueberry and mountain holly, with an herbaceous layer of three-seeded sedge (*Carex trisperma*), two-seeded sedge (*C. disperma*), bunchberry, and sphagnum mosses (*Sphagnum* spp.). Large areas of this wetland type have historically been affected by forestry operations in the Study Area, and most areas have been cutover within the last 25 years and have since been pre-commercially thinned. This has led to a well-developed herbaceous and shrub understory in the openings, and the age class of the forest structure is young and contains more spruce that would be present in the absence of pre-commercial thinning.

Hydrology

These wetlands form the greater part of large complexes associated with the upper reaches of catchments and associated with headwater streams. These wetlands are wet most of the time but they are dryer than other wetlands types, lacking wetland characteristics near upland transitions particularly during droughty periods. Within the larger wetland complexes, the OFW is usually adjacent to upland while the slightly richer mesotrophic forested wetlands (MFW) and beaver impoundment wetlands (BIW) fringe the watercourses where they receive periodic mineral and organic material input during flooding.

Soils

The soils underlying these wetlands are derived from coarse-textured granitic glaciofluvial deposits and stony lodgement till. A layer of peat up to 30 cm thick covers the mineral soil with stones and small boulders emerging through it along the wide fringing transitions to upland.

3.3.2.1.2 Mesotrophic Forested Wetland

Mesotrophic forested wetland (MFW), a typical one of which is shown in Photo 2, is the second most abundant wetland type within the Study Area, covering approximately 72 ha (4.3% of the Study Area). These wetlands are distributed throughout the Study Area and are associated with watercourses and areas of groundwater discharge and seepage. They tend to be situated between OFW and watercourses or in deeply incised gorges. These wetlands tend to be more consistently wet, and as they tend to occupy areas closer to streams, they are more influenced by flooding. They are less prone to dryness and forest fire, but proximity to OFW makes them susceptible to fires. Data on soils, vegetation and hydrology for the MFW Control Wetland and adjacent upland are included in Appendix C.

Photo 2 A view of a typical mesotrophic forested wetland showing scattered maples (*Acer* spp.), cinnamon fern, balsam fir, and mixed bryophytes.

Vegetation

Mesotrophic forested wetland (MFW) is characterized by a forest cover that ranges from coniferous (balsam fir and black spruce), to mixedwood (balsam fir, red maple, black spruce, and occasional eastern white cedar). The forest cover of this wetland type is in some cases similar to OFW, although in contrast, the understory is not dominated by ericaceous shrubs. The MFW is characterized by ground cover that is usually dominated by mixed fern species interspersed with three-seeded sedge. Associations with watercourses and seepages supply these wetlands with slightly more mineral laden water supply than available to OFW, which when combined with stable hydrology create conditions that can support uncommon plant species. While no SOCC were identified within any of the wetlands in the Study Area, a white fringed orchid was found in a MFW outside of the Study Area. Other uncommon plants found in MFW in the Study Area included checkered rattlesnake-plantain (*Goodyera tesselata*; ranked as "S4" ("Secure") by AC CDC), and dwarf rattlesnake-plantain (*G. repens,* ranked as "S4" ("Secure") by AC CDC). Most of the area of this wetland type within the Study Area is managed for forestry and has been harvested within the last 25 years. Only 15 of the 72 ha of MFW within the Study Area are classed as mature-overmature forest.

Hydrology

MFW tends to be closely associated with watercourses or groundwater discharge points, which are their primary sources of water. Along watercourses, this wetland type usually begins just beyond the typical high water mark with shrub riparian habitat within the flood zone, so that hydrology is somewhat stable within the MFW, and more stable where they are fed by seepage and groundwater discharge.

Soils

The soils in these wetlands have varying depths of peat over silty loam and sometimes mixed organic silty muck that occurs in areas that have had beaver activity in the distant past.

3.3.2.1.3 Shrub Riparian Wetland

There are approximately 32 ha of shrub riparian wetland (SRW) along watercourses throughout the Study Area (1.9% of the Study Area). This wetland type, shown in Photo 3, occurs along watercourses where the water level fluctuates widely either because of beaver activity or "flashy" flow in the associated watercourse, which inhibits the development of a forest cover by drowning trees during high water periods. Beaver activity of varying ages is evident at many locations along most watercourses in the Study Area. These wetlands differ from beaver meadows in that they have developed full shrub layers and have typically not been flooded for extended periods within the last five years. Data on soils, vegetation and hydrology for the SRW Control Wetland and adjacent upland are included in Appendix C.

Vegetation

SRW are strongly dominated by speckled alder (*Alnus incana*), with scattered hybrid birch (*Betula x caerulea*), black spruce, and willow near the margins. The understory is not usually well developed but is dominated by tall meadow-rue (*Thalictrum pubescens*), blue-joint reed grass, spotted touch-me-not (*Impatiens capensis*), and sensitive fern (*Onoclea sensibilis*).

Hydrology

SRW are closely associated with watercourses by definition, and their hydrology is subject to the water level in these. As a result they are subject to inundation during flood periods and over longer cycles through beaver impoundment. SRW are often fringed by a much wider band of forested wetland (*i.e.,* either OFW or MFW). There is some transitional gradient between the two types, but the normal flood level does not usually extend beyond the shrub vegetation into the forested wetland beyond.

Where these wetlands occur along watercourses in gullies, they are also fed by shallow groundwater seepage from the toe of the adjacent slopes.

Photo 3 Shrub riparian wetland showing the typical dense coverage of speckled alder.

Soils

The soils found in SRW vary from mineral soil with very little organic material, to having 40 cm or more of organic muck. The latter condition can be found in areas that were subject to extended periods of beaver impoundment which allowed the accumulation of a deep layer of organic material with some mineral component, before the water level dropped. Where SRW occur along watercourses that are subject to annual freshets there is less accumulation of organic material.

3.3.2.1.4 Beaver Impoundment Wetland

There are approximately 21 ha of BIW within the Study Area (1.2% of the Study Area). This includes active or recently active beaver-made impoundments and the adjacent fringing meadow and are scattered throughout the Study Area with a slight concentration in the southern portion of the Study Area. Most of these wetlands are located at the site of long-term beaver activity where the water level fluctuates from year to year depending on the condition and location of dams. There is commonly a wide fringing meadow surrounding these wetlands. The absence of shrub cover or recent snags of drowned trees as present in typical SRW indicates regular and recent inundation. Within the Study Area, the fringing meadow is typically larger by area than the open water portion of BIW. Data on soils, vegetation and hydrology for the BIW Control Wetland and adjacent upland are included in Appendix C. Photo 4 shows a representative sample of this wetland type.

Vegetation

Plant diversity is low in BIW, which are dominated by blue joint reed grass and black girdle wool grass (*Scirpus atrocinctus*), and have a sparse shrub cover of willow, speckled alder, and young black spruce and balsam fir near the margins. Some wetlands of this type have scattered dense patches of leatherleaf (*Chamaedaphne calyculata*) and sweet gale (*Myrica gale*) growing near the open water. The fluctuation of the water table creates a vegetation community that is dominated by species adapted to a broad range of hydrological conditions and/or pioneer species, and they do not represent high potential areas for rare plants, which are typically adapted to specific and stable conditions. However, two uncommon species were found near the margin of a BIW (mosquito bulrush (*Scirpus hattorianus*) and blunt-leaved orchid (*Platanthera obtusata*)).

Hydrology

These wetlands usually have some open water component and are associated with a watercourse. The proportion of meadow to open water varies greatly depending on the condition of the beaver dam creating the impoundment. Most of these areas undergo regular cycles of rising and dropping water levels as dams are breached and repaired over the years. Over longer periods, these wetlands have very similar functions. Often the wetland boundary will shift if a dam is breached or altered for a sustained period, but they are typically located in flat plains and where wetland conditions are retained in the meadow that forms in the flooded area after a dam breaches. They are also often fed by seepages along the surrounding upland embankments.

Photo 4 **Typical beaver impoundment wetland, looking along the transition to upland at left. The open water is at right**.

Soils

The soils in these wetlands are highly variable depending on the position and the age of the impoundment. If an area has been used for many years, deep layers of organic muck can accumulate. This muck becomes thinner near the edges and in areas where there is flowing water. In the Study Area, this organic muck overlays soil that can be gravelly or stony/bouldery closer to the channel, or comprised of coarse-grained sandy loam derived from weathered granite.

3.3.2.1.5 Bog

There are 12 ha of bog within the Study Area (0.7% of the total area), of which more than 8 ha is divided between two bogs located at opposite ends of the PDA. One, shown in Photo 5, is a typical bog located within the footprint of the proposed tailings storage facility, and the other is located in the southern portion of the Study Area near Trouser Lake. The latter is less typical in that it transitions to fen and is not distinctly raised. These areas exhibit signs of heavy moose usage and moose were observed in the area during field work. Data on soils, vegetation and hydrology for the bog control wetland and adjacent upland are included in Appendix C.

Photo 5 Bog habitat showing typical vegetation.

Vegetation

The bogs within the Study Area have typical vegetation for the region, with stunted tamarack (*Larix laricina*) and black spruce around the margins with various sphagnum mosses and ericaceous shrub species dominating the centre. Dominant shrub species in bogs in the Study Area were Labrador tea (*Ledum groenlandicum*) and leatherleaf, and the herbaceous layer is dominated by *Sphagnum* spp., boreal bog sedge (*Carex magellanica*), tussock cottongrass (*Eriophorum vaginatum*), three-leaved false Solomon's seal (*Maianthemum trifolium*), and northern pitcher plant (*Sarracenia purpurea*).

Hydrology

These bogs are fed by rainwater though they are not fully ombrotrophic, as they appear to be receiving water from adjacent OFW, and indirectly from nearby watercourses. The hydrology of these bogs will be predominantly influenced by precipitation and weather, but occasionally by watercourse flooding and influx from adjacent OFW.

Soils

The soil in the bogs in the Study Area is comprised of sphagnum-based peat. While the depth was not measured, the peat layer is not well developed as bogs are uncommon and small within the Study Area compared to typical bogs found in New Brunswick.

3.3.2.1.6 Fen

There are 9 ha of Fen wetlands within the Study Area (0.5% of the total area), concentrated in the southern portion. These wetlands are usually associated with areas of open water and have some degree of groundwater input. A representative example of a fen is shown in Photo 6. Data on soils, vegetation and hydrology for the Fen Control Wetland and adjacent upland are included in Appendix C.

Photo 6 Fen habitat photo taken near Trouser Lake at the transition from bog to fen.

Vegetation

The fens in the Study Area are typically dominated by few-flowered sedge (*Carex oligosperma*), few seeded sedge (*C. pauciflora*), northern arrowhead (*Sagittaria cuneata*), Michaux's sedge, and three leaved false Solomon's seal. The species richness is high within these wetlands relative to others within the Study Area due to higher mineral availability than other wetland types, the wide gradient of hydrologic conditions from the open water to the upland side, and the absence of dense tree cover. While no plant SAR or SOCC were found, some uncommon species were found in fens in the Study Area including brown beakrush, Michaux's sedge, and white fringed orchid.

Hydrology

Fens are concentrated in the southern portion of the Study Area and all share a degree of connectivity within a large, sprawling wetland complex dominated by OFW. These wetlands all have a high degree of groundwater input as evidenced by the number of springs found during field work. Groundwater input is particularly pronounced in the Trouser and Christmas Lakes area where there are major springs that feed these two bodies of water. The latter is essentially a large spring. The outflow of this lake at the time of field work was approximately 2 m wide while the inflow was less than 50 cm wide (and was also spring fed). Because of the location of these wetlands within large complexes and the high input from groundwater, the hydrology tends to be very stable.

Soils

Soils in fens consist of deep, sedge-based peat. The depth was not measured, but the edge was observed in the clear open water, and was estimated to be at least 2 m deep at the deepest point.

3.3.2.1.7 Disturbed Scirpus Meadow

Disturbed scirpus meadow (DSM), a typical example of which is shown in Photo 7, is relatively uncommon, occupying 2.6 ha (0.15%) of the Study Area. These wetlands tend to form in borrow pits where road building materials were excavated for the construction of forestry roads. While the present wetland conditions would likely change given enough time for more organic material to accumulate, the conditions are stable enough that pits as old as 20 years remained in this condition. Data on soils, vegetation and hydrology for the DSM Control Wetland and adjacent upland are included in Appendix C.

Vegetation

DSM is strongly dominated by common woolly bulrush (*Scirpus cyperinus*) with no forest cover and only scattered willows (*Salix* spp.), grey birch (*Betula populifolia*), and red raspberry around the margins.

Hydrology

DSM accumulate water from surface runoff and from ditches along the adjacent logging roads. Water is usually perched on bedrock and there is some standing water throughout much of the growing season. In spring and following heavy precipitation events, these will often fill, draining gradually afterward over days or weeks.

Soils

DSM typically contain soils consisting of a layer of peat (approximately 10 cm) over a thin layer of disturbed sandy loam. The native soil had been largely removed for road building and the remaining soil rests on bedrock and is mixed textured. Over a time period spanning decades, peat would accumulate further in these wetlands and they would assume a fen-like character.

Photo 7 Disturbed scirpus meadow surrounded by Spruce-Balsam Fir upland.

3.3.2.1.8 Lacustrine Shallow Water Wetland

One lacustrine shallow water (LSW) Wetland, less than 1 ha, within the Study Area, accounting for just 0.05% of the total area. It is located at the southern end of the Study Area. Christmas Lake is classified as an LSW. It is less than 2 m deep and is vegetated throughout with aquatic vegetation so is therefore classified as a wetland (Environmental Laboratory 1987). This wetland is fringed by a band of lacustrine fen and drains into Trouser Lake. It is heavily groundwater fed and contributes to maintaining base flow in McBean Brook. Data on soils, vegetation and hydrology for the LSW Control Wetland and adjacent upland are included in Appendix C. Photo 8 shows a representative sample of this wetland type.

Vegetation

The vegetation is sparse within the wetland, but is evenly distributed throughout with some concentration near the edges. The dominant plant species in this wetland was white buttons (*Eriocaulon aquaticum*), with lesser amounts of slender water milfoil (*Myriophyllum tenellum*), northern arrowhead, ribbon-leaved pondweed (*Potamageton epihydrus*), and variegated pond-lily (*Nuphar variegata*) also present. No plant SAR or SOCC were found, but slender water milfoil, and eastern purple bladderwort (*Utricularia purpurea*), which were found there, are uncommon.

Photo 8 **Lacustrine shallow water wetland at Christmas Lake looking west toward outflow where a moose is standing. The lake is shallow and vegetated predominantly with white buttons (*Eriocaulon aquaticum*).**

Hydrology

This wetland is fed by a large amount of groundwater diffusely seeping in from the bottom of the open water. There is a small inflow on the northeastern side of Christmas Lake that flows from a spring-fed forested wetland, but the watercourse flowing out of Christmas Lake towards Trouser Lake was several times larger than the surface inflow. The wetland is located in an unusual position at the top of a high embankment approximately 5 m higher than Trouser Lake which is nearby to the northwest so that the water cascades down over the embankment toward the Trouser Lake wetland complex. Despite the spring-fed nature of this lake, there is some evidence of minor fluctuations in water level.

Soils

The soils in this wetland type consist of a uniform silty organic muck that is up to 60 cm deep with boulders and stones scattered throughout.

3.3.3 Summary

The majority of wetlands in the Study Area are forested, which is typical of the Beadle Ecodistrict and Central Uplands Ecoregion, although there is a conspicuous absence of eutrophic wetlands such as cedar swamps compared to other ecodistricts in the Ecoregion, reflecting the lack of calcareous and predominance of granitic bedrock formations. The forested wetlands are generally poor in nutrients,

low in plant diversity, and largely dominated by black spruce and balsam fir with ericaceous shrub understory. There is some peat formation in these wetlands, and while the hydrologic input to these maintains wetness with some consistency, it is not sufficiently wet and/or drainage is not sufficiently impeded to allow paludification to progress at a rate that is conducive to bog formation. The scarcity of bogs in the Study Area is typical of the Central Uplands Ecoregion. Evidence of beaver activity of varying ages is nearly ubiquitous along watercourses that do not follow ravines. This activity has shaped the hydrology and vegetation communities of the wetlands in the Study Area.

In the Study Area, the NBDELG wetlands summarized in Table 3.2 were nested within large complexes derived from the types described above. Many of these wetlands are hydraulically contiguous, such that effects on some part of the larger complex may also affect a NBDELG wetland, regardless of proximity.

4.0 FUNCTIONAL ASSESSMENT OF WETLANDS

The New Brunswick *Wetland Conservation Policy* and the *Federal Policy on Wetland Conservation* both state a goal of "no net loss of wetland function". Wetland function is defined as a process or series of processes that take place within a wetland. Valued wetland functions such as providing wildlife habitat, promoting species diversity, transforming nutrients, providing fish habitat, and allowing for resource extraction can be grouped into categories for simplicity: ecological, hydrological, water quality, and sociological functions. These functions can be observed within individual wetlands but are also cumulative, especially where wetlands are connected spatially and/or hydraulically at or below the surface.

While all wetlands fulfill some functions, the degree to which they fulfill specific functions varies widely and depends on variables such as size, watershed position, soil, climate, vegetation type and density, and adjacent upland conditions. Changes to one wetland can alter the functions of other associated wetlands; especially those located hydrologically down-gradient. Some important hydrological, habitat and water quality functions of wetlands may not be measurable at the individual wetland level, but as with any habitat type, including non-wetland areas, may be more pronounced at the watershed level where the cumulative wetland function is important to downstream conditions in out-flowing watercourses.

To understand the function of the wetlands within the Study Area and the value that may be placed on those functions, Stantec assessed the wetlands within the Study Area both as units, and in the context of the surrounding watersheds.

4.1 METHODS

Stantec assessed wetland function based on criteria derived from *Wetland Ecological Functions Assessment: An overview of Approaches* (Hanson *et al.* 2008). Wetland Functional Assessment Forms were completed for each wetland complex associated with NBDELG mapped wetlands, and are included in Appendix D of this report. For the purposes of these NBDELG functional assessments, wetland units associated with NBDELG wetlands were grouped if they were directly contiguous via other wetlands, and/or if they were less than 30 m apart and hydraulically connected. As noted in Section 3.4, it may be necessary to revisit hydrologic function in the EIA where the interactions of the Project with surface water and groundwater will include, as appropriate, analyses and understanding provided by technical studies in those disciplines that may better inform the hydrologic function of wetlands.

As part of the field survey program, Stantec collected information on indicators of wetland function such as wetland type, hydrology, soils, grade, inflow/outflow ratio, presence of SOCC, vegetation condition, proportion of open water, beaver activity, slope position, and size. Reference photographs of the wetlands in the Study Area were taken.

Stantec used the collected information to describe the functions of wetlands in the Study Area according to categories of wetland function (hydrological, ecological, and hydrological), followed by functional assessments of watershed units of wetlands for all NBDNR watercourses flowing out of the Study Area.

As an indication of the relative regional importance of the Study Area relative to two large NBDELG mapped watersheds, as delineated in the New Brunswick Aquatic Data Warehouse (Nashwaak Headwaters and Napadogan Brook), Stantec estimated the proportion of wetlands within each of these watersheds that lies within the Study Area. In the absence of accurate wetland maps for these greater areas, the NBDNR 0-25 cm depth-to-water-table model (DTWT) was used to represent the proportion of wetland within the Study Area versus the entire watersheds (*i.e.,* areas with a DTWT less than 25 cm are generally considered to be wetland area). DTWT modelling data are commonly used to estimate location and extent of wetland areas.

4.2 RESULTS

4.2.1 Key Wetland Functions

4.2.1.1 Hydrological Functions

Within the Study Area, due to their extent and nature, the various types of wetlands could be expected to afford at least some valued hydrological functions (*i.e.,* base flow maintenance, peak flow mitigation, stormwater storage, groundwater discharge/recharge). While there are no obvious indications of outstanding individual hydrological functions (other than the maintenance of baseflow of the watercourses within the Study Area), the importance of these wetlands may primarily rest in their large aerial extent. Much of the wetland area typically rests on thin organic soil layers over saturated, coarse textured (conductive) overburden with an average depth of 8 m (McClenaghan *et. al*., 2012) and is largely fed by throughflow (*i.e.,* shallow groundwater flow through unconsolidated over-burden) from the surrounding slopes. During drier periods, the lower water table in these wetlands would likely afford some capacity for additional storage. Rain events following such periods are at least partially intercepted by these wetlands so that in the case of heavy events, flashy discharge into watercourses may be somewhat or at least initially mitigated. During saturated periods, these wetlands do not likely play an important role in regulating stream flow. The extensive network of forested wetland complexes, arranged in wide, flat valleys, may serve to mitigate heavy runoff events following heavy precipitation and spring snow melt, but this function is at least partially attributable to, and more reasonably explained by, the topography of the valleys.

In the portion of the Study Area to the north of Sisson Brook, water supply to wetlands appears to be more significantly a product of throughflow input in bottom lands, while deeper groundwater flow appears to be a relatively more important source in the southern portion of the PDA. In the McBean and possibly Sisson Brook watersheds, water exchange between groundwater and wetlands is evidenced by several groundwater seepages and discharges. Here, groundwater discharge through wetlands evidently supports base flow in the watercourses flowing from the McBean and Sisson Brooks portions of the Study Area. Despite the extensive wetland area within the Study Area, groundwater recharge is not likely an important function for wetlands within the Study Area as there is very little human population in or around the Study Area using groundwater for drinking, and the bedrock is known to be relatively impermeable and does not likely allow high rate of recharge.

It is evident that it will be important to further explore this conceptual model of hydrologic function of wetlands in the EIA. This will be better supported by the technical hydrological and hydrogeological studies that are being done in support of the feasibility study and the environmental effects assessment.

4.2.1.2 Ecological Functions

The Study Area is within the Beadle Ecodistrict which is atypical to the Central Uplands Ecoregion in that it almost entirely rests on granitic rock with very little calcareous component to the soils. The Study Area as a whole is less productive than most of the Central Uplands, with black spruce dominating much of the Study Area. The presence of tolerant hardwood stands on certain sites can be more closely attributed to frost and soil drainage rather than soil richness. Additionally, no areas were found with especially high biodiversity (*i.e.,* containing unusual plant assemblages or having a high value for plant SAR or SOCC). It is believed that this is, in large part, due to the lack of calcareous deposits in the soil and bedrock. The richest sites with the highest potential for plant SAR or SOCC in New Brunswick are commonly associated with calcareous soils. Wetlands that express these conditions are often dominated by eastern white cedar, which is largely absent from the Study Area. Even in areas where there is obvious groundwater discharge where, in other parts of the province, assemblages of orchids and uncommon species can often be found, there is little change to the plant communities and the mineral input appears minimal. The difference between OFW and MFW in the Study Area is commonly attributed to groundwater input, which is slightly more mineral rich than the water feeding OFW. Even so, the more minerotrophic MFW is similar to OFW, and is also often dominated by black spruce, with the most notable and common difference being the presence of maple species such as red maple and mountain maple in MFW. This reflects the mineral-poor geochemistry of granitic bedrock and rainfall. As noted in Section 3.4.1.2.1, the predominant forested wetlands likely exist largely as a product of throughflow discharge of intercepted rainfall within the upper reaches of the catchment.

As for wildlife habitat, the wetlands within the Study Area evidently help to support a healthy local moose population, as evidenced by widespread browse, tracks, sightings, and scat. The large complexes throughout the Study Area may provide calving areas, although there is no data to support this. The most important wildlife function noted for wetlands was their use by avian SAR and SOCC. Several records of SAR/SOCC were recorded in or near wetlands in the project area by Stantec in 2011 and by others in recent years. These species included Canada Warbler, Olive-sided Flycatcher, and Rusty Blackbird. Most of the records for these species were associated with wetlands. While Rusty Blackbird was typically associated with BIW, the other species were found in or near OFW, MFW, and RSW.

4.2.1.3 Water Quality Functions

It is difficult to determine the role of a wetland in maintaining water quality given the variety of factors that influence it and the many parameters used to measure it. Typically, water quality is judged by its ability to support aquatic life, particularly fish, and humans through potability. The desired qualities of water for these functions are that it be high in oxygen, pH neutral, moderately conductive, low in temperature, and free of toxic elements. In addition to wetland function, influences on these variables can be attributed to the upland soil and vegetation characteristics, surrounding land use, underlying geology, groundwater influence, and topography. Table 4.1 contains data for some important water quality parameters and water quality data measurements collected in watercourses in and downstream of the Study Area.

While the role of wetlands in the Study Area cannot be directly linked to the actual water quality in adjacent watercourses, the measured values for these parameters by Stantec (2012b) reflect a chemical nature that would be expected in areas of oligotrophic wetlands and granitic geology

(Table 4.1). Headwaters containing large oligotrophic wetlands with coniferous forest cover and slow moving water could be expected to contain acidic and possibly warm surface water that may be low in dissolved oxygen. As noted in Section 3.4.1.2.1, the predominant wetlands in the Study Area appear to be discharge areas that "process" groundwater en route to surface watercourses. The chemical signature of headwater streams certainly reflects oligotrophic wetland and granitic geology influences. McBean and Bird Brooks have such headwaters, and have acidic water low in dissolved oxygen, as would be expected in smaller streams in this environment, proximal to oligotrophic wetlands. The low dissolved oxygen may be related to the presence of organic matter and consequently high biochemical oxygen demand. The low pH and low DO that were recorded in the upper reaches of these watersheds, where the wetlands were most abundant, quickly improved downstream closer to the confluence with higher order watercourses. This might be attributed to groundwater influence (well oxygenated) and/or more pronounced topography with swifter flowing water that has picked up more base cations through contact with mineral soil subjected to turbulence and aeration. The higher order reaches of Napadogan Brook generally have higher pH, temperature, conductivity, and DO to a lesser extent, than their lower order tributaries within the Study Area.

Table 4.1 General Water Quality Parameters for Major Watercourses Within and Downstream of the Study Area

Watercourse	Temperature °C	pH	Conductivity (µs/cm)	DO (mg/L)
Sisson Brook (S1)	8.9 to 15.5	4.9* to 6.7	14.4 to 21.9	8.1 to 11.5
Bird Brook (B1)	9.7 to 13.6	4.7* to 6.3	16.4 to 23.0	4.6 to 9.6
McBean Brook (M1)	12.1 to 17.4	4.3* to 6.4	15.5 to 28.7	6.5 to 9.4
Tributaries to the West Branch Napadogan Brook (W1A, W1B, W3)	10.6 to 14.5	5.8 to 6.4	19.0 to 24.0	8.4 to 10.5
West Branch Napadogan Brook (outside Study Area)	9.1 to 16.7	5.3 to 7.0	22.9 to 30.5	7.83 to 10.5
Main stem Napadogan Brook (outside Study Area)	14.2 to 21.8	6.5 to 7.6	27.5 to 33.3	8.4 to 10.2

Notes:
* Low pH values were collected in boggy headwater areas surrounded by wetland.
Source: Stantec (2012b).

4.2.1.4 Sociological Functions

Throughout the Study Area the most important sociological function of wetlands could be considered to be the production of merchantable timber. The majority of the wetland habitat within the Study Area is dominated by softwood forest cover, and is largely managed for timber. Most of the operable forested wetlands have been harvested for timber within the last 25 years, and much of this area has undergone silvicultural treatments to increase future yields. Such treatments would affect the hydrology of wetlands by altering interception and infiltration, and evapotranspiration.

In addition to logging, there is widespread evidence of moose hunting throughout the Study Area, with much of this activity centred on wetlands which provide important habitat for moose. Hunting signs from recent years are posted around the Study Area, indicating the area's use by local hunters. In addition to hunting, trapping is known to have occurred in the Study Area.

4.2.2 The Role of the Study Area at a Regional Scale

There are two major watershed divisions within the Study Area, Nashwaak Headwaters and Napadogan Brook, both forming part of the headwaters of the Nashwaak River. The former includes drainage from the Study Area to the south via McBean Brook to the Nashwaak River, and the latter includes drainage from the Study Area to the east via Napadogan Brook to the Nashwaak River.

Table 4.2 shows that the Study Area represents approximately 1% of the Nashwaak Headwaters watershed as mapped by NBDNR and 11% of the Napadogan Brook watershed. As estimated by the depth-to-water-table (DTWT) data for these watersheds, the percentage of the larger watersheds that are wetland areas is similar to that of the Study Area. This different proportion of area would suggest that the Study Area likely plays a greater functional role for the Napadogan Brook watershed than for the Nashwaak Headwaters watershed, although of the 1% of the Nashwaak Headwaters watershed area that falls within the Study Area, 38% is wetland. Figure 3.1 shows the watersheds within the Study Area at a smaller scale. Of the watersheds shown on that figure, only M1 is included in the Nashwaak Headwaters Watershed, while all others are part of the Napadogan Brook Watershed. Within the Nashwaak Headwaters Watershed, there were many sources of groundwater input to wetlands including the large wetland complex that encompasses Christmas Lake and Trouser Lake.

Table 4.2 Summary of the Estimated Importance of the Study Area to Each of the Two Major Watersheds[1]

Watershed	%Area where Depth to Water Table is <25cm		% of Total Watershed Area in Study Area	% of Watershed Wetlands in Study Area
	Study Area	Watershed		
Napadogan Brook	11.6	11.52	11.2	11.30
Nashwaak Headwaters	12.6	16.28	1.1	0.88

Notes:
[1] As represented by the percent of wetlands in each watershed that occurs within the Study Area.

4.2.3 Wetland Function by Sub-Watershed

The watersheds of watercourses in and around the Study Area are shown in Figure 3.1. There are six sub-watersheds intersecting the Study Area to varying degrees which are named for the watercourse that they drain into. They are: Three unnamed tributaries to West Branch Napadogan Brook (W1A, W1B, W3), Sisson Brook (S1), McBean Brook (M1), and Bird Brook (B1). Table 4.3 summarizes the types and areas of wetlands within each of these watersheds. Of these six, only three have large areas within the Study Area: B1, S1, and M1. All watersheds in the Study Area are discussed below.

Table 4.3 Summary of Wetland Types Within Each Watershed in the Study Area

Watershed	Area (ha) by Wetland Type within the Study Area								Total Wetland Area (ha) within the Study Area	% Wetland within the Study Area Portion
	OFW	MFW	SRW	BIW	Bog	Fen	DSM	LSW		
Bird Brook (B1)	79.46	28.57	14.63	5.01	7.70	-	2.00	-	137.36	21.37
McBean Brook (M1)	79.96	15.98	3.80	2.19	4.05	9.05	-	0.86	115.89	37.94
Sisson Brook (S1)	13.58	22.94	2.42	10.80	-	-	0.57	-	50.31	11.90

Table 4.3 Summary of Wetland Types Within Each Watershed in the Study Area

Watershed	Area (ha) by Wetland Type within the Study Area								Total Wetland Area (ha) within the Study Area	% Wetland within the Study Area Portion
	OFW	MFW	SRW	BIW	Bog	Fen	DSM	LSW		
Tributary to Northwest Branch Napadogan Brook (W1A)	26.20	4.61	8.29	1.91	-	-	-	-	41.01	24.53
Tributary to Northwest Branch Napadogan Brook (W1B)	26.65	0.09	3.12	1.25	0.24	-	0.06	-	31.40	26.61
Tributary to Northwest Branch Napadogan Brook (W3)	3.82	-	-	-	-	-	-	-	3.82	17.79
Total	**229.66**	**72.19**	**32.25**	**21.16**	**11.99**	**9.05**	**2.63**	**0.86**	**379.80**	**23.36**

Legend:
OFW = oligotrophic forested wetland MFW = mesotrophic forested wetland SRW = shrub riparian wetland
BIW = beaver impoundment wetland DSM = disturbed scirpus meadow LSW = lacustrine shallow water wetland

Watershed B1 (Bird Brook)

This watershed of Bird Brook occupies more area in the Study Area than any other watershed (642 ha) and contains the most wetland by area. This watershed, as shown on Figure 3.1, is located in the centre of the Study Area. It is arranged in a west-east direction and drains to the east where the Study Area abuts West Branch Napadogan Brook. Most of this watershed is in the Study Area.

As can be seen from the topography of Figure 3.1, this watershed drains from two hills in the west of the Study Area, and one to the east, but the largest portion of the watershed is a glaciofluvial outwash plain which collects surface runoff and throughflow inputs in a series of largely slow-moving, meandering watercourses that snake through the valley. Wetlands that feed these watercourses (themselves fed by runoff and groundwater input) are strongly dominated by OFW, with a lesser component of MFW and SRW. This watershed is approximately 21% wetland, which is less than the 23% average for the watersheds within the Study Area.

As evidenced by the dominance of OFW, this watershed is not a highly productive terrestrial ecosystem and is dominated largely by poor forest types, with the exception of a small area of richer upland on the western end near the Fire Road. The watershed has been affected by historical logging activity, with most upland and forested wetland having been cutover in the last 25 years. The landscape has an extensive network of logging access roads, and watercourse crossings are subject to beaver activity. This infrastructure presumably causes washouts during freshets and flood conditions. The frequency of these sedimentation events is mitigated by the large flat wetland complexes, dense vegetation cover, and slow moving watercourses. Most of the bog habitat within the Study Area is located within this watershed and several bird SAR/SOCC were identified within this watershed, associated with wetlands during the 2011 field surveys, including Canada Warbler and Olive-sided Flycatcher (Stantec 2012a).

This watershed has been identified by Stantec (2012b) as supporting outer Bay of Fundy Atlantic salmon habitat, and is of average productivity habitat for salmonids.

Watershed M1 (McBean Brook)

This watershed has the third largest area of the watersheds within the Study Area at 311 ha and is the only watershed that drains to the southwest as a part of the Nashwaak Headwaters Watershed. While approximately a quarter of this watershed falls within the Study Area, it has the greatest proportion of wetland within the Study Area at nearly 38%. Its wetlands are strongly dominated by OFW (almost 70%) and are arranged almost entirely into one large wetland complex that extends well beyond the Study Area. Despite the prevalence of OFW, this watershed as a whole is probably somewhat more minerotrophic than watershed B1 due to richer overall upland soil, and a high degree of groundwater input by virtue of its relatively flat nature juxtaposed to steep ridges, especially to the east. This assertion is supported by the conductivity data in Table 3.4 although the pH of the water within the wetland complexes is among the lowest in the Study Area, by a narrow margin. Numerous springs were identified throughout this watershed, including two large inputs at Christmas Lake and Trouser Lake. The former is fed by a small spring-fed watercourse, and is formed at the site of a large spring which gives the lake its character. The much larger outflow that cascades over a steep embankment toward Trouser Lake provides visual evidence of the groundwater input. In the western end of Trouser Lake, there are numerous signs of groundwater seeping at the foot of embankments, but also in the western end of the wetland, where there is a “pit” in the peat where water can be seen welling up from the ground, at which point an open channel meanders toward the lake.

Water flowing slowly through the large acidic wetland complexes tends to be acidic, warm, and low in dissolved oxygen. This condition is apparently counteracted by the influence of groundwater, although within the Study Area the groundwater does not appear to have the buffering power that it does in other areas of the Central Uplands Ecoregion due to granitic geology. The result is that water flowing from McBean Brook, while within acceptable limits for a fish-bearing watercourse, is acidic in the upper reaches, relatively warm, and low in DO.

Watershed S1 (Sisson Brook)

Watershed S1 is associated with Sisson Brook, which flows to the east from the Study Area into the West Branch Napadogan Brook. This watershed is centrally located and is almost entirely within the Study Area. This watershed occupies the second largest portion of the Study Area, with 429 ha of it inside the Study Area. This watershed is notable for its relative lack of wetland, having the lowest percentage of wetland at only 12% of its total area. This paucity of wetland is largely a product of better drainage in the valley bottom through the more pronounced stream gradient and general eastward slope, even though like the other watersheds, it is bordered by significant upland ridges to the east and north. Unlike B1 and M1, the wetlands within watershed S1 are predominantly MFW, with only half as much OFW and BIW. There is no bog or fen within this watershed. Despite the more minerotrophic wetland proportions in this watershed, and more broad-leaf dominated upland habitat, the pH is only slightly higher than the other major watersheds in the Study Area, and the other water quality parameters, presented in Table 3.4, are similar to other watersheds with a higher percentage of wetland.

Wetlands within the S1 watershed likely play their greatest role in the maintenance of base flow in Sisson Brook through groundwater input, and in the reduction of flow energy during high flow periods.

This watershed was found to be highly productive for brook trout, but no Atlantic salmon were found within the watershed (Stantec 2012b).

Watershed W1A (Unnamed Tributary to West Branch Napadogan Brook)

Watershed W1A is located at the northwestern end of the Study Area and drains to the north via an unnamed tributary to the West Branch Napadogan Brook. This watershed shares a large headwater wetland complex with B1 and flows in the opposite direction but ultimately into the same watercourse. Slightly more than half (167 ha) of this watershed falls within the Study Area and although much smaller than B1 its wetland composition is similar in extent and makeup. Most of the wetland is OFW, with small areas of SRW and BIW. Unlike B1, there is no bog or fen wetland in the watershed, inside the Study Area. The wetland complex in this watershed is extensive, but is not comprised of large bodies of wetlands, but rather narrower lightly paludified swales in linear configurations. This watershed does not process a large amount of water and appears to have less groundwater influence than other watersheds in the Study Area, possibly due to lower valley ridges comparatively resulting in less hydraulic driving force.

This watershed had less evidence of moose activity than B1 and M1. There were multiple records of Olive-sided Flycatcher and one recorded Common Nighthawk, both avian SAR, in or adjacent to wetlands within W1A (Stantec 2012a).

Watershed W1B (Unnamed Tributary to West Branch Napadogan Brook)

Most (118 ha) of watershed W1B falls within the Study Area, and of that area 26% is wetland. The watershed drains to the northeast via an unnamed tributary of the West Branch Napadogan Brook. This watershed is similar to W1A although the wetlands are concentrated in the western side of the small watershed, becoming less extensive as the topography drops off to the east toward West Branch Napadogan Brook. A large portion of the OFW in the western side of this watershed has been recently clear cut. Avian SAR/SOCC including Olive sided Flycatcher, Canada Warbler and Rusty Blackbird were recorded in and near the large wetland complex in the centre of the watershed (Stantec 2012a).

Watershed W3 (Unnamed Tributary to West Branch Napadogan Brook)

Only a small portion (21 ha) of watershed W3 is in the Study Area at the northern end. Of the area within the Study Area, 18% is wetland. While the one wetland in the watershed extends outside the Study Area to the north, the Study Area boundary was not extended further to encompass it given the flat topography and the slow rate of drainage to the north that makes it unlikely that the Project would measurably affect the wetland complex to the north. The area of wetland in this watershed that is within the Study Area is entirely OFW (less than 4 ha). Much of this wetland has been clear cut within the last four years. This wetland does have storage capacity that is likely only fully utilized during spring snow melt, and likely serves to mitigate peak flows during that period, although the recent clear cut in the area has likely diminished that capability substantially for some time.

4.2.4 Function of Wetland Types

While the wetland complexes within the Study Area function as networks, there are also notable functional differences between the eight different types of wetland that make up the various complexes. The magnitude of functional value of the different wetland types is largely a product of the abundance of that type within the Study Area, which varies greatly (Table 4.3). However, on a per unit of area basis, there are differences associated with geographic, topographic and structural factors, such as watershed position, vegetation cover, and water source, that must be considered when developing mitigation or compensation strategies. A summary of the wetland functions for each type and functional category is shown in Table 4.4. Individual functional assessments for wetlands associated with NBDELG wetlands are included in Appendix D.

Within the Study Area, the most important wetland type is OFW, primarily due to the large proportion of the Study Area occupied by this wetland type (14%), and the sociological functions fulfilled by the moose hunting and forestry opportunities that these wetlands provide. This wetland type exists in areas of throughflow discharge and runoff from adjacent areas. Its trees and vegetation play a major role in interception and evapotranspiration during the growing season and would tend to mitigate peak flows during runoff events in these drier times. However, in predominant wet periods, their thin organic layers will be saturated and likely play a minimal role in slowing discharge of groundwater and runoff to watercourses. In dry periods, these wetland types may exacerbate low flow conditions in streams through interception, evapotranspiration and storage and therefore their presence is a negative factor for maintenance of stream flows at these times.

While OFW dominates the landscape, the ecological functions played by this type is probably less important on a per-unit-area basis than wetland types such as Fens, LSW, Bogs and BIMs, which contain greater species diversity, structural diversity, and contain aquatic habitat. These wetland types, with the exception of Bogs, process a much greater volume of water by wetland area, than do OFW. The Fen wetlands and LSW are noticeably groundwater fed, as are the SRW and MFW at some locations. All of these wetland types with the exception of the bogs are more minerotrophic than OFW. SRW and BIW were notable for multiple records of Species at Risk (e.g., Canada Warblers, Olive-sided Flycatchers, and Rusty Blackbirds) in or near these wetland types.

Table 4.4 Summary of Key Wetland Functions for Each Wetland Type by Function Category

Wetland Type	Watershed Position	Estimated Regional (Madawaska Uplands) Abundance	Function Category			
			Hydrological	Water quality	Ecological	Sociological
Oligotrophic Forested Wetland (OFW)	Upper	Common	Effective at sublimating snowfall directly from coniferous foliage in winter and by mitigating spring thaws so that peak runoff periods are spread out over wider timeframes. They are areas of throughflow discharge and have little influence over stream flow under normal conditions. They may mitigate peak flows during flood events and may lessen runoff except perhaps in dry warm periods where evapotranspiration, interception and storage may lessen consequent runoff.	Typically large and flat, and allow rainwater to percolate slowly toward watercourses, reducing peak flow events and associated erosion events.	Low in diversity but are abundant and have minor habitat value for a variety of species.	Heavily managed for forest products within the Study Area and are used for moose hunting.
Mesotrophic Forested Wetland (MFW)	Mid	Common	Often fed by groundwater and throughflow discharge and by watercourses in flood plains where they may help mitigate peak flows. Similar hydrologic function to OFW.	Prevent erosion along watercourse by stabilizing areas within the high water mark. They also help mitigate road washout events by retaining sediments during high flow.	Some of these wetlands serve as vestiges of mature forest in a heavily cutover landscape and provide habitat for moose, bear, and avian SAR such as Canada Warbler and Olive-sided Flycatcher.	Some of these wetlands are managed for timber production in the Study Area and are used for moose hunting.
Shrub Riparian Wetland (SRW)	Mid to Lower	Common	Typically located along watercourses and prevent erosion and reduce flow energy during flood periods.	These wetlands establish quickly in disturbed areas, stabilizing watercourse banks to reduce erosion. They also provide shade that helps maintain cool water temperature.	Maintain quality for fish habitat and provide nesting and/or foraging areas for birds including Canada Warbler.	These wetlands show little or no evidence of use by humans.

Table 4.4 Summary of Key Wetland Functions for Each Wetland Type by Function Category

Wetland Type	Watershed Position	Estimated Regional (Madawaska Uplands) Abundance	Function Category			
			Hydrological	Water quality	Ecological	Sociological
Beaver Impoundment Wetland (BIW)	Mid to Lower	Common	Hold rainfall and runoff on the landscape and release it slowly through porous outflows. Flow energy of watercourses is reduced in the impoundments.	They retain large quantities of sediment from watercourses, but periodically create large sedimentation events at wash-outs on roadways. They have a slight increasing effect on water temperature.	Create and provide habitat that is enriched by sediment deposit and creates structural diversity in the landscape. Rusty Blackbirds (SOCC) were seen using these habitats in the Study Area.	These wetlands exhibit little evidence of use by humans, although the open nature of the vegetation cover may facilitate moose hunting opportunities.
Bog	Upper	Common	The small bogs in the Study Area do not cumulatively fulfill strong hydrological function. They are primarily isolated from groundwater, but may under certain conditions serve to help maintain base flow in the downstream environment to a minor extent.	Bogs are isolated from groundwater input and tend to release nutrient poor, low pH water into the downstream environment.	In the Study Area, these may provide calving areas for moose and potential nesting areas for common nighthawks (one was seen foraging over the largest bog in the Study Area). They also provide carbon storage.	These wetlands exhibit little evidence of use by humans, although the open nature of the vegetation cover may facilitate moose hunting opportunities.
Fen	Upper to Mid	Common	Fens in the Study Area are heavily groundwater fed and are concentrated near the headwaters of McBean Brook. These wetlands contribute to base-flow maintenance. These fens process groundwater to watercourses but may play only a minor role in retention and slowing discharge to watercourses due to lesser evapotranspiration and extended periods of positive water balance.	Heavily fed by groundwater and supply a steady and substantial flow of clean water to receiving watercourses.	Contain plant species that are not found in other habitats (no SOCC found) and show evidence of heavy use by moose. The combination of open water, herbaceous and shrub communities provide diverse habitat to a variety of species.	These wetlands exhibit little evidence of use by humans, although the open nature of the vegetation cover may facilitate moose hunting opportunities.

Table 4.4 Summary of Key Wetland Functions for Each Wetland Type by Function Category

Wetland Type	Watershed Position	Estimated Regional (Madawaska Uplands) Abundance	Function Category			
			Hydrological	Water quality	Ecological	Sociological
Lacustrine Shallow Water Wetland (LSW)	Upper to Mid	Moderate	Trouser Lake is the only LSW and is heavily groundwater fed; this wetland by virtue of its spring provides a conduit for base flow in McBean Brook.	This wetland does little to improve the quality of the groundwater passing through and likely increases the temperature somewhat.	One of the largest bodies of open water within the Study Area providing habitat for various forms of aquatic life including fish and herpetiles. Wading birds and moose were seen at the site, and evidence of use suggests that it is an important moose foraging site.	ATV access and a tree stand were seen near this wetland. Moose were also observed within the wetland.

Legend:
OFW = oligotrophic forested wetland MFW = mesotrophic forested wetland SRW = shrub riparian wetland
BIW = beaver impoundment wetland DSM = disturbed scirpus meadow LSW = lacustrine shallow water wetland

5.0 SUMMARY

The preparation of this Baseline Vegetated and Wetland Environments Technical Report was to provide background information for the Environmental Impact Assessment (EIA) for the Sisson Project (the Project). The purpose of this Technical Report was to describe the baseline conditions of the vegetation and wetland components of the terrestrial environment in the vicinity of the Project, to assist in the later evaluation of environmental effects of the Project in the EIA Report.

This report focused on evaluating the vegetated and wetland environments near the Project in two key areas: the Project Development Area (PDA) and the surrounding Study Area. The PDA is the area of physical disturbance associated with the construction and operation of the Project (approximately 1,200 ha). The Study Area is the area around the PDA, within which field studies have been undertaken in areas with available terrestrial habitat information (*i.e.*, Crown land) (approximately 1695 ha).

This Technical Report presents background data obtained and field studies conducted within the Study Area. A description of the vegetated environment within the Study Area in terms of species composition and the various communities present is provided in the report. Additionally, the characterization, delineation, and functional assessment of wetlands that could be affected by the Project either directly by construction or operation activities, or indirectly as a result of potential alteration to drainage patterns or to the water table that could result from the presence of the Project.

The Stantec team first consulted various informational sources to compile existing knowledge with respect to the vegetated and wetland environments from published literature and to describe the available vegetation (with an emphasis on SAR and SOCC) and wetlands. These sources included the NBDNR Forest Cover Inventory Data, aerial imagery and LiDAR data, Atlantic Canada Conservation Data Centre (AC CDC), NBDELG mapped wetlands, soils data, and results from field surveys conducted near the Study Area in 2008 in support of the Project. Gaps in available information were determined to focus the data collection efforts to be carried out in support of the EIA.

Stantec employed remote sensing and wetland modelling based on available information to plan the field studies and identify habitats with elevated potential for harbouring SAR and SOCC. Stantec developed a field plan based on this information and on current knowledge of the Project as conceived at the time of planning the field studies (*e.g.,* from the Project Description for the Sisson Project, submitted to the Canadian Environmental Assessment Agency in April 2011 (Stantec 2011). Stantec then conducted field investigations to assess the baseline vegetated and wetland environments within the Study Area from June through August 2011.

The Stantec team conducted field investigations to characterize the baseline vegetated environment and to determine the presence of vascular plant SOCC and SAR in and around the Study Area. Upland forested habitats were classified into five types, including Spruce-Balsam Fir, tolerant hardwood, mixedwood, rich softwood, and intolerant hardwood. A total of 315 plant species (Appendix B) were identified in the Study Area and vicinity. One SOCC (spotted coralroot) was found outside the Study Area, but none were identified within the Study Area. The study identified no plants that are SAR within or outside the Study Area.

A total of 380 ha of wetland were identified within the Study Area that was distributed among eight distinct types of wetland across six sub-watersheds. Twenty-two percent of the area of the Study Area is wetland. The wetlands within the Study Area were mostly oligotrophic and mesotrophic forested wetlands that have historically been or are actively managed for timber production. The most notable functions of the general wetland environment within the Study Area are:

- as habitat for wildlife such as moose, but particularly as habitat for avian SOCC and SAR such as Canada Warbler, Olive-sided Flycatcher, and Rusty Blackbird, which were found at multiple locations associated with wetlands (Stantec 2012a);
- for the maintenance of flow and water quality in adjacent watercourses through numerous and abundant throughflow and groundwater throughput, and the mitigation of peak flow events during drier periods;
- timber harvesting, which is practiced throughout much of the wetlands in the Study Area and supplies wood to New Brunswick mills, contributing to employment in the forestry sector; and
- as headwaters to outer Bay of Fundy Atlantic salmon habitat in the Nashwaak River and, in the case of the Bird Brook watershed (B1), as actual Atlantic salmon habitat, at least in the 3rd order reaches.

Overall, the Study Area is typical of most regions in New Brunswick where the majority of wetlands are forested, although there is a notable absence of eutrophic wetlands such as cedar swamps compared to other ecodistricts in the Central Uplands Ecoregion. The forested wetlands are generally poor in nutrients, low in plant diversity and largely dominated by black spruce with ericaceous shrub understory. There is some peat formation in these wetlands, and while the hydrology is stable (persistently wet), it is not stable enough and drainage is not poor enough to allow paludification to progress at a rate that is conducive to bog formation. The scarcity of bogs in the Study Area is typical to the Central Uplands Ecoregion. Evidence of beaver activity of varying ages, nearly ubiquitous along watercourses that do not follow ravines, indicates that such activity has shaped the hydrology and vegetation communities of the wetlands in the Study Area.

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Appendix A

Glossary and List of Acronyms and Units

GLOSSARY

Term	Definition
baseline	Background, pre-activity, pre-construction, or pre-Project environmental conditions.
bryophyte	Non-vascular photosynthetic plants with no true roots and a dominant gametophyte (*i.e.,* "n") stage, referring to mosses, liverworts, and hornworts.
colluvial	A loose deposit of rock debris accumulated through the action of gravity at the base of a cliff or slope.
depth to water table model (DTWT)	This is a model available from NBDNR that predicts the depth to water table in New Brunswick. This model can be used to predict the location of wetlands by looking at those portions of the model that indicate a depth to water table of less than 30 cm. The model produced by the province is limited in accuracy by it use of coarse-scale hydrograph and digital elevation model (DEM). Higher accuracy is possible using the same algorithm with a more accurate DEM and hydrograph.
dicot	A flowering plant with two embryonic seed leaves or cotyledons that usually appear at germination.
endemic	Restricted to a specific geographic area.
flashy	Refers to flow levels in watercourses that fluctuates quickly and widely following changes in precipitation, stormwater, or snow melt events.
hemiparasitic	Referring to plant species that receive a portion of their nutrition from a direct connection to a host plant species.
hydrograph	In the context of this report, it refers to the three dimensional representation of the location and extent of surface water features on the landscape.
glaciofluvial deposits	Deposits of materials that were transported by water flowing from melting glaciers.
intolerant	In the context of tree species or forest stands, refers to a lack of tolerance of shade where individuals or assemblages of tree species do not grow well in low-light conditions or the shade of other plants.

Term	Definition
lacustrine	Associated with lakes.
lodgement till	Material that is pressed to a valley floor when its weight becomes too great to be moved by a glacier.
mesotrophic	Referring to environments with intermediate calcium content, generally with moderate nutrient content.
metasedimentary	Sedimentary rock that shows evidence of metamorphism.
minerotrophic	Pertaining to wetlands or habitats receiving water and minerals from surrounding physiographic sources such as springs or soils, not just from precipitation.
mycotrophic	Referring to a plant species (typically non-photosynthetic) that obtains part or all of its carbon, nutrient, and/or water supply through a relationship with one or more fungal species. The fungi may, in turn, obtain nutrition partially or wholly from a separate photosynthetic plant host.
oligotrophic	Referring to environments with low calcium content, generally with low primary productivity and low nutrient content.
pre-commercial thinning (PCT)	A silvicultural treatment practiced in young stands to decrease the number of trees and reduce competition for water and nutrients in order to increase diameter growth of selected crop trees.
Project Development Area (PDA)	The area of physical disturbance associated with the construction and operation of the Project, an area of approximately 12 km² that includes the area of physical disturbance associated with the open pit, processing facility, and storage areas for tailings and waste rock, plus access roads.
paludification	Bog expansion resulting from the gradual rising of the water table as accumulation of peat impedes water drainage.
salmonid	A fish of the salmon family (Salmonidae).
species at risk	Species at risk include species that are listed under Schedule 1 of the *Species at Risk Act (SARA)* as “Extirpated”, “Endangered”, or “Threatened” and/or listed under the New Brunswick *Endangered Species Act* (NB *ESA*) as “Endangered” or “Regionally Endangered”.

Term	Definition
species of conservation concern	Species of conservation concern includes those listed species that are not currently under the protection of *SARA* (*i.e.*, are listed as "special concern" in Schedule 1 of *SARA*; listed in Schedule 2 or 3 of *SARA*; listed as "special concern", "threatened" or "endangered" by COSEWIC but not yet listed in Schedule 1 of *SARA*); ranked as "S1", "S2", or "S3" in New Brunswick by AC CDC; and/or ranked as "May Be At Risk" or "Sensitive" in New Brunswick by the Canadian Endangered Species Conservation Council (CESCC).
Study Area	An area surrounding the PDA within which the field studies described in this report were focused. The Study Area encompasses the entire PDA, as well as contiguous wetlands downstream of the PDA to the point where they converge with a larger receiving watercourse/wetland system. The Study Area also included a minimum buffer area of 45 metres (m) from the perimeter of the PDA. Additional areas around Trouser Lake and Christmas Lake to the south of the PDA were also included as part of the Study Area due to their potential for harbouring plant species of conservation concern. The Study Area comprises an area of approximately 1,695 ha.
symbiont	An organism that is part of a relationship with at least one other species; the relationship can be beneficial to one or all of the species involved.
tolerant	In the context of tree species or forest stands, refers to tolerance of shade where individuals or assemblages of tree species grow well in low-light conditions or the shade of other plants.

AC CDC Status Rank Definitions	
S1	Extremely rare: May be especially vulnerable to extirpation (typically 5 or fewer occurrences or very few remaining individuals).
S2	Rare: May be vulnerable to extirpation due to rarity or other factors (6 to 20 occurrences or few remaining individuals).
S3	Uncommon, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences).
S4	Usually widespread, fairly common, and apparently secure with many occurrences, but of longer-term concern (*e.g.*, watch list) (100+ occurrences).

AC CDC Status Rank Definitions	
S5	Widespread, abundant, and secure, under present conditions.
S#S#	Numeric range rank: A range between two consecutive ranks for a species/community. Denotes uncertainty about the exact rarity (*e.g.*, S1S2).
SH	Historical: Previously occurred in the province but may have been overlooked during the past 20-70 years. Presence is suspected and will likely be rediscovered; depending on species/community.
SU	Unrankable: Possibly in peril, but status is uncertain - need more information.
SX	Extinct/Extirpated: Believed to be extirpated from its former range.
S?	Unranked: Not yet ranked.
SA	Accidental: Accidental or casual, infrequent and far outside usual range. Includes species (usually birds or butterflies) recorded once or twice, or only at very great intervals, hundreds or even thousands of miles outside their usual range.
SE	Exotic: An exotic established in the province (*e.g.*, Purple Loosestrife or Coltsfoot); may be native in nearby regions.
SE#	Exotic numeric: An established exotic that has been assigned a rank.
SP	Potential: Potentially occurs, but no occurrences have been reported.
SR	Reported but without persuasive documentation (*e.g.*, misidentified specimen).
SRF	Reported falsely: Erroneously reported and the error has persisted in the literature.
SZ	Zero: Not of practical conservation concern because there are no definable occurrences, although the species is native and appears regularly. An SZ rank is generally used for long distance migrants that pass through the province occasionally.

AC CDC SAR Predictive Range Map Rank Definitions	
1	Possible occurrence.
2	Less probable occurrence.

Provincial General Status Rank Definitions (NB ESA and CESCC)	
At Risk	Species for which a formal assessment has been completed, and determined to be at risk of extirpation or extinction. Includes species either listed as “Endangered” or “Threatened” by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or as Endangered or Regionally Endangered under the NB *ESA* and accompanying regulations.
May Be At Risk	Species or populations that may be at risk of extirpation or extinction, and are therefore candidates for a detailed risk assessment.
Sensitive	Species which are not believed to be at risk of extirpation or extinction, but which may require special attention or protection to prevent them from becoming at risk.
Secure	Species that are not believed to be “At Risk”, “May Be At Risk”, or “Sensitive”. These were generally species that were widespread and/or abundant.
Status Undetermined	Species for which there is insufficient data, information, or knowledge available to evaluate their status. These are usually species for which there were few documented occurrences in New Brunswick.
Not Assessed	Species known or believed to be present in New Brunswick but which have not yet been assessed.
Exotic	Species that have been introduced to the province as a result of human activity (*i.e.,* non-native).
Extirpated	Species that are no longer thought to be present in New Brunswick, although they exist elsewhere.
Extinct	Species that are no longer thought to exist anywhere.

Provincial General Status Rank Definitions (NB ESA and CESCC)	
Accidental	Vagrants, or species occurring infrequently and unpredictably, for which New Brunswick is outside of their usual range. For NBDNR general status ranks it was used only for birds and dragonflies.
Occurrence Not Verified	Species which have been reported in New Brunswick, but for which there is no documented evidence, or species which are suspected to occur in New Brunswick because they occur in neighbouring provinces or states.

COSEWIC/SARA Status Definitions	
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
Special Concern (SC)	A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.

LIST OF ACRONYMS AND UNITS

Acronym/Unit	Definition
°C	degree Celsius
AC CDC	Atlantic Canada Conservation Data Centre
BIW	beaver impoundment wetland
CCFM	Canadian Council of Forest Ministers
CEAA	*Canadian Environmental Assessment Act*
CESCC	Canadian Endangered Species Conservation Council
cm	centimetre
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DEM	digital elevation model
DSM	disturbed scirpus meadow
DTWT	depth to water table
e.g.,	for example
EIA/EA	environmental impact assessment/environmental assessment
GIS	geographic information system
GPS	global positioning system
ha	hectare
i.e.,	that is
km	kilometre (1,000 metres)
LiDAR	light detection and ranging
LSW	lacustrine shallow water wetland
m	metre

Acronym/Unit	Definition
masl	metres above sea level
MFW	mesotrophic forested wetland
NB *ESA*	New Brunswick *Endangered Species Act*
NBDELG	New Brunswick Department of Environment and Local Government (formerly New Brunswick Department of Environment, or NBENV)
NBDNR	New Brunswick Department of Natural Resources
NBELC	New Brunswick Ecological Land Classification
OFW	oligotrophic forested wetland
PCT	pre-commercially thinned
PDA	Project Development Area
SAR	species at risk
SARA	*Species at Risk Act*
SNB	Service New Brunswick
SOCC	species of conservation concern
SRW	shrub riparian wetland
VEC	valued environmental component

Appendix B

List of Vascular Plants Found In and Around the Study Area

Table B1 List of Vascular Plants Found In and Around the Study Area

Common name	AC CDC binomial	AC CDC S-Rank	NBDNR/CESCC Status Rank
Balsam Fir	*Abies balsamea*	S5	Secure
Striped Maple	*Acer pensylvanicum*	S5	Secure
Red Maple	*Acer rubrum*	S5	Secure
Sugar Maple	*Acer saccharum*	S5	Secure
Mountain Maple	*Acer spicatum*	S5	Secure
Common Yarrow	*Achillea millefolium*	S5	Secure
White Baneberry	*Actaea pachypoda*	S4	Secure
Colonial Bent Grass	*Agrostis capillaris*	SNA	Exotic
Redtop	*Agrostis gigantea*	SNA	Exotic
Upland Bent Grass	*Agrostis perennans*	S5	Secure
Rough Bent Grass	*Agrostis scabra*	S5	Secure
Bog Rosemary	*Andromeda polifolia*	S5	Secure
Howell's Pussytoes	*Antennaria howellii* ssp. *neodioica*	S5	Secure
Spreading Dogbane	*Apocynum androsaemifolium*	S5	Secure
Bristly Sarsaparilla	*Aralia hispida*	S5	Secure
Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure
Arethusa	*Arethusa bulbosa*	S4	Secure
Jack-in-the-pulpit	*Arisaema triphyllum*	S5	Secure
Common Lady Fern	*Athyrium filix-femina*	S5	Secure
Yellow Birch	*Betula alleghaniensis*	S5	Secure
Paper Birch	*Betula papyrifera*	S5	Secure
Gray Birch	*Betula populifolia*	S5	Secure
a hybrid Birch [papyrifera X populifolia]	*Betula x caerulea*	SNA	Not Assessed
Devil's Beggarticks	*Bidens frondosa*	S5	Secure
Daisy-leaved Moonwort	*Botrychium matricariifolium*	S4	Secure
Leathery Moonwort	*Botrychium multifidum*	S4	Secure
Northern Shorthusk	*Brachyelytrum septentrionale*	S5	Secure
Fringed Brome	*Bromus ciliatus*	S5	Secure
Bluejoint Reed Grass	*Calamagrostis canadensis*	S5	Secure
Pickering's Reed Grass	*Calamagrostis pickeringii*	S3	Secure
Wild Calla	*Calla palustris*	S5	Secure
Large Water-Starwort	*Callitriche heterophylla*	S4S5	Secure
Marsh Water-starwort	*Callitriche palustris*	S5	Secure
Tuberous Grass Pink	*Calopogon tuberosus*	S4	Secure
Hemp	*Cannabis sativa*	SNA	Exotic
Pennsylvania Bittercress	*Cardamine pensylvanica*	S5	Secure
Water Sedge	*Carex aquatilis*	S5	Secure
Drooping Woodland Sedge	*Carex arctata*	S5	Secure
Brownish Sedge	*Carex brunnescens*	S5	Secure
Silvery Sedge	*Carex canescens*	S5	Secure
Crawford's Sedge	*Carex crawfordii*	S5	Secure
Fringed Sedge	*Carex crinita*	S5	Secure
Dewey's Sedge	*Carex deweyana*	S5	Secure
Two-seeded Sedge	*Carex disperma*	S5	Secure
Star Sedge	*Carex echinata*	S5	Secure
Graceful Sedge	*Carex gracillima*	S5	Secure
Nodding Sedge	*Carex gynandra*	S5	Secure

Table B1 List of Vascular Plants Found In and Around the Study Area

Common name	AC CDC binomial	AC CDC S-Rank	NBDNR/CESCC Status Rank
Bladder Sedge	*Carex intumescens*	S5	Secure
Slender Sedge	*Carex lasiocarpa*	S5	Secure
Mud Sedge	*Carex limosa*	S4	Secure
Boreal Bog Sedge	*Carex magellanica*	S5	Secure
Michaux's Sedge	*Carex michauxiana*	S3	Secure
Few-Seeded Sedge	*Carex oligosperma*	S5	Secure
Necklace Spike Sedge	*Carex ormostachya*	S3	Secure
Few-Flowered Sedge	*Carex pauciflora*	S5	Secure
Necklace Sedge	*Carex projecta*	S5	Secure
Broom Sedge	*Carex scoparia*	S5	Secure
Awl-fruited Sedge	*Carex stipata*	S5	Secure
Tussock Sedge	*Carex stricta*	S5	Secure
Three-seeded Sedge	*Carex trisperma*	S5	Secure
Northern Beaked Sedge	*Carex utriculata*	S5	Secure
Greenish Sedge	*Carex viridula*	S4	Secure
Wiegand's Sedge	*Carex wiegandii*	S3	Secure
Leatherleaf	*Chamaedaphne calyculata*	S5	Secure
Fireweed	*Chamerion angustifolium*	S5	Secure
White Turtlehead	*Chelone glabra*	S5	Secure
Bulbous Water-hemlock	*Cicuta bulbifera*	S5	Secure
Drooping Wood Reed Grass	*Cinna latifolia*	S5	Secure
Small Enchanter's Nightshade	*Circaea alpina*	S5	Secure
Yellow Bluebead Lily	*Clintonia borealis*	S5	Secure
Canada Horseweed	*Conyza canadensis*	S5	Secure
Goldthread	*Coptis trifolia*	S5	Secure
Spotted Coralroot	*Corallorhiza maculata* var. *occidentalis*	S2S3	Sensitive
Alternate-leaved Dogwood	*Cornus alternifolia*	S5	Secure
Bunchberry	*Cornus canadensis*	S5	Secure
Red Osier Dogwood	*Cornus sericea*	S5	Secure
Beaked Hazel	*Corylus cornuta*	S5	Secure
Pink Lady's-Slipper	*Cypripedium acaule*	S5	Secure
Orchard Grass	*Dactylis glomerata*	SNA	Exotic
Dewdrop	*Dalibarda repens*	S5	Secure
Poverty Oat Grass	*Danthonia spicata*	S5	Secure
Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure
a Panic Grass	*Dichanthelium acuminatum* var. *acuminatum*	SNA	
Woolly Panic Grass	*Dichanthelium acuminatum* var. *fasciculatum*	S5	Secure
Northern Bush Honeysuckle	*Diervilla lonicera*	S5	Secure
Hairy Flat-top White Aster	*Doellingeria umbellata*	S5	Secure
Spoon-Leaved Sundew	*Drosera intermedia*	S5	Secure
Round-leaved Sundew	*Drosera rotundifolia*	S5	Secure
Mountain Wood Fern	*Dryopteris campyloptera*	S5	Secure
Spinulose Wood Fern	*Dryopteris carthusiana*	S5	Secure
Crested Wood Fern	*Dryopteris cristata*	S5	Secure
Evergreen Wood Fern	*Dryopteris intermedia*	S5	Secure
a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed

Table B1 List of Vascular Plants Found In and Around the Study Area

Common name	AC CDC binomial	AC CDC S-Rank	NBDNR/CESCC Status Rank
a Hybrid Wood-fern	*Dryopteris x triploidea*	SNA	Not Assessed
Three-Way Sedge	*Dulichium arundinaceum*	S5	Secure
Ovate Spikerush	*Eleocharis ovata*	S5	Secure
Common Spikerush	*Eleocharis palustris*	S5	Secure
Trailing Arbutus	*Epigaea repens*	S5	Secure
Northern Willowherb	*Epilobium ciliatum*	S5	Secure
Marsh Willowherb	*Epilobium palustre*	S5	Secure
Field Horsetail	*Equisetum arvense*	S5	Secure
Water Horsetail	*Equisetum fluviatile*	S5	Secure
Woodland Horsetail	*Equisetum sylvaticum*	S5	Secure
Eastern Burnweed	*Erechtites hieraciifolia*	S5	Secure
Rough Fleabane	*Erigeron strigosus*	S5	Secure
White Buttons	*Eriocaulon aquaticum*	S5	Secure
Narrow-leaved Cottongrass	*Eriophorum angustifolium* ssp. *scabriusculum*	S5	Secure
Tussock Cottongrass	*Eriophorum vaginatum*	S5	Secure
Tawny Cottongrass	*Eriophorum virginicum*	S5	Secure
Yellow Trout Lily	*Erythronium americanum*	S5	Secure
Spotted Joe-pye-weed	*Eupatorium maculatum*	S5	Secure
Common Boneset	*Eupatorium perfoliatum*	S5	Secure
Common Eyebright	*Euphrasia nemorosa*	SNA	Exotic
Low Rough Aster	*Eurybia radula*	S5	Secure
Grass-leaved Goldenrod	*Euthamia graminifolia*	S5	Secure
American Beech	*Fagus grandifolia*	S5	Secure
Red Fescue	*Festuca rubra*	S5	Secure
White Ash	*Fraxinus americana*	S5	Secure
Black Ash	*Fraxinus nigra*	S5	Secure
Rough Bedstraw	*Galium asprellum*	S5	Secure
Common Marsh Bedstraw	*Galium palustre*	S5	Secure
Dyer's Bedstraw	*Galium tinctorium*	S5	Secure
Three-petaled Bedstraw	*Galium trifidum*	S5	Secure
Three-petaled Bedstraw	*Galium trifidum* ssp. *trifidum*	S5	Secure
Large-Leaved Avens	*Geum macrophyllum*	S5	Secure
Water Avens	*Geum rivale*	S5	Secure
Northern Manna Grass	*Glyceria borealis*	S5	Secure
Canada Manna Grass	*Glyceria canadensis*	S5	Secure
Common Tall Manna Grass	*Glyceria grandis*	S5	Secure
Slender Manna Grass	*Glyceria melicaria*	S5	Secure
Fowl Manna Grass	*Glyceria striata*	S5	Secure
Marsh Cudweed	*Gnaphalium uliginosum*	SNA	Exotic
Lesser Rattlesnake-plantain	*Goodyera repens*	S4	Secure
Checkered Rattlesnake-Plantain	*Goodyera tesselata*	S4	Secure
Common Oak Fern	*Gymnocarpium dryopteris*	S5	Secure
Common Cow Parsnip	*Heracleum maximum*	S5	Secure
Orange Hawkweed	*Hieracium aurantiacum*	SNA	Exotic
Canada Hawkweed	*Hieracium canadense*	S5	Secure
Mouse-ear Hawkweed	*Hieracium pilosella*	SNA	Exotic

Table B1 List of Vascular Plants Found In and Around the Study Area

Common name	AC CDC binomial	AC CDC S-Rank	NBDNR/CESCC Status Rank
King Devil Hawkweed	*Hieracium praealtum*	SNA	Exotic
Common Mare's-Tail	*Hippuris vulgaris*	S4S5	Secure
Shining Firmoss	*Huperzia lucidula*	S5	Secure
Northern St. John's-Wort	*Hypericum boreale*	S5	Secure
Canada St. John's-wort	*Hypericum canadense*	S5	Secure
Pale St. John's-Wort	*Hypericum ellipticum*	S5	Secure
Common St. John's-wort	*Hypericum perforatum*	SNA	Exotic
Common Winterberry	*Ilex verticillata*	S5	Secure
Spotted Jewelweed	*Impatiens capensis*	S5	Secure
Harlequin Blue Flag	*Iris versicolor*	S5	Secure
Short-tailed Rush	*Juncus brevicaudatus*	S5	Secure
Toad Rush	*Juncus bufonius*	S5	Secure
Soft Rush	*Juncus effusus*	S5	Secure
Thread Rush	*Juncus filiformis*	S5	Secure
Brown-Fruited Rush	*Juncus pelocarpus*	S5	Secure
Path Rush	*Juncus tenuis*	S5	Secure
Sheep Laurel	*Kalmia angustifolia*	S5	Secure
Pale Bog Laurel	*Kalmia polifolia*	S5	Secure
Tall Blue Lettuce	*Lactuca biennis*	S5	Secure
Tamarack	*Larix laricina*	S5	Secure
Common Labrador Tea	*Ledum groenlandicum*	S5	Secure
Oxeye Daisy	*Leucanthemum vulgare*	SNA	Exotic
Butter-And-Eggs	*Linaria vulgaris*	SNA	Exotic
Broad-Leaved Twayblade	*Listera convallarioides*	S4	Secure
Heart-leaved Twayblade	*Listera cordata*	S4	Secure
Canada Fly Honeysuckle	*Lonicera canadensis*	S5	Secure
Mountain Fly Honeysuckle	*Lonicera villosa*	S5	Secure
Northern Bog Clubmoss	*Lycopodiella inundata*	S4S5	Secure
Stiff Clubmoss	*Lycopodium annotinum*	S5	Secure
Northern Clubmoss	*Lycopodium complanatum*	S4S5	Secure
Round-branched Tree-clubmoss	*Lycopodium dendroideum*	S5	Secure
Flat-branched Tree-clubmoss	*Lycopodium obscurum*	S5	Secure
Ground-Fir	*Lycopodium sabinifolium*	S3	Secure
American Water Horehound	*Lycopus americanus*	S5	Secure
Northern Water Horehound	*Lycopus uniflorus*	S5	Secure
Swamp Yellow Loosestrife	*Lysimachia terrestris*	S5	Secure
Large False Solomon's Seal	*Maianthemum racemosum*	S5	Secure
Three-leaved False Soloman's Seal	*Maianthemum trifolium*	S5	Secure
Green Adder's-Mouth	*Malaxis unifolia*	S4	Secure
Ostrich Fern	*Matteuccia struthiopteris*	S5	Secure
Indian Cucumber Root	*Medeola virginiana*	S5	Secure
American Cow Wheat	*Melampyrum lineare*	S5	Secure
Yellow Sweet-clover	*Melilotus officinalis*	SNA	Exotic
Bog Buckbean	*Menyanthes trifoliata*	S5	Secure
Partridgeberry	*Mitchella repens*	S5	Secure
Naked Bishop's-Cap	*Mitella nuda*	S5	Secure
One-flowered Wintergreen	*Moneses uniflora*	S5	Secure

Table B1 List of Vascular Plants Found In and Around the Study Area

Common name	AC CDC binomial	AC CDC S-Rank	NBDNR/CESCC Status Rank
Pinesap	*Monotropa hypopithys*	S4	Secure
Indian Pipe	*Monotropa uniflora*	S5	Secure
Sweet Gale	*Myrica gale*	S5	Secure
Slender Water Milfoil	*Myriophyllum tenellum*	S4	Secure
Mountain Holly	*Nemopanthus mucronatus*	S5	Secure
Variegated Pond-lily	*Nuphar lutea*	S5	Secure
Whorled Wood Aster	*Oclemena acuminata*	S5	Secure
Bog Aster	*Oclemena nemoralis*	S5	Secure
Common Evening Primrose	*Oenothera biennis*	S4S5	Secure
Woodland Cudweed	*Omalotheca sylvatica*	S4	Secure
Sensitive Fern	*Onoclea sensibilis*	S5	Secure
One-sided Wintergreen	*Orthilia secunda*	S5	Secure
Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure
Interrupted Fern	*Osmunda claytoniana*	S5	Secure
Royal Fern	*Osmunda regalis*	S5	Secure
Common Wood Sorrel	*Oxalis montana*	S5	Secure
European Wood Sorrel	*Oxalis stricta*	S5	Secure
Northern Beech Fern	*Phegopteris connectilis*	S5	Secure
Common Timothy	*Phleum pratense*	SNA	Exotic
Black Chokeberry	*Photinia melanocarpa*	S5	Secure
Norway Spruce	*Picea abies*		
White Spruce	*Picea glauca*	S5	Secure
Black Spruce	*Picea mariana*	S5	Secure
Red Spruce	*Picea rubens*	S5	Secure
Jack Pine	*Pinus banksiana*	S5	Secure
Eastern White Pine	*Pinus strobus*	S5	Secure
Common Plantain	*Plantago major*	SNA	Exotic
Tall Northern Green Orchid	*Platanthera aquilonis*	S4	Secure
White Fringed Orchid	*Platanthera blephariglottis*	S3	Secure
Club Spur Orchid	*Platanthera clavellata*	S4	Secure
White Bog Orchid	*Platanthera dilatata* var. *dilatata*	S4	Secure
Blunt-leaved Orchid	*Platanthera obtusata*	S4	Secure
Small Round-leaved Orchid	*Platanthera orbiculata*	S4	Secure
Canada Blue Grass	*Poa compressa*	SNA	Exotic
Fowl Blue Grass	*Poa palustris*	S5	Secure
Dotted Smartweed	*Polygonum punctatum*	S3	Secure
Arrow-leaved Smartweed	*Polygonum sagittatum*	S5	Secure
Rock Polypody	*Polypodium virginianum*	S5	Secure
Balsam Poplar	*Populus balsamifera*	S5	Secure
Large-toothed Aspen	*Populus grandidentata*	S5	Secure
Trembling Aspen	*Populus tremuloides*	S5	Secure
Ribbon-leaved Pondweed	*Potamogeton epihydrus*	S5	Secure
Variable-leaved Pondweed	*Potamogeton gramineus*	S5	Secure
Rough Cinquefoil	*Potentilla norvegica*	S5	Secure
Three-leaved Rattlesnakeroot	*Prenanthes trifoliolata*	S5	Secure
Common Self-heal	*Prunella vulgaris*	S5	Secure
Bracken Fern	*Pteridium aquilinum*	S5	Secure

Table B1 List of Vascular Plants Found In and Around the Study Area

Common name	AC CDC binomial	AC CDC S-Rank	NBDNR/CESCC Status Rank
Shinleaf	*Pyrola elliptica*	S5	Secure
Common Buttercup	*Ranunculus acris*	SNA	Exotic
Creeping Buttercup	*Ranunculus repens*	SNA	Exotic
Rhodora	*Rhododendron canadense*	S5	Secure
White Beakrush	*Rhynchospora alba*	S5	Secure
Brown Beakrush	*Rhynchospora fusca*	S3	Secure
Skunk Currant	*Ribes glandulosum*	S5	Secure
Bristly Black Currant	*Ribes lacustre*	S5	Secure
One-rowed Yellowcress	*Rorippa microphylla*	SNA	Exotic
Allegheny Blackberry	*Rubus allegheniensis*	S5	Secure
Bristly Dewberry	*Rubus hispidus*	S5	Secure
Red Raspberry	*Rubus idaeus*	S5	Secure
Dwarf Red Raspberry	*Rubus pubescens*	S5	Secure
Garden Sorrel	*Rumex acetosa*	SNA	Exotic
Curled Dock	*Rumex crispus*	SNA	Exotic
Greater Water Dock	*Rumex orbiculatus*	S5	Secure
Northern Arrowhead	*Sagittaria cuneata*	S5	Secure
Bebb's Willow	*Salix bebbiana*	S5	Secure
Pussy Willow	*Salix discolor*	S5	Secure
Cottony Willow	*Salix eriocephala*	S5	Secure
Shining Willow	*Salix lucida*	S5	Secure
Bog Willow	*Salix pedicellaris*	S3	Secure
Balsam Willow	*Salix pyrifolia*	S5	Secure
Black Elderberry	*Sambucus nigra* ssp. *canadensis*	S5	Secure
Red Elderberry	*Sambucus racemosa*	S5	Secure
Northern Pitcher Plant	*Sarracenia purpurea*	S5	Secure
Marsh Scheuchzeria	*Scheuchzeria palustris*	S4	Secure
Water Bulrush	*Schoenoplectus subterminalis*	S5	Secure
Black-girdled Bulrush	*Scirpus atrocinctus*	S5	Secure
Common Woolly Bulrush	*Scirpus cyperinus*	S5	Secure
Mosquito Bulrush	*Scirpus hattorianus*	S4	Secure
Small-fruited Bulrush	*Scirpus microcarpus*	S5	Secure
Marsh Skullcap	*Scutellaria galericulata*	S5	Secure
Mad-dog Skullcap	*Scutellaria lateriflora*	S5	Secure
Bladder Campion	*Silene vulgaris*	SNA	Exotic
Canada Goldenrod	*Solidago canadensis*	S5	Secure
Zigzag Goldenrod	*Solidago flexicaulis*	S5	Secure
Rough-stemmed Goldenrod	*Solidago rugosa*	S5	Secure
American Mountain Ash	*Sorbus americana*	S5	Secure
Showy Mountain Ash	*Sorbus decora*	S4S5	Secure
American Burreed	*Sparganium americanum*	S5	Secure
Narrow-leaved Burreed	*Sparganium angustifolium*	S5	Secure
Green-fruited Burreed	*Sparganium emersum*	S5	Secure
Broad-fruited Burreed	*Sparganium eurycarpum*	S4S5	Secure
White Meadowsweet	*Spiraea alba*	S5	Secure
Steeplebush	*Spiraea tomentosa*	S5	Secure
Slender Ladies'-tresses	*Spiranthes lacera*	S5	Secure

Table B1 List of Vascular Plants Found In and Around the Study Area

Common name	AC CDC binomial	AC CDC S-Rank	NBDNR/CESCC Status Rank
Clasping-leaved Twisted-stalk	*Streptopus amplexifolius*	S5	Secure
Rose Twisted-stalk	*Streptopus lanceolatus*	S5	Secure
Heart-leaved Aster	*Symphyotrichum cordifolium*	S5	Secure
Calico Aster	*Symphyotrichum lateriflorum*	S5	Secure
New York Aster	*Symphyotrichum novi-belgii*	S5	Secure
Purple-stemmed Aster	*Symphyotrichum puniceum*	S5	Secure
Common Dandelion	*Taraxacum officinale*	SNA	Exotic
Canada Yew	*Taxus canadensis*	S5	Secure
Tall Meadow-Rue	*Thalictrum pubescens*	S5	Secure
New York Fern	*Thelypteris noveboracensis*	S5	Secure
Eastern Marsh Fern	*Thelypteris palustris*	S5	Secure
Eastern White Cedar	*Thuja occidentalis*	S5	Secure
Pale False Manna Grass	*Torreyochloa pallida*	S5	Secure
Fraser's Marsh St. John's-wort	*Triadenum fraseri*	S5	Secure
Alpine Clubrush	*Trichophorum alpinum*	S4	Secure
Northern Starflower	*Trientalis borealis*	S5	Secure
Yellow Clover	*Trifolium aureum*	SNA	Exotic
Red Clover	*Trifolium pratense*	SNA	Exotic
White Clover	*Trifolium repens*	SNA	Exotic
Red Trillium	*Trillium erectum*	S5	Secure
Painted Trillium	*Trillium undulatum*	S5	Secure
Coltsfoot	*Tussilago farfara*	SNA	Exotic
Broad-leaved Cattail	*Typha latifolia*	S5	Secure
Stinging Nettle	*Urtica dioica*	S4	Secure
Horned Bladderwort	*Utricularia cornuta*	S5	Secure
Flat-leaved Bladderwort	*Utricularia intermedia*	S5	Secure
Greater Bladderwort	*Utricularia macrorhiza*	S5	Secure
Eastern Purple Bladderwort	*Utricularia purpurea*	S4	Secure
Sessile-leaved Bellwort	*Uvularia sessilifolia*	S5	Secure
Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure
Large Cranberry	*Vaccinium macrocarpon*	S5	Secure
Velvet-leaved Blueberry	*Vaccinium myrtilloides*	S5	Secure
Small Cranberry	*Vaccinium oxycoccos*	S5	Secure
Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure
Wild Celery	*Vallisneria americana*	S4	Secure
Green False Hellebore	*Veratrum viride*	S4	Secure
Common Mullein	*Verbascum thapsus*	SNA	Exotic
Common Speedwell	*Veronica officinalis*	S5	Exotic
Squashberry	*Viburnum edule*	S4	Secure
Hobblebush	*Viburnum lantanoides*	S5	Secure
Northern Wild Raisin	*Viburnum nudum*	S5	Secure
Tufted Vetch	*Vicia cracca*	SNA	Exotic
Marsh Blue Violet	*Viola cucullata*	S5	Secure
a Violet	*Viola* sp.		

Appendix C

Wetland Delineation Data Sheets

Wetland Plot

New Brunswick Department of Environment Wetland Delineation Data Sheet

Project site: Sisson | Date: Sept. 15/11 | Field crew: GQ + KM
Applicant/Owner: HDI | Sample point: Wetland OFW (no NBEMN)
County: Carleton | Coordinates: 24569946.406 7487990.155
PID: | Project number: 121810356
Do normal environmental conditions exist on-site? Yes ☑ No ☐ Explain:
Atypical situation? Yes ☐ No ☑ Explain
Is this a potential **problem area**? Yes ☐ No ☑ Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule)	Yes ☑	No ☐
Wetland hydrology	Yes ☑	No ☐
Hydric soils	Yes ☑	No ☐

Wetland determination YES ☑ NO ☐

Wetland type: Oligotrophic, Forested wetland
Rational for determination: All wetland criteria met

Vegetation

Tree stratum: (Plot size: 10m)	% cover	Dominant?	Indicator status
1. pic mar	40	✓	FACW-
2.			
3.			
4.			
5.			
6.			
	40	= Total cover	

Shrub stratum: (Plot size: 5m)	% cover	Dominant?	Indicator status	
1. pic mar	30	✓	FACW-	117x.5=58.5
2. kal ang	30	✓	FAC	117x.2=23.4
3. nem muc	20		OBL	
4. vac myr	30	✓	FAC	
5. vib nud	5		OBL	
6. bet pap	2		FAC	
7.				
8.				
	117	= Total cover		

Herb stratum: (Plot size: 2m)	% cover	Dominant?	Indicator status	
1. Cartri	10	✓	OBL	22x.5=11
2. Corcan	5	✓	FAC-	22x.2=4.4
3. dalrep	2		FAC	
4. eri vag	1		OBL	
5. Sci cyp	1		FACW+	
6. gaubis	1		FACW	
7. toptri	2		FACW	
8.				
9.				
10.				
11.				
	22	= Total cover		

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 6 (A)
Total # of dominant species across all strata: 6 (B)
% of dominant species that are OBL,FACW,FAC: 100% (A/B)

Prevalence index worksheet:
Total cover of:
OBL species ____ x 1 = ____
FACW species ____ x 2 = ____
FAC species ____ x 3 = ____
FACU species ____ x 4 = ____
UPL species ____ x 5 = ____
Total: ____ (A) = ____ (B)
Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
__ Rapid test for hydrophytic vegetation
✓ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)
[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? YES ☑ NO ☐

Comments: Sphagnum = 30
plesch = 15
pol com = 5

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — Oligotrophic Forested WL — WL Plot

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- ✓ Surface water (A1)
- ✓ High water table (A2)
- ✓ Saturation (A3)
- ___ Water marks (B1)
- ___ Sediment deposits (B2)
- ___ Drift deposits (B3)
- ___ Algal mat or crust (B4)
- ___ Iron deposits (B5)
- ___ Inundation visible on aerial imagery (B7)
- ___ Sparsely vegetated concave surface (B8)
- ___ Water stained leaves (B9)
- ___ Aquatic fauna (B13)
- ___ Marl deposits (B15)
- ___ Hydrogen sulphide odour (C1)
- ___ Oxidized rhizospheres on living roots (C3)
- ___ Presence of reduced iron (C4)
- ___ Recent iron reduction in tilled soils (C6)
- ___ Thin muck surface (C7)
- ___ Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- ___ Surface soil cracks (B6)
- ___ Drainage patterns (B10)
- ___ Moss trim lines (B16)
- ___ Dry-season water table (C2)
- ___ Crayfish burrows (C8)
- ___ Saturation visible on aerial imagery (C9)
- ___ Stunted or stressed plants (D1)
- ___ Geomorphic position (D2)
- ___ Shallow aquitard
- ___ Microtopographic relief (D4)
- ___ FAC-Neutral test (D5)

Comments: _____

Field observations:

Surface water present? Yes ✓ No ___ Depth 0-3cm
Water table present? Yes ✓ No ___ Depth 7cm
Saturation present? Yes ✓ No ___ Depth 0cm

Wetland hydrology present? YES ✓ **NO** ☐

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

	Matrix		Redox features					
Depth (cm)	Colour (moist)	%	Colour (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-22	7.5YR2.5/1	100					fibric	
22-30	7.5YR2.5/1	100					coarse loamy sand	

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ___ Histosol (A1)
- ✓ Histic epipedon (A2)
- ___ Black histic (A3)
- ___ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ___ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ___ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: Soil sampled between boulders

Restrictive layer (if observed): Type _____
Depth _____

Hydric soil present? YES ✓ **NO** ☐

Additional notes: _____

New Brunswick Department of Environment Wetland Delineation Data Sheet

Project site Sisson | Date Sept. 15/11 | Field crew GQ & KM
Applicant/Owner HDI | Sample point Upland for OFW
County Carleton | Coordinates 2456947.809, 748 7968.182
PID | Project number 121810356
Do normal environmental conditions exist on-site? Yes ☑ No ☐ Explain:
Atypical situation? Yes ☐ No ☑ Explain
Is this a potential **problem area**? Yes ☐ No ☑ Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule)	Yes ☑	No ☐
Wetland hydrology	Yes ☐	No ☑
Hydric soils	Yes ☐	No ☑

Wetland type: Upland - Oligotrophic forested WL

Rational for determination: no hydrology or hydric soils present wetland

Wetland determination YES ☐ NO ☑

Vegetation

Tree stratum: (Plot size: 10m)	% cover	Dominant?	Indicator status	
1. pic mar	65	✓	FACW-	80 x .5 = 40
2. abi bal	15		FAC	80 x .2 = 16
3.				
4.				
5.				
6.				
	80	= Total cover		

Shrub stratum: (Plot size: 5m)	% cover	Dominant?	Indicator status	
1. pic mar	25	✓	FACW-	120 x .5 = 60
2. abi bal	20		FAC	120 x .2 = 24
3. vib nud	15		OBL	
4. Vac myr	60	✓	FAC	
5.				
6.				
7.				
8.				
	120	= Total cover		

Herb stratum: (Plot size: 2m)	% cover	Dominant?	Indicator status	
1. cor can	20	✓	FAC-	22 x .5 = 11
2. mai can	2		FAC-	22 x .2 = 4.4
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
	22	= Total cover		

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 4 (A)
Total # of dominant species across all strata: 4 (B)
% of dominant species that are OBL,FACW,FAC: 100 (A/B)

Prevalence index worksheet:
Total cover of:
OBL species ____ x 1 = ____
FACW species ____ x 2 = ____
FAC species ____ x 3 = ____
FACU species ____ x 4 = ____
UPL species ____ x 5 = ____
Total: ____ (A) = ____ (B)
Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
__ Rapid test for hydrophytic vegetation
✓ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)
[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present?
YES ☑ NO ☐

Comments:

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — Oligotrophic Fen WL - UPLAND

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- / Surface water (A1)
- / High water table (A2)
- ___ Saturation (A3)
- ___ Water marks (B1)
- / Sediment deposits (B2)
- ___ Drift deposits (B3)
- ___ Algal mat or crust (B4)
- / Iron deposits (B5)
- / Inundation visible on aerial imagery (B7)
- / Sparsely vegetated concave surface (B8)
- ___ Water stained leaves (B9)
- ___ Aquatic fauna (B13)
- ___ Marl deposits (B15)
- ___ Hydrogen sulphide odour (C1)
- / Oxidized rhizospheres on living roots (C3)
- ___ Presence of reduced iron (C4)
- ___ Recent iron reduction in tilled soils (C6)
- ___ Thin muck surface (C7)
- ___ Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- / Surface soil cracks (B6)
- / Drainage patterns (B10)
- ___ Moss trim lines (B16)
- / Dry-season water table (C2)
- / Crayfish burrows (C8)
- / Saturation visible on aerial imagery (C9)
- / Stunted or stressed plants (D1)
- / Geomorphic position (D2)
- / Shallow aquitard
- ___ Microtopographic relief (D4)
- ___ FAC-Neutral test (D5)

Comments: None observed

Field observations:

Surface water present? Yes ___ No ✓ Depth ___
Water table present? Yes ___ No ✓ Depth ___
Saturation present? Yes ___ No ✓ Depth ___

Wetland hydrology present? YES ☐ **NO** ☑

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (cm)	Matrix Colour (moist)	Matrix %	Redox features Colour (moist)	Redox features %	Redox features Type[1]	Redox features Loc[2]	Texture	Remarks
0-7	7.5YR2.5/1	100						

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ___ Histosol (A1)
- ___ Histic epipedon (A2)
- ___ Black histic (A3)
- ___ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ___ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ___ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: ___

Restrictive layer (if observed): Type boulder/rock
Depth 7cm

Hydric soil present? YES ☐ **NO** ☑

Additional notes: ___

New Brunswick Department of Environment Wetland Delineation Data Sheet

Project site Sisson | Date Sept. 15/11 | Field crew GQ & KM
Applicant/Owner HDI | Sample point NBDNR-463906 7069, 4
County Carleton | Coordinates 2456204.582, 7487947.864
PID | Project number 121810356
Do normal environmental conditions exist on-site? Yes ☑ No ☐ Explain:
Atypical situation? Yes ☐ No ☑ Explain
Is this a potential **problem area**? Yes ☐ No ☑ Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule) — Yes ☑ No ☐
Wetland hydrology — Yes ☑ No ☐
Hydric soils — Yes ☑ No ☐

Wetland determination YES ☑ NO ☐

Wetland type: Mesotrophic Forested WL
Rational for determination: All wetland criteria met

Vegetation

Tree stratum: (Plot size: 10m)	% cover	Dominant?	Indicator status	
1. abi bal	30	✓	FAC	45x.5=22.5
2. pic mar	15	✓	FACW-	45x.2=9
3.				
4.				
5.				
6.				
	45	= Total cover		

Shrub stratum: (Plot size: 5m)	% cover	Dominant?	Indicator status	
1. aln inc ssp. rug	15	✓	FACW+	41x.5=20.5
2. ace rub	8	✓	FAC	41x.2=8.2
3. abi bal	8		FAC	
4. bet all	2		FAC	
5. pic mar	6		FACW-	
6. nem muc	1		OBL	
7. fag gra	1		FACU	
8.				
	41	= Total cover		

Herb stratum: (Plot size: 2m)	% cover	Dominant?	Indicator status	
1. Car tri	90	✓	OBL	103x.5=51.5
2. dry car	5		FAC+	103x.2=20.6
3. cor can	2		FAC-	
4. tri bor	2		FAC	
5. Oxa mon	2		na	
6. gan his	1		FACW	
7. epi pal	1		OBL	
8.				
9.				
10.				
11.				
	103	= Total cover		

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 5 (A)
Total # of dominant species across all strata: 5 (B)
% of dominant species that are OBL,FACW,FAC: 100 (A/B)

Prevalence index worksheet:
Total cover of:
OBL species ____ x 1 = ____
FACW species ____ x 2 = ____
FAC species ____ x 3 = ____
FACU species ____ x 4 = ____
UPL species ____ x 5 = ____
Total: ____ (A) = ____ (B)
Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
__ Rapid test for hydrophytic vegetation
✓ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)
[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? YES ☑ NO ☐

Comments: Sphagnum spp = 90%
Wetland type often has Osmcin, Vibnud, some stands have Thuocc.
Often good Goodyera sp. habitat.

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — Meso For WL — Wetland Plot

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- ✓ Surface water (A1)
- ✓ High water table (A2)
- ✓ Saturation (A3)
- ___ Water marks (B1)
- ___ Sediment deposits (B2)
- ___ Drift deposits (B3)
- ___ Algal mat or crust (B4)
- ___ Iron deposits (B5)
- ___ Inundation visible on aerial imagery (B7)
- ___ Sparsely vegetated concave surface (B8)
- ___ Water stained leaves (B9)
- ___ Aquatic fauna (B13)
- ___ Marl deposits (B15)
- ✓ Hydrogen sulphide odour (C1)
- ___ Oxidized rhizospheres on living roots (C3)
- ___ Presence of reduced iron (C4)
- ___ Recent iron reduction in tilled soils (C6)
- ___ Thin muck surface (C7)
- ___ Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- ___ Surface soil cracks (B6)
- ___ Drainage patterns (B10)
- ___ Moss trim lines (B16)
- ___ Dry-season water table (C2)
- ___ Crayfish burrows (C8)
- ___ Saturation visible on aerial imagery (C9)
- ___ Stunted or stressed plants (D1)
- ___ Geomorphic position (D2)
- ___ Shallow aquitard
- ___ Microtopographic relief (D4)
- ___ FAC-Neutral test (D5)

Comments: _____

Field observations:

Surface water present? Yes ✓ No ___ Depth 0-10cm
Water table present? Yes ✓ No ___ Depth 5cm
Saturation present? Yes ✓ No ___ Depth 0cm

Wetland hydrology present? YES ✓ **NO** ☐

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (cm)	Matrix Colour (moist)	Matrix %	Redox features Colour (moist)	Redox features %	Redox features Type[1]	Redox features Loc[2]	Texture	Remarks
0-40+	7.5YR2.5/2	100	—	—	—	—	hemic	Organic

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ✓ Histosol (A1)
- ___ Histic epipedon (A2)
- ___ Black histic (A3)
- ___ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ___ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ___ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: _____

Restrictive layer (if observed): Type —
Depth —

Hydric soil present? YES ✓ **NO** ☐

Additional notes: _____

New Brunswick Department of Environment Wetland Delineation Data Sheet

Project site: Sisson | Date: Sept. 15/11 | Field crew: GQ + KM
Applicant/Owner: HDI | Sample point: upland for NBDNR-463906706 9
County: Carleton | Coordinates: 2456193.295, 7487939.168
PID: | Project number: 121810356
Do normal environmental conditions exist on-site? Yes ☑ No ☐ Explain:
Atypical situation? Yes ☐ No ☑ Explain
Is this a potential **problem area**? Yes ☐ No ☑ Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule) — Yes ☐ No ☑
Wetland hydrology — Yes ☐ No ☑
Hydric soils — Yes ☐ No ☑

Wetland type: Mesotrophic forested WL - UPLAND
Rational for determination: No wetland criteria met

Wetland determination — YES ☐ NO ☑

Vegetation

Tree stratum: (Plot size: 10m)	% cover	Dominant?	Indicator status
1. Pic rub	40	✓	FACU
2.			
3.			
4.			
5.			
6.			
	40	= Total cover	

Shrub stratum: (Plot size: 5m)	% cover	Dominant?	Indicator status	
1. Pic rub	6		FACU	98x.5=49
2. abi bal	85	✓	FAC	98x.2=19.6
3. ace rub	7		FAC	
4.				
5.				
6.				
7.				
8.				
	98	= Total cover		

Herb stratum: (Plot size: 2m)	% cover	Dominant?	Indicator status	
1. dry car	1	✓	FAC+	2x.5=1
2. ara nud	1	✓	FACU	2x.2=0.4
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
	2	= Total cover		

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 2 (A)
Total # of dominant species across all strata: 4 (B)
% of dominant species that are OBL,FACW,FAC: 50 (A/B)

Prevalence index worksheet:
Total cover of:
OBL species ____ x 1 = ____
FACW species ____ x 2 = ____
FAC species ____ x 3 = ____
FACU species ____ x 4 = ____
UPL species ____ x 5 = ____
Total: ____ (A) = ____ (B)
Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
__ Rapid test for hydrophytic vegetation
__ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)
[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present?
YES ☐ NO ☑

Comments: bryos = ptiacri, dicpol, lysl spf + baztri

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — Meso for WL - UPLAND

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- ___ Surface water (A1)
- ___ High water table (A2)
- ___ Saturation (A3)
- ___ Water marks (B1)
- ___ Sediment deposits (B2)
- ___ Drift deposits (B3)
- ___ Algal mat or crust (B4)
- ___ Iron deposits (B5)
- ___ Inundation visible on aerial imagery (B7)
- ___ Sparsely vegetated concave surface (B8)
- ___ Water stained leaves (B9)
- ___ Aquatic fauna (B13)
- ___ Marl deposits (B15)
- ___ Hydrogen sulphide odour (C1)
- ___ Oxidized rhizospheres on living roots (C3)
- ___ Presence of reduced iron (C4)
- ___ Recent iron reduction in tilled soils (C6)
- ___ Thin muck surface (C7)
- ___ Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- ___ Surface soil cracks (B6)
- ___ Drainage patterns (B10)
- ___ Moss trim lines (B16)
- ___ Dry-season water table (C2)
- ___ Crayfish burrows (C8)
- ___ Saturation visible on aerial imagery (C9)
- ___ Stunted or stressed plants (D1)
- ___ Geomorphic position (D2)
- ___ Shallow aquitard
- ___ Microtopographic relief (D4)
- ___ FAC-Neutral test (D5)

Comments: none observed

Field observations:

Surface water present? Yes ____ No ✓ Depth ____
Water table present? Yes ____ No ✓ Depth ____
Saturation present? Yes ____ No ✓ Depth ____

Wetland hydrology present? YES ☐ **NO** ☑

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (cm)	Matrix Colour (moist)	Matrix %	Redox features Colour (moist)	Redox %	Redox Type[1]	Redox Loc[2]	Texture	Remarks
0-10	7.5YR2/1	100	—	—	—	—	fibric	
10-12	7.5YR2.5/2	100	—	—	—	—	Silty loam	
12-16	7.5YR 5/2	100	—	—	—	—	sandy loam	
16-20	5YR 3/4	100	—	—	—	—	sandy loam	
20-35	7.5YR5/6	100	—	—	—	—	Sandy loam	

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ___ Histosol (A1)
- ___ Histic epipedon (A2)
- ___ Black histic (A3)
- ___ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ___ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ___ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: ____

Restrictive layer (if observed): Type rock
Depth 35

Hydric soil present? YES ☐ **NO** ☑

Additional notes: ____

New Brunswick Department of Environment Wetland Delineation Data Sheet

Project site: Sisson | Date: Sept. 15/11 | Field crew: KM + GQ
Applicant/Owner: HDI | Sample point: NBENV-4640567081
County: Carleton | Coordinates: 245387.9m, 7489512.6m NBDS
PID: | Project number: 121810356
Do normal environmental conditions exist on-site? Yes ☑ No ☐ Explain:
Atypical situation? Yes ☐ No ☑ Explain
Is this a potential **problem area**? Yes ☐ No ☑ Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule)	Yes ☑	No ☐
Wetland hydrology	Yes ☑	No ☐
Hydric soils	Yes ☑	No ☐

Wetland determination YES ☑ NO ☐

Wetland type: Riparian shrub wetland
Rational for determination: All wetland criteria met

Vegetation

Tree stratum: (Plot size: 10m)	% cover	Dominant?	Indicator status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total cover		

Shrub stratum: (Plot size: 5m)	% cover	Dominant?	Indicator status
1. aln inc ssprug	85	✓	FACW+
2. rub ida	8		FAC-
3. bet x cae	3		na
4. sal dis	2		FACW
5. pic mar	2		FACW-
6.			
7.			
8.			
100	= Total cover		

Herb stratum: (Plot size: 2m)	% cover	Dominant?	Indicator status	
1. imp cap	10	✓	FACW	18 x .5 = 9
2. cal can	5	✓	FACW+	18 x .2 = 3.6
3. epi pal	1		OBL	
4. tha pub	2		FACW+	
5.				
6.				
7.				
8.				
9.				
10.				
11.				
18	= Total cover			

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 3 (A)
Total # of dominant species across all strata: 3 (B)
% of dominant species that are OBL,FACW,FAC: 100 (A/B)

Prevalence index worksheet:
Total cover of:
OBL species ____ x 1 = ____
FACW species ____ x 2 = ____
FAC species ____ x 3 = ____
FACU species ____ x 4 = ____
UPL species ____ x 5 = ____
Total: ____ (A) = ____ (B)
Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
__ Rapid test for hydrophytic vegetation
✓ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)
[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present?
YES ☑ NO ☐

Comments:

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — Riparian Shrub WL — WL Plot

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- ___ Surface water (A1)
- ✓ High water table (A2)
- ✓ Saturation (A3)
- ___ Water marks (B1)
- ___ Sediment deposits (B2)
- ___ Drift deposits (B3)
- ___ Algal mat or crust (B4)
- ___ Iron deposits (B5)
- ___ Inundation visible on aerial imagery (B7)
- ___ Sparsely vegetated concave surface (B8)
- ___ Water stained leaves (B9)
- ___ Aquatic fauna (B13)
- ___ Marl deposits (B15)
- ___ Hydrogen sulphide odour (C1)
- ___ Oxidized rhizospheres on living roots (C3)
- ___ Presence of reduced iron (C4)
- ___ Recent iron reduction in tilled soils (C6)
- ___ Thin muck surface (C7)
- ___ Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- ___ Surface soil cracks (B6)
- ___ Drainage patterns (B10)
- ___ Moss trim lines (B16)
- ___ Dry-season water table (C2)
- ___ Crayfish burrows (C8)
- ___ Saturation visible on aerial imagery (C9)
- ___ Stunted or stressed plants (D1)
- ___ Geomorphic position (D2)
- ___ Shallow aquitard
- ___ Microtopographic relief (D4)
- ___ FAC-Neutral test (D5)

Comments: _____

Field observations:

Surface water present? Yes ___ No ___ Depth ___
Water table present? Yes ✓ No ___ Depth 30cm
Saturation present? Yes ✓ No ___ Depth 10cm

Wetland hydrology present? YES ✓ **NO** ☐

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (cm)	Matrix Colour (moist)	Matrix %	Redox features Colour (moist)	Redox features %	Redox features Type[1]	Redox features Loc[2]	Texture	Remarks
0-40+	7.5YR 2.5/1	100	—	—	—	—	fibric	organic

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ✓ Histosol (A1)
- ___ Histic epipedon (A2)
- ___ Black histic (A3)
- ___ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ___ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ___ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: _____

Restrictive layer (if observed): Type ___/___
Depth ___/___

Hydric soil present? YES ✓ **NO** ☐

Additional notes: _____

New Brunswick Department of Environment Wetland Delineation Data Sheet

Project site Sisson | Date Sept. 15/11 | Field crew KM*GG
Applicant/Owner HDI | Sample point upland for NBE NW-46405674814
County Carleton | Coordinates 2455400.2m, 7489517.9m NSDS
PID | Project number 12101356

Do normal environmental conditions exist on-site? Yes ☑ No ☐ Explain:
Atypical situation? Yes ☐ No ☑ Explain
Is this a potential **problem area**? Yes ☐ No ☑ Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule) — Yes ☐ No ☑
Wetland hydrology — Yes ☐ No ☑
Hydric soils — Yes ☐ No ☑

Wetland type: Upland-adjacent to Riparian Shrub WL
Rational for determination: No wetland criteria met

Wetland determination YES ☐ NO ☑

Vegetation

Tree stratum: (Plot size: 10m)

	% cover	Dominant?	Indicator status
1. pic rub	40	✓	FACU
2.			
3.			
4.			
5.			
6.			
	40	= Total cover	

Shrub stratum: (Plot size: 5m)

	% cover	Dominant?	Indicator status	
1. pic rub	50	✓	FACU	80x.5=40
2. abi bal	30	✓	FAC	80x.2=16
3.				
4.				
5.				
6.				
7.				
8.				
	80	= Total cover		

Herb stratum: (Plot size:)

	% cover	Dominant?	Indicator status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
		= Total cover	

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 1 (A)
Total # of dominant species across all strata: 3 (B)
% of dominant species that are OBL,FACW,FAC: 33.3 (A/B)

Prevalence index worksheet:
Total cover of:
OBL species ____ x 1 = ____
FACW species ____ x 2 = ____
FAC species ____ x 3 = ____
FACU species ____ x 4 = ____
UPL species ____ x 5 = ____
Total: ____ (A) = ____ (B)
Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
__ Rapid test for hydrophytic vegetation
__ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)
[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present?
YES ☐ NO ☑

Comments:

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — Rip Shrub WL - UPLAND

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- ___ Surface water (A1)
- ___ High water table (A2)
- ___ Saturation (A3)
- ___ Water marks (B1)
- ___ Sediment deposits (B2)
- ___ Drift deposits (B3)
- ___ Algal mat or crust (B4)
- ___ Iron deposits (B5)
- ___ Inundation visible on aerial imagery (B7)
- ___ Sparsely vegetated concave surface (B8)
- ___ Water stained leaves (B9)
- ___ Aquatic fauna (B13)
- ___ Marl deposits (B15)
- ___ Hydrogen sulphide odour (C1)
- ___ Oxidized rhizospheres on living roots (C3)
- ___ Presence of reduced iron (C4)
- ___ Recent iron reduction in tilled soils (C6)
- ___ Thin muck surface (C7)
- ___ Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- ___ Surface soil cracks (B6)
- ___ Drainage patterns (B10)
- ___ Moss trim lines (B16)
- ___ Dry-season water table (C2)
- ___ Crayfish burrows (C8)
- ___ Saturation visible on aerial imagery (C9)
- ___ Stunted or stressed plants (D1)
- ___ Geomorphic position (D2)
- ___ Shallow aquitard
- ___ Microtopographic relief (D4)
- ___ FAC-Neutral test (D5)

Comments: none observed

Field observations:

Surface water present? Yes ____ No ✓ Depth ____
Water table present? Yes ____ No ✓ Depth ____
Saturation present? Yes ____ No ✓ Depth ____

Wetland hydrology present? YES ☐ **NO** ☑

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

	Matrix		Redox features					
Depth (cm)	Colour (moist)	%	Colour (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	7.5YR3/1	100	—	—	—	—	fibric	
12-20	—	—	—	—	—	—	granite cobble	

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ___ Histosol (A1)
- ___ Histic epipedon (A2)
- ___ Black histic (A3)
- ___ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ___ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ___ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: ____

Restrictive layer (if observed): Type rock
Depth 20

Hydric soil present? YES ☐ **NO** ☑

Additional notes: ____

New Brunswick Department of Environment Wetland Delineation Data Sheet

Project site Sisson | Date Sept. 15/11 | Field crew KM & GQ
Applicant/Owner HDI | Sample point MBEN-46387061
County Carleton | Coordinates 2456797.881, 7487564.411
PID | Project number 121810356
Do normal environmental conditions exist on-site? Yes ☑ No ☐ Explain:
Atypical situation? Yes ☐ No ☑ Explain
Is this a potential **problem area**? Yes ☐ No ☑ Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule)	Yes ☑	No ☐
Wetland hydrology	Yes ☑	No ☐
Hydric soils	Yes ☑	No ☐

Wetland type: Beaver Impoundment Meadow
Rational for determination: All wetland criteria met

Wetland determination YES ☑ NO ☐

Vegetation

Tree stratum: (Plot size: 10m)	% cover	Dominant?	Indicator status	
1.				many snags.
2.				
3.				
4.				
5.				
6.				
	= Total cover			

Shrub stratum: (Plot size: 5m)	% cover	Dominant?	Indicator status	
1. aln inc ssp. rug	2	✓	FACW+	4x.5=2
2. nemmuc	1	✓	OBL	4x.2=0.8
3. sal dis	1	✓	FACW	
4.				
5.				
6.				
7.				
8.				
	4 = Total cover			

Herb stratum: (Plot size: 2m)	% cover	Dominant?	Indicator status	
1. cal can	75	✓	FACW+	105x.5=52.5
2. sci atr	25	✓	FACW+	105x.2=21
3. tri fra	2		OBL	
4. eut gra	3		FAC	
5.				
6.				
7.				
8.				
9.				
10.				
11.				
	105 = Total cover			

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 5 (A)
Total # of dominant species across all strata: 5 (B)
% of dominant species that are OBL,FACW,FAC: 100 (A/B)

Prevalence index worksheet:
Total cover of:
OBL species ____ x 1 = ____
FACW species ____ x 2 = ____
FAC species ____ x 3 = ____
FACU species ____ x 4 = ____
UPL species ____ x 5 = ____
Total: ____ (A) = ____ (B)
Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
__ Rapid test for hydrophytic vegetation
✓ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)
[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present?
YES ☑ NO ☐

Comments:

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — Beaver Impoundment Meadow

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- ___ Surface water (A1)
- ___ High water table (A2)
- ✓ Saturation (A3)
- ___ Water marks (B1)
- ___ Sediment deposits (B2)
- ✓ Drift deposits (B3)
- ___ Algal mat or crust (B4)
- ___ Iron deposits (B5)
- ___ Inundation visible on aerial imagery (B7)
- ___ Sparsely vegetated concave surface (B8)
- ___ Water stained leaves (B9)
- ___ Aquatic fauna (B13)
- ___ Marl deposits (B15)
- ___ Hydrogen sulphide odour (C1)
- ___ Oxidized rhizospheres on living roots (C3)
- ___ Presence of reduced iron (C4)
- ___ Recent iron reduction in tilled soils (C6)
- ___ Thin muck surface (C7)
- ___ Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- ___ Surface soil cracks (B6)
- ___ Drainage patterns (B10)
- ___ Moss trim lines (B16)
- ___ Dry-season water table (C2)
- ___ Crayfish burrows (C8)
- ___ Saturation visible on aerial imagery (C9)
- ✓ Stunted or stressed plants (D1)
- ___ Geomorphic position (D2)
- ___ Shallow aquitard
- ___ Microtopographic relief (D4)
- ___ FAC-Neutral test (D5)

Comments: Water was observed to be much higher earlier in season

Field observations:

Surface water present? Yes ___ No ✓ Depth ___
Water table present? Yes ✓ No ___ Depth 38cm
Saturation present? Yes ✓ No ___ Depth 10cm

Wetland hydrology present? YES ✓ **NO** ☐

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (cm)	Matrix Colour (moist)	Matrix %	Redox features Colour (moist)	Redox features %	Redox features Type[1]	Redox features Loc[2]	Texture	Remarks
0-4	7.5YR2.5/1	100					hemic/saprie	
4-8	7.5YR2.5/1	100					Silt and organic	
8-16	10YR 5/2	95	7.5YR 2.5/1	5	C	M	silty sand	hot redox organic concentrations
16-30	10YR 6/2	85	7.5YR 4/4	15	C	M	silty sand	

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ___ Histosol (A1)
- ___ Histic epipedon (A2)
- ___ Black histic (A3)
- ___ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ✓ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ___ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: ___

Restrictive layer (if observed): Type ___ Depth ___

Hydric soil present? YES ✓ **NO** ☐

Additional notes: ___

New Brunswick Department of Environment Wetland Delineation Data Sheet BIW UPLAND

Project site Sisson | Date Sept. 15/11 | Field crew KM + GQ
Applicant/Owner HDI | Sample point Upland for NBENV-463876 7061, 22
County Carleton | Coordinates
PID | Project number 121810356
Do normal environmental conditions exist on-site? Yes ☑ No ☐ Explain:
Atypical situation? Yes ☐ No ☑ Explain
Is this a potential **problem area**? Yes ☐ No ☑ Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule)	Yes ☐	No ☑
Wetland hydrology	Yes ☐	No ☑
Hydric soils	Yes ☐	No ☑

Wetland determination YES ☐ NO ☑

Wetland type: Upland - adjacent to recently abandoned beaver meadow
Rational for determination: No wetland criteria met

Vegetation

Tree stratum: (Plot size: 10m)

	% cover	Dominant?	Indicator status
1. Pic rub	15	✓	FACU
2.			
3.			
4.			
5.			
6.			
	15 = Total cover		

Shrub stratum: (Plot size: 5m)

	% cover	Dominant?	Indicator status
1. abi bal	85	✓	FAC
2. pic rub	5		FACU
3. pic mar	5		FACW-
4. bet x cae	2		na
5.			
6.			
7.			
8.			
	97 = Total cover		

97 x .5 = 48.5
97 x .2 = 19.4

Herb stratum: (Plot size: 2m)

	% cover	Dominant?	Indicator status
1.			
2. N/A			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	_____ = Total cover		

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 1 (A)
Total # of dominant species across all strata: 2 (B)
% of dominant species that are OBL,FACW,FAC: 50 (A/B)

Prevalence index worksheet:
Total cover of:
OBL species _____ x 1 = _____
FACW species _____ x 2 = _____
FAC species _____ x 3 = _____
FACU species _____ x 4 = _____
UPL species _____ x 5 = _____
Total: _____ (A) = _____ (B)
Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:
__ Rapid test for hydrophytic vegetation
__ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)
[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present?
YES ☐ NO ☑

Comments: hylspl = 50%, plesch = 20%

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — Beaver Impoundment wl - UPLAND

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- / Surface water (A1)
- / High water table (A2)
- / Saturation (A3)
- ___ Water marks (B1)
- ___ Sediment deposits (B2)
- ___ Drift deposits (B3)
- ___ Algal mat or crust (B4)
- / Iron deposits (B5)
- / Inundation visible on aerial imagery (B7)
- / Sparsely vegetated concave surface (B8)
- / Water stained leaves (B9)
- / Aquatic fauna (B13)
- / Marl deposits (B15)
- ___ Hydrogen sulphide odour (C1)
- ___ Oxidized rhizospheres on living roots (C3)
- ___ Presence of reduced iron (C4)
- ___ Recent iron reduction in tilled soils (C6)
- ___ Thin muck surface (C7)
- / Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- / Surface soil cracks (B6)
- / Drainage patterns (B10)
- / Moss trim lines (B16)
- / Dry-season water table (C2)
- / Crayfish burrows (C8)
- / Saturation visible on aerial imagery (C9)
- / Stunted or stressed plants (D1)
- / Geomorphic position (D2)
- / Shallow aquitard
- / Microtopographic relief (D4)
- / FAC-Neutral test (D5)

Comments: N/A

Field observations:

Surface water present? Yes ___ No ✓ Depth ___
Water table present? Yes ___ No ✓ Depth ___
Saturation present? Yes ___ No ✓ Depth ___

Wetland hydrology present? YES ☐ **NO** ✓

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (cm)	Matrix Colour (moist)	Matrix %	Redox features Colour (moist)	Redox features %	Redox features Type[1]	Redox features Loc[2]	Texture	Remarks
0-18	7.5YR2.5/2	100					fibric	
18-20	7.5YR6/2	100					silty sand	AE layer

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ___ Histosol (A1)
- ___ Histic epipedon (A2)
- ___ Black histic (A3)
- ___ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ___ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ___ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: ___

Restrictive layer (if observed): Type rock
Depth 20 cm

Hydric soil present? YES ☐ **NO** ✓

Additional notes: ___

New Brunswick Department of Environment Wetland Delineation Data Sheet

Project site: Sisson | Date: Sept 15/11 | Field crew: KM & GQ
Applicant/Owner: HD1 | Sample point: NBENV-463986 7072
County: Carleton | Coordinates: 2456090.527, 7488993.152
PID: | Project number: 121810356
Do normal environmental conditions exist on-site? Yes ☑ No ☐ Explain:
Atypical situation? Yes ☐ No ☑ Explain
Is this a potential **problem area**? Yes ☐ No ☑ Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule)	Yes ☑	No ☐
Wetland hydrology	Yes ☑	No ☐
Hydric soils	Yes ☑	No ☐

Wetland determination YES ☑ NO ☐

Wetland type: Bog
Rational for determination: All wetland criteria met

Vegetation

Tree stratum: (Plot size: 10m)	% cover	Dominant?	Indicator status	
1. Lar lar	3	✓	FACW	4x.5=2
2. pic mar	1		FACW-	4x.2=1.8
3.				
4.				
5.				
6.				
	4	= Total cover		

Shrub stratum: (Plot size: 5m)	% cover	Dominant?	Indicator status	
1. Lar lar	4		FACW	79x.5=39.5
2. pic mar	10		FACW-	79x.2=15.8
3. Ledgro	30	✓	OBL	
4. cha cal	35	✓	OBL	
5.				
6.				
7.				
8.				
	79	= Total cover		

Herb stratum: (Plot size: 2m)	% cover	Dominant?	Indicator status	
1. Car mag	20	✓	na (OBL)	38x.5=19
2. Mai tri	10	✓	OBL	38x.2=7.6
3. eri vag	5		OBL	
4. Sar pur	3		OBL	
5.				
6.				
7.				
8.				
9.				
10.				
11.				
	38	= Total cover		

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 5 (A)
Total # of dominant species across all strata: 5 (B)
% of dominant species that are OBL,FACW,FAC: 100 (A/B)

Prevalence index worksheet:
Total cover of:
OBL species ____ x 1 = ____
FACW species ____ x 2 = ____
FAC species ____ x 3 = ____
FACU species ____ x 4 = ____
UPL species ____ x 5 = ____
Total: ____ (A) = ____ (B)
Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
__ Rapid test for hydrophytic vegetation
✓ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)
[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? YES ☑ NO ☐

Comments: Sph = 100%

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — Bog Wetland

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- ✓ Surface water (A1)
- ✓ High water table (A2)
- ✓ Saturation (A3)
- ___ Water marks (B1)
- ___ Sediment deposits (B2)
- ___ Drift deposits (B3)
- ___ Algal mat or crust (B4)
- ___ Iron deposits (B5)
- ___ Inundation visible on aerial imagery (B7)
- ___ Sparsely vegetated concave surface (B8)
- ✓ Water stained leaves (B9)
- ___ Aquatic fauna (B13)
- ___ Marl deposits (B15)
- ✓ Hydrogen sulphide odour (C1)
- ___ Oxidized rhizospheres on living roots (C3)
- ___ Presence of reduced iron (C4)
- ___ Recent iron reduction in tilled soils (C6)
- ___ Thin muck surface (C7)
- ___ Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- ___ Surface soil cracks (B6)
- ___ Drainage patterns (B10)
- ___ Moss trim lines (B16)
- ___ Dry-season water table (C2)
- ___ Crayfish burrows (C8)
- ___ Saturation visible on aerial imagery (C9)
- ___ Stunted or stressed plants (D1)
- ___ Geomorphic position (D2)
- ___ Shallow aquitard
- ___ Microtopographic relief (D4)
- ___ FAC-Neutral test (D5)

Comments: _____

Field observations:

Surface water present? Yes ✓ No ___ Depth 0-5cm
Water table present? Yes ✓ No ___ Depth 0cm
Saturation present? Yes ✓ No ___ Depth 0cm

Wetland hydrology present? YES ☑ **NO** ☐

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (cm)	Matrix Colour (moist)	Matrix %	Redox features Colour (moist)	Redox features %	Redox features Type[1]	Redox features Loc[2]	Texture	Remarks
0-40+	5YR3/2	100					fibric	

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ✓ Histosol (A1)
- ___ Histic epipedon (A2)
- ___ Black histic (A3)
- ✓ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ___ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ___ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: _____

Restrictive layer (if observed): Type _____

Depth _____

Hydric soil present? YES ☑ **NO** ☐

Additional notes: _____

New Brunswick Department of Environment Wetland Delineation Data Sheet

Project site Sisson
Applicant/Owner HDI
County Carleton
PID
Date Sept. 15/11 Field crew KM + GQ
Sample point upland for NBENV 463986 7072, 40
Coordinates 2456086.901, 7489008,593
Project number 121810356

Do normal environmental conditions exist on-site? Yes ☑ No ☐ Explain:
Atypical situation? Yes ☐ No ☑ Explain
Is this a potential **problem area**? Yes ☐ No ☑ Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule) Yes ☑ No ☐
Wetland hydrology Yes ☐ No ☑
Hydric soils Yes ☐ No ☑

Wetland determination YES ☐ NO ☑

Wetland type: Upland - adjacent to bog
Rational for determination: No hydrology or hydric soils present

Vegetation

Tree stratum: (Plot size: 10m)

	% cover	Dominant?	Indicator status	
1. abibal	20	✓	FAC	40x.5=20
2. larlar	15	✓	FACW	40x.2=8
3. picmar	5		FACW-	
4.				
5.				
6.				
	40	= Total cover		

Shrub stratum: (Plot size: 5m)

	% cover	Dominant?	Indicator status	
1. nemmuc	15	✓	OBL	55x.5=27.5
2. vacmyr	25	✓	FAC	55x.2=11
3. led grb	5		OBL	
4. kal ang	10		FAC	
5.				
6.				
7.				
8.				
	55	= Total cover		

Herb stratum: (Plot size: 2m)

	% cover	Dominant?	Indicator status	
1. pte aqu	40	✓	FACW	78x.5=39
2. cor can	35	✓	FAC-	78x.2=15.9
3. gaubis	1		FACW	
4. Epirep	2		na	
5.				
6.				
7.				
8.				
9.				
10.				
11.				
	78	= Total cover		

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 5 (A)
Total # of dominant species across all strata: 6 (B)
% of dominant species that are OBL,FACW,FAC: 83.3 (A/B)

Prevalence index worksheet:
Total cover of:
OBL species ____ x 1 = ____
FACW species ____ x 2 = ____
FAC species ____ x 3 = ____
FACU species ____ x 4 = ____
UPL species ____ x 5 = ____
Total: ____ (A) = ____ (B)
Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
__ Rapid test for hydrophytic vegetation
✓ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)
[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? YES ☑ NO ☐

Comments: Cladina = 50%

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — BOG UPLAND

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- ___ Surface water (A1)
- ___ High water table (A2)
- ___ Saturation (A3)
- ___ Water marks (B1)
- ___ Sediment deposits (B2)
- ___ Drift deposits (B3)
- ___ Algal mat or crust (B4)
- ___ Iron deposits (B5)
- ___ Inundation visible on aerial imagery (B7)
- ___ Sparsely vegetated concave surface (B8)
- ___ Water stained leaves (B9)
- ___ Aquatic fauna (B13)
- ___ Marl deposits (B15)
- ___ Hydrogen sulphide odour (C1)
- ___ Oxidized rhizospheres on living roots (C3)
- ___ Presence of reduced iron (C4)
- ___ Recent iron reduction in tilled soils (C6)
- ___ Thin muck surface (C7)
- ___ Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- ___ Surface soil cracks (B6)
- ___ Drainage patterns (B10)
- ___ Moss trim lines (B16)
- ___ Dry-season water table (C2)
- ___ Crayfish burrows (C8)
- ___ Saturation visible on aerial imagery (C9)
- ___ Stunted or stressed plants (D1)
- ___ Geomorphic position (D2)
- ___ Shallow aquitard
- ___ Microtopographic relief (D4)
- ___ FAC-Neutral test (D5)

Comments: none observed

Field observations:

Surface water present? Yes ____ No ____ Depth _____
Water table present? Yes ____ No ____ Depth _____
Saturation present? Yes ____ No ____ Depth _____

Wetland hydrology present? YES [ ] **NO** [✓]

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (cm)	Matrix Colour (moist)	Matrix %	Redox features Colour (moist)	Redox %	Redox Type[1]	Redox Loc[2]	Texture	Remarks
0-5	7.5YR 2.5/1	100					silty loam	
5-8	7.5YR 6/2	100					Sandy loam	
8-10	2.5YR 4/6	100					Sandy loam	
10-35	7.5YR 5/8	100					Loamy sand	

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ___ Histosol (A1)
- ___ Histic epipedon (A2)
- ___ Black histic (A3)
- ___ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ___ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ___ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: _____

Restrictive layer (if observed): Type rock
Depth 35

Hydric soil present? YES [ ] **NO** [✓]

Additional notes: _____

New Brunswick Department of Environment Wetland Delineation Data Sheet

Project site: Sisson | Date: Sept 15/11 | Field crew: GQ + km
Applicant/Owner: HDT | Sample point: NBENV 463606 7056
County: Carleton | Coordinates: 2457187.812 7484793.440
PID: | Project number: 121810356

Do normal environmental conditions exist on-site? Yes [✓] No [ ] Explain:
Atypical situation? Yes [ ] No [✓] Explain
Is this a potential **problem area**? Yes [ ] No [✓] Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule)	Yes [✓]	No [ ]
Wetland hydrology	Yes [✓]	No [ ]
Hydric soils	Yes [✓]	No [ ]

Wetland type: Fen

Rational for determination: All wet criteria met

Wetland determination
YES [✓] NO [ ]

Vegetation

Tree stratum: (Plot size:)	% cover	Dominant?	Indicator status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total cover		

Shrub stratum: (Plot size: 5)	% cover	Dominant?	Indicator status
1. Chaem cal	35	✓	OBL
2. Myrica gale	5		OBL
3.			
4.			
5.			
6.			
7.			
8.			
	= Total cover		

Herb stratum: (Plot size:)	% cover	Dominant?	Indicator status
1. Carex oligosp	40	✓	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total cover		

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 2 (A)
Total # of dominant species across all strata: 2 (B)
% of dominant species that are OBL,FACW,FAC: 100 (A/B)

Prevalence index worksheet:
Total cover of:

OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Total:	(A) =	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
__ Rapid test for hydrophytic vegetation
✓ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)
[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present?
YES [✓] NO [ ]

Comments:

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — FEN WETLAND PLOT

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- ✓ Surface water (A1)
- ✓ High water table (A2)
- ✓ Saturation (A3)
- ___ Water marks (B1)
- ___ Sediment deposits (B2)
- ___ Drift deposits (B3)
- ___ Algal mat or crust (B4)
- ___ Iron deposits (B5)
- ___ Inundation visible on aerial imagery (B7)
- ___ Sparsely vegetated concave surface (B8)
- ___ Water stained leaves (B9)
- ___ Aquatic fauna (B13)
- ___ Marl deposits (B15)
- ✓ Hydrogen sulphide odour (C1)
- ___ Oxidized rhizospheres on living roots (C3)
- ___ Presence of reduced iron (C4)
- ___ Recent iron reduction in tilled soils (C6)
- ___ Thin muck surface (C7)
- ___ Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- ___ Surface soil cracks (B6)
- ___ Drainage patterns (B10)
- ___ Moss trim lines (B16)
- ___ Dry-season water table (C2)
- ___ Crayfish burrows (C8)
- ✓ Saturation visible on aerial imagery (C9)
- ___ Stunted or stressed plants (D1)
- ___ Geomorphic position (D2)
- ___ Shallow aquitard
- ___ Microtopographic relief (D4)
- ___ FAC-Neutral test (D5)

Comments: _____

Field observations:

Surface water present? Yes ✓ No ___ Depth 15cm
Water table present? Yes ✓ No ___ Depth 0
Saturation present? Yes ✓ No ___ Depth 0

Wetland hydrology present? YES [✓] **NO** [ ]

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (cm)	Matrix Colour (moist)	Matrix %	Redox features Colour (moist)	Redox features %	Redox features Type[1]	Redox features Loc[2]	Texture	Remarks
0-40	5yr 3/2	100					hemic, silty	

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ✓ Histosol (A1)
- ___ Histic epipedon (A2)
- ___ Black histic (A3)
- ✓ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ___ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ___ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: _____

Restrictive layer (if observed): Type _____

Depth _____

Hydric soil present? YES [✓] **NO** [ ]

Additional notes: No upland pit done as the bens are bordered by other WLS - see OFW Upland for representative upland conditions.

New Brunswick Department of Environment Wetland Delineation Data Sheet

Project site: Sisson
Date: Sept. 15/11
Field crew: KM + GO
Applicant/Owner: HDI
Sample point: NBENV-4639667061
County: Carleton
Coordinates: 2456864.344, 7488620.088
PID:
Project number: 121810356

Do normal environmental conditions exist on-site? Yes ☑ No ☐ Explain:
Atypical situation? Yes ☐ No ☑ Explain
Is this a potential **problem area**? Yes ☐ No ☑ Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule): Yes ☑ No ☐
Wetland hydrology: Yes ☑ No ☐
Hydric soils: Yes ☑ No ☐

Wetland determination YES ☑ NO ☐

Wetland type: Disturbed scirpus meadow
Rational for determination: All wetland criteria met

Vegetation

Tree stratum: (Plot size: 10 m)

	% cover	Dominant?	Indicator status
1.			
2. N/A			
3.			
4.			
5.			
6.			
	= Total cover		

Shrub stratum: (Plot size: 5m)

	% cover	Dominant?	Indicator status	
1. Salix	3	✓	FACW	8x.5=4
2. rubida	5	✓	FAC-	8x.2=1.6
3.				
4.				
5.				
6.				
7.				
8.				
	8 = Total cover			

Herb stratum: (Plot size: 2m)

	% cover	Dominant?	Indicator status	
1. Sci cyp	60	✓	FACW+	84x.5=42
2. agr hyem	9		FAC	84x.2=16.8
3. cartri	3		OBL	
4. dry cri	2		FACW+	
5. tri fra	2		OBL	
6. eut gra	2		FAC	
7. lyc uni	2		OBL	
8. viola sp.	2		—	
9. Sol rug	1		FAC	
10. Spar ame	1		OBL	
11. hyp bor	1		OBL	
	84 = Total cover			

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 3 (A)
Total # of dominant species across all strata: 3 (B)
% of dominant species that are OBL,FACW,FAC: 100% (A/B)

Prevalence index worksheet:
Total cover of:

OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Total:	(A) =	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

__ Rapid test for hydrophytic vegetation
✓ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? YES ✓ NO ☐

Comments:

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — Scirpus Meadow Wetland

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- ___ Surface water (A1)
- ✓ High water table (A2)
- ✓ Saturation (A3)
- ___ Water marks (B1)
- ___ Sediment deposits (B2)
- ___ Drift deposits (B3)
- ___ Algal mat or crust (B4)
- ___ Iron deposits (B5)
- ___ Inundation visible on aerial imagery (B7)
- ___ Sparsely vegetated concave surface (B8)
- ___ Water stained leaves (B9)
- ___ Aquatic fauna (B13)
- ___ Marl deposits (B15)
- ___ Hydrogen sulphide odour (C1)
- ___ Oxidized rhizospheres on living roots (C3)
- ___ Presence of reduced iron (C4)
- ___ Recent iron reduction in tilled soils (C6)
- ___ Thin muck surface (C7)
- ___ Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- ___ Surface soil cracks (B6)
- ___ Drainage patterns (B10)
- ___ Moss trim lines (B16)
- ___ Dry-season water table (C2)
- ___ Crayfish burrows (C8)
- ___ Saturation visible on aerial imagery (C9)
- ___ Stunted or stressed plants (D1)
- ___ Geomorphic position (D2)
- ___ Shallow aquitard
- ___ Microtopographic relief (D4)
- ___ FAC-Neutral test (D5)

Comments: _____

Field observations:

Surface water present? Yes ___ No ✓ Depth ___

Water table present? Yes ✓ No ___ Depth 18

Saturation present? Yes ✓ No ___ Depth 0

Wetland hydrology present? YES ✓ **NO** ☐

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth (cm)	Matrix Colour (moist)	Matrix %	Redox features Colour (moist)	Redox %	Redox Type[1]	Redox Loc[2]	Texture	Remarks
0-10	7.5YR2.5/1	100					Sapric-peat	
10-12	7.5YR2.5/2	100					Sandy Silt loam	
12-19	7.5YR4/1	100					Sandy loam	
19-35	7.5YR2.5/1	100					Sandy loam	

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ___ Histosol (A1)
- ___ Histic epipedon (A2)
- ___ Black histic (A3)
- ___ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ___ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ✓ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: _____

Restrictive layer (if observed): Type Cemented soil

Depth 35

Hydric soil present? YES ✓ **NO** ☐

Additional notes: _____

New Brunswick Department of Environment Wetland Delineation Data Sheet

Project site Sisson | Date Sept. 15/11 | Field crew KM + GQ
Applicant/Owner HDI | Sample point Upland for NBENV 463966706
County Carleton | Coordinates 24568854.289, 7488622.253
PID | Project number 121810356
Do normal environmental conditions exist on-site? Yes ☑ No ☐ Explain:
Atypical situation? Yes ☐ No ☑ Explain
Is this a potential **problem area**? Yes ☐ No ☑ Explain

Wetland determination (Check one only for each criteria)

Dominant hydrophytic vegetation (50/20 rule)	Yes ☑	No ☐
Wetland hydrology	Yes ☐	No ☑
Hydric soils	Yes ☐	No ☑

Wetland determination YES ☐ NO ☑

Wetland type: Upland - adjacent to disturbed Scirpus meadow
Rational for determination: No hydrology or hydric soils present

Vegetation

Tree stratum: (Plot size: 10m)

	% cover	Dominant?	Indicator status	
1. abi bal	5	✓	FAC	20 x .5 = 10
2. bet pop	5	✓	FAC	20 x .2 = 4
3. pic rub	10	✓	FACU	
4.				
5.				
6.				
	20	= Total cover		

Shrub stratum: (Plot size: 5m)

	% cover	Dominant?	Indicator status	
1. abi bal	5		FAC	39 x .5 = 19.5
2. bet pop	6		FAC	39 x .2 = 7.8
3. vac myr	20	✓	FAC	
4. pru pen	4		FACU-	
5. pic rub	4		FACU	
6.				
7.				
8.				
	39	= Total cover		

Herb stratum: (Plot size: 2m)

	% cover	Dominant?	Indicator status	
1. corcan	80	✓	FAC-	96 x .5 = 48
2. lyc cla	7		FAC	96 x .2 = 19.2
3. Sol rug	3		FAC	
4. cal can	2		FACW+	
5. ana mar	2		na	
6. tri und	2		FACU*	
7.				
8.				
9.				
10.				
11.				
	96	= Total cover		

Dominance test worksheet:
# of dominant species that are OBL,FACW,FAC: 4 (A)
Total # of dominant species across all strata: 5 (B)
% of dominant species that are OBL,FACW,FAC: 80% (A/B)

Prevalence index worksheet:
Total cover of:

OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Total:	(A)	=	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
__ Rapid test for hydrophytic vegetation
✓ Dominance Test is > 50%
__ Prevalence Index is ≤ 3.0[1]
__ Morphological adaptations[1] (explain)
__ Problematic hydrophytic vegetation[1] (explain)
[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? YES ☑ NO ☐

Comments:

New Brunswick Department of Environment Wetland Delineation Data Sheet

Hydrology — Disturbed Scirpus Meadow - UPLAND

Primary Hydrological Indicators: (minimum of one is required; check all that apply)

- / Surface water (A1)
- / High water table (A2)
- / Saturation (A3)
- / Water marks (B1)
- / Sediment deposits (B2)
- / Drift deposits (B3)
- / Algal mat or crust (B4)
- / Iron deposits (B5)
- / Inundation visible on aerial imagery (B7)
- / Sparsely vegetated concave surface (B8)
- / Water stained leaves (B9)
- / Aquatic fauna (B13)
- / Marl deposits (B15)
- / Hydrogen sulphide odour (C1)
- / Oxidized rhizospheres on living roots (C3)
- / Presence of reduced iron (C4)
- / Recent iron reduction in tilled soils (C6)
- / Thin muck surface (C7)
- ___ Other (explain in comments)

Secondary Hydrological Indicators: (minimum of two required; check all that apply)

- / Surface soil cracks (B6)
- / Drainage patterns (B10)
- / Moss trim lines (B16)
- / Dry-season water table (C2)
- / Crayfish burrows (C8)
- / Saturation visible on aerial imagery (C9)
- / Stunted or stressed plants (D1)
- / Geomorphic position (D2)
- / Shallow aquitard
- / Microtopographic relief (D4)
- / FAC-Neutral test (D5)

Comments: None observed -

Field observations:

Surface water present? Yes ___ No ✓ Depth ___
Water table present? Yes ___ No ✓ Depth ___
Saturation present? Yes ___ No ✓ Depth ___

Wetland hydrology present? YES ☐ **NO** ☑

Soil profile

Profile description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

	Matrix		Redox features					
Depth (cm)	Colour (moist)	%	Colour (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	7.5YR 3/1	100					fibric	
3-5	7.5YR 2.5/3	100					silt clay loam	w. organic material
5-10	7.5YR 6/2	100					Sandy loam	AE layer
10-12	2.5YR 3/6	100					Sandy loam	BF layer
12-22	10YR 4/6	100					Sandy Silt loam	

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains. [2]Location: PL = Pore Lining, M = Matrix.

- ___ Histosol (A1)
- ___ Histic epipedon (A2)
- ___ Black histic (A3)
- ___ Hydrogen sulphide (A4)
- ___ Stratified layers (A5)
- ___ Depleted zone below dark surface (A11)
- ___ Thick dark surface (A12)
- ___ Sandy mucky mineral (S1)
- ___ 5cm mucky peat or peat (S3)
- ___ Sandy gleyed matrix (S4)
- ___ Sandy redox (S5)
- ___ Stripped matrix (S6)
- ___ Dark surfaces (S7)
- ___ Polyvalue below surface (S8)
- ___ Thin dark surface (S9)
- ___ Loamy gleyed matrix (F2)
- ___ Depleted matrix (F3)
- ___ Redox dark surface (F6)
- ___ Depleted dark surface (F7)
- ___ Redox depressions (F8)

Comments: ___

Restrictive layer (if observed): Type rock
Depth 22

Hydric soil present? YES ☐ **NO** ☑

Additional notes: ___

Appendix D

Wetland Functional Assessment Forms

Surveyor: *Greg Quinn*, *Krystal Mathieson*	
NBWLID: *4638567057, 4638767036, 4638567049, 4639667061, 4640267036, 4639467064, 4638767040, 4639267063, 4639867070, 4639667066, 4639867072, 4639067069, 4639367073, 4638167078,*	Date: *8/10/2011*
Project Name: *Sisson*	Project Number: 121810356
Wetland Type: *Forested*	Secondary Type: *Bog*
☑ Riparian?	☐ Provincially Significant?

Wetland description overview: Wetland 2

A large headwater wetland complex encompassing several NBDELG wetlands, and is dominated by Oligotrophic Forested Wetland (OFW) with lesser components of Bog, Mesotrophic Forested Wetland (MFW), and Shrub Riparian Wetland. The wetland sprawls across a wide glaciofluvial outwash plain and encompasses most of Bird Brook and its first and second order tributaries. The wider expanses of wetland toward the upland tend to be OFW, while MFW, SRW, and Beaver Impoundment Wetland (BIW) types are associated with the watercourses and narrow swales. The Bog habitat is concentrated in one area of the northern part of the wetland. This wetland complex crosses a watershed divide at the northern end where the landscape drains north toward West Branch Napadogan River and was split at that divide for this assessment.

Inlets and outlets / watercourses	
Inlet present?	Type: *Watercourse* Number: *Multiple*
Beaver dam(s) present?	Number: *Multiple* ☑ Is beaver activity ongoing?
Primary watercourse	Permanent or intermittent flow? *Permanent*
	Wet width? *2 metres at outflow*
	☐ Inflow larger than outflow? ☑ Outflow present?
	Fluctuating water level? *Medium*
	Rate degree of braiding in the channel(s): *Medium*
	Under which condition does the watercourse appear to overflow its normal channel? *Only under heavy rainfall events*

Stormwater retention and water quality features	
Rate capacity to store stormwater:	*High*
Restrictions at outflow?	*Multiple beaver dams occur throughout the wetland*
Estimate position in watershed:	*Upper position*
Vegetation density	Slows drainage? *Moderately*
	Stabilizes shoreline/banks? *Yes*
	Provides shade for watercourse? *Yes*
Is there sedimentation occurring within the wetland?	Minor/ periodic occurrences

Species of Conservation Concern	
	☑ SOCC present?
List species observed:	*Canada Warbler*
	Olive-sided Flycatcher
	Rusty Blackbird, Vesper Sparrow, Blad Eagle
Does the wetland support appropriate habitat for SOCC known to occur in the area?	All SOCC known to occur in the area were recorded in the wetland. There were 13 sightings of Canada Warbler, 7 sightings for Olive-sided Flycatcher, and 1 Rusty Blackbird. There were also two Vesper Sparrow records associated with the wetland: a species not typically associated with wetland.

Community characteristics	
☐ Uncommon or unique community?	If "yes", describe briefly:
☑ Does this wetland have strong potential for carbon storage?	
Rate the structural diversity of this wetland:	
Are there are variety of distinct vegetation communities within the wetland?	
Percent open water?	

Wildlife	
List wildlife species observed within the wetland:	As with much of the study area, the wetland is well used by moose. A cow moose was observed in winter. Beaver activity is prevalent along the watercourses.
Indicate any indirect evidence of notable wildlife use.	Moose browse, tracks, and droppings. Fisher tracks were observed in winter.
Likelihood of fish-bearing	*High*
☐ Fish observed?	☐ High quality amphibian habitat?

Invasive species	
List any invasive species that are present within the wetland:	No invasive species were observed in the wetland.
Are any of these invasives dominant or clearly becoming dominant? (list)	

Anthropogenic influences	
Is the wetland anthropogenic in origin?	*No*
List any direct anthropogenic influences on the wetland.	Forestry activities have affected most of the forested areas through overstory removal, road construction and precommercial thinning.
List any evidence of scientific, recreational, cultural, educational, conservational use:	There are moose hunting signs visible along roads that cross these wetlands, and they likely provide an important feature for moose hunting. Forestry related activities are also widespread in the forested areas of the wetland.

Summary of wetland functions	
Hydrological functions Based on the observable features of the wetland, summarize any notable hydrological functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	This wetland is primarily fed through throughflow moving through basal till. There is some visual evidence of water table variation at the surface suggesting that during drier periods, this wetland complex may have abundant capacity to store water from rainfall events, largely attributable to its expansive size. During wetter periods, this wetland is saturated, however and surface water would move through more quickly. During direr periods, precipitation is largely absorbed and released through evaporation and evapotranspiration via the extensive forest cover on this wetland. Reduction is flow energy in surface water runoff occurring in this wetland may be partially attributable to the well vegetated surface of the wetland, but moreso as a product of the flat topography of the valley, and the porous overburden beneath the wetland through which most of the water flowing into bird brook likely passes. This wetland lines nearly the entire length of Bird Brook and tributaries so that the maintenance of base flow in this watercourse can be attributable to the groundwater inputs to this wetland. This wetland is not remarkable in its ability to perform hydrological function except that it is extensive and any functions that are performed are done so over a large area. However, many such large wetland complexes occur in the vicinity of the Project Assessment Area.
Water quality functions Based on the observable features of the wetland, summarize any notable water quality-related functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	The wetland contains tree and shrub vegetation at a density that would slow water and contribute to water quality enhancement, and may provide cool water to downstream wetlands as the water in this wetland is held below ground. Multiple beaver dams at locations along Bird Brook and tributaries have both positive and negative effects on elements of water quality, but notably would allow suspended sediments to settle. Once water enters the watercourses, this wetland has little effect on water quality.
Ecological functions Based on the observable features of the wetland, summarize any notable ecological or habitat functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	Avian species at risk were recorded within this wetland (Canada Warbler, Olive-sided Flycatcher, Common Nighthawk and Rusty Blackbird). These species were found at several locations inside and outside the Study Area and it does not appear that habitat for any of these species is limiting in the area. This wetland provides habitat and food source (e.g. an abundance of blueberries) for moose, bear, and other wildlife of the region, in conjunction with the surrounding upland and other nearby wetlands. No plant SOCC were found. In general this wetland is typical to this area where wetlands in general are abundant, and it does not appear to be highly productive in terms of plant diversity or wildlife. This wetland supports Bean Brook and its tributaries which were found to support Atlantic Salmon in the lower reaches.
Social Functions Summarize the wetland's importance for use by humans in a commercial, recreational, scientific, cultural, conservational, or educational capacity if present.	This wetland may occasionally be used for hunting, and evidence of fishing activities along Bird Brook was noted. There was little evidence that it provides any significant social function.

Surveyor: *Greg Quinn*, *Krystal Mathieson*	
NBWLID: *4638467036*	Date: *8/24/2011*
Project Name: *Sisson*	Project Number: 121810356
NBDELG Wetland Type: *Fresh Marsh*	Secondary Type:
☐ Riparian?	☐ Provincially Significant?

Wetland description overview: Wetland 2

A small, hydraulically isolated Disturbed Scirpus Meadow (DSM) formed in a disturbed borrow-pit that now dominated by bulrushes. It is located at the top of the watershed divide and has a small, intermittent outlet through a partially blocked culvert under an old forestry road.

Inlets and outlets / watercourses	
Inlet present?	Type:. Number:
Beaver dam(s) present?	Number: ☐ Is beaver activity ongoing?
Primary watercourse	Permanent or intermittent flow? (none) *Choose an item.*
	Wet width?
	☐ Inflow larger than outflow? ☑ Outflow present?
	Fluctuating water level? *Low*
	Rate degree of braiding in the channel(s): *Low*
	Under which condition does the watercourse appear to overflow its normal channel? *Only during spring freshet*

Stormwater retention and water quality features	
Rate capacity to store stormwater:	*Low*
Restrictions at outflow?	*Partially blocked (crushed) 12" culvert.*
Estimate position in watershed:	*Upper position*
Vegetation density	Slows drainage? *Moderately*
	Stabilizes shoreline/banks? *NA*
	Provides shade for watercourse? *No*
Is there sedimentation occurring within the wetland?	No

Species of Conservation Concern	
	☐ SOCC present?
List species observed:	
Does the wetland support appropriate habitat for SOCC known to occur in the area?	No SOCC are known to occur in the greater area, and the wetland represents low overall potential for SOCC.

Community characteristics	
☐ Uncommon or unique community?	If "yes", describe briefly:
☐ Does this wetland have strong potential for carbon storage?	
Rate the structural diversity of this wetland: *Low*	
Are there are variety of distinct vegetation communities within the wetland? No, fairly uniform	
Percent open water? *less than 5%*	

Wildlife	
List wildlife species observed within the wetland:	This wetland may serve as a vernal pool for herpetiles, although during the visit in mid-summer, standing water was limited and this function was not confirmed. The wetland may also provide feeding opportunities for birds such as red-winged and rusty blackbirds.
Indicate any indirect evidence of notable wildlife use.	
Likelihood of fish-bearing	
☐ Fish observed?	☐ High quality amphibian habitat?

Invasive species	
List any invasive species that are present within the wetland:	No invasive species were observed in the wetland.
Are any of these invasives dominant or clearly becoming dominant? (list)	

Anthropogenic influences	
Is the wetland anthropogenic in origin?	*No*
List any direct anthropogenic influences on the wetland.	
List any evidence of scientific, recreational, cultural, educational, conservational use:	N/A

Summary of wetland functions	
Hydrological functions Based on the observable features of the wetland, summarize any notable hydrological functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	This wetland has a small catchment area, but water that does flow into the wetland is held and slowly released through a somewhat restrictive culvert at the outflow. This wetland is of minimal hydrological functional; importance on a landscape scale.
Water quality functions Based on the observable features of the wetland, summarize any notable water quality-related functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	The wetland contains herbaceous vegetation at a density that would slow water and contribute to water quality enhancement. However, the small size and catchment area of the wetland limits the importance of this function on a landscape scale.
Ecological functions Based on the observable features of the wetland, summarize any notable ecological or habitat functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	This wetland is dominated by dense bulrushes which may provide foraging and nesting opportunities for birds such as red-winged and rusty blackbirds. The wetland may also act as a vernal pool for breeding amphibians, although due neither of these functions were observed at the wetland, partially due to the mid-summer timing of the assessment of this wetland. This wetland is not important for ecological functions relative to other wetlands at the landscape level.
Social Functions Summarize the wetland's importance for use by humans in a commercial, recreational, scientific, cultural, conservational, or educational capacity if present.	There was no evidence that this wetland fulfills any significant social function.

Surveyor: Greg Quinn, Krystal Mathieson	
NBWLID: 4635767047, 4636567043, and 4636067045	Date: 7/5/2011
Project Name: Sisson	Project Number: 121810356
Wetland Type: Forested	Secondary Type: Fresh Marsh
☑ Riparian?	☐ Provincially Significant?

Wetland description overview: Wetland 3

The NBENV mapped polygons within this wetland complex form the riparian portion of a larger, spring-fed wetland that is dominated by OFW and MFW. Most of the NBENV mapped portions are classified as BIW. This wetland forms the headwater for the largest of three tributaries to Sisson Brook (S1A) and has groundwater inputs from point locations at the southern and western ends, as well as diffuse input from along the southeastern boundary at the toe of the pronounced linear ridge. Southwest of the NBENV portion of the wetland, much of the OFW was clear cut approximately 10 years ago.

Inlets and outlets / watercourses	
Inlet present?	Type: Seepage/Spring Number: Multiple
Beaver dam(s) present?	Number: Multiple ☑ Is beaver activity ongoing?
Primary watercourse	Permanent or intermittent flow? Permanent
	Wet width? 1-2 m
	☐ Inflow larger than outflow? ☑ Outflow present?
	Fluctuating water level? Low
	Rate degree of braiding in the channel(s): Low
	Under which condition does the watercourse appear to overflow its normal channel? Only under heavy rainfall events

Stormwater retention and water quality features	
Rate capacity to store stormwater:	Medium
Restrictions at outflow?	Multiple beaver dams retain water within the wetland complex.
Estimate position in watershed:	Upper position
Vegetation density	Slows drainage? Effectively
	Stabilizes shoreline/banks? Yes
	Provides shade for watercourse? Somewhat
Is there sedimentation occurring within the wetland?	Minor/ periodic occurrences

Species of Conservation Concern	
	☑ SOCC present?
List species observed:	Canada Warbler
	Rusty Blackbird
	Olive-sided Flycatcher
Does the wetland support appropriate habitat for SOCC known to occur in the area?	See above species.

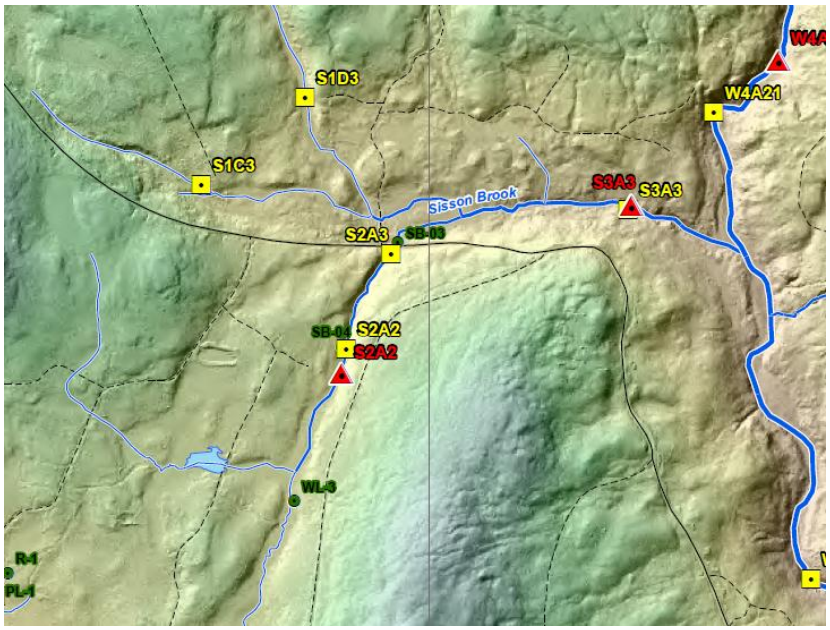
Community characteristics	
☐ Uncommon or unique community?	If "yes", describe briefly:
☐ Does this wetland have strong potential for carbon storage?	
Rate the structural diversity of this wetland: Medium	
Are there are variety of distinct vegetation communities within the wetland? Three distinct communities	
Percent open water? 5 to 25%	

Wildlife	
List wildlife species observed within the wetland:	As with much of the rest of the study area, the wetland is well used by moose and bears, and beaver activity is ongoing at multiple locations. A number of migratory birds were also recorded.
Indicate any indirect evidence of notable wildlife use.	
Likelihood of fish-bearing	High
☐ Fish observed?	☐ High quality amphibian habitat?

Invasive species	
List any invasive species that are present within the wetland:	No invasive species were observed in the wetland.
Are any of these invasives dominant or clearly becoming dominant? (list)	

Anthropogenic influences	
Is the wetland anthropogenic in origin?	No
List any direct anthropogenic influences on the wetland.	A forestry road and some trails related to mineral exploration cross the wetland providing opportunity for beaver impoundment.
List any evidence of scientific, recreational, cultural, educational, conservational use:	N/A

Summary of wetland functions	
Hydrological functions Based on the observable features of the wetland, summarize any notable hydrological functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	This Wetland forms the headwater of the S1A tributary to Sisson Brook and fringes the watercourse much of the way. Most notable is the groundwater input to this wetland, which is localized on the western side, and diffuse along the eastern side where it issues from the toe of Nashwaak Ridge. While surface runoff from this steep slope is flashy, there are beaver impoundments and sufficient vegetation to reduce the flow energy and mitigate peak flows, while the groundwater input supplies Sisson Brook with a steady supply of clean cool water that helps maintain base flow. Snowmelt is retained by the forested headwater area, where water percolates through densely vegetated basal till toward the watercourse. Beaver dams in the middle of the watershed retain water and maintain a high water table, further contributing to base flow. Once the watercourse reaches the northern portion of the complex, runoff increases in speed where the watercourse continues downstream. Relative to the greater wetland complex to the east, this wetland is of moderate hydrological function at a landscape scale
Water quality functions Based on the observable features of the wetland, summarize any notable water quality-related functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	Groundwater supplies this wetland complex with clean cool water and active beaver impoundments allow sediments to settle out and provide a source of nutrients for downstream fish habitat, but they may also slightly increase water temperature. However, the small size of the wetland relative to the very large complex downstream to the east limits the importance of this function on a landscape scale.
Ecological functions Based on the observable features of the wetland, summarize any notable ecological or habitat functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	This wetland complex forms the headwaters of the largest of three tributaries to Sisson Brook which supports highly productive trout habitat. The substantial groundwater input, flow regulation, and nutrients from beaver impoundments collectively serve to support this productive habitat. The wetland also provides habitat and food source (e.g. an abundance of blueberries) for moose, bear, and other wildlife of the region, in conjunction with the surrounding upland and other nearby wetlands. In general, the wetland is oligotrophic and not highly productive. The beaver activity in this wetland has created multiple impoundments that provide habitat for aquatic species and add to the structural diversity of the wetland. One bird species of conservation concern (Canada Warbler) was recorded in this wetland, but similar habitat for this species is widely available in the area..
Social Functions Summarize the wetland's importance for use by humans in a commercial, recreational, scientific, cultural, conservational, or educational capacity if present.	This wetland may occasionally be used for hunting and fishing, but there was little evidence that it provides any significant social function.



Surveyor: Greg Quinn, Krystal Mathieson	
NBWLID: 4637467036, 4637667033	Date: 7/28/2011
Project Name: Sisson	Project Number: 121810356
Wetland Type: Shrub	Secondary Type: Forested
☑ Riparian?	☐ Provincially Significant?

Wetland description overview: Wetland 4

The NBENV mapped polygons delineate active and older beaver meadows (BIW and SRW) which are part of a larger riparian wetland complex along Sisson Brook (and tributaries) that is mostly comprised of balsam fir-dominated MFW. Unlike other wetland complexes in the Study Area, there are no expansive OFWs fringing the watercourses due to steeper topography in this watershed. Wetland 3 located 530 m to the south is connected to this wetland by Sisson Brook.

Inlets and outlets / watercourses	
Inlet present?	Type: Watercourse Number: 2
Beaver dam(s) present?	Number: Multiple ☑ Is beaver activity ongoing?
Primary watercourse	Permanent or intermittent flow? Permanent
	Wet width? 2 m
	☐ Inflow larger than outflow? ☑ Outflow present?
	Fluctuating water level? Medium
	Rate degree of braiding in the channel(s): Low
	Under which condition does the watercourse appear to overflow its normal channel? Only under heavy rainfall events

Stormwater retention and water quality features	
Rate capacity to store stormwater:	Medium
Restrictions at outflow?	Beaver dams and a road culvert provide some restriction to drainage
Estimate position in watershed:	Middle position
Vegetation density	Slows drainage? Moderately
	Stabilizes shoreline/banks? Yes
	Provides shade for watercourse? Yes
Is there sedimentation occurring within the wetland?	Minor/ periodic occurrences

Species of Conservation Concern	
	☑ SOCC present?
List species observed:	Canada Warbler
Does the wetland support appropriate habitat for SOCC known to occur in the area?	Canada Warbler was identified in this wetland at two locations.

Community characteristics	
☐ Uncommon or unique community?	If "yes", describe briefly:
☐ Does this wetland have strong potential for carbon storage?	
Rate the structural diversity of this wetland: Medium	
Are there are variety of distinct vegetation communities within the wetland? Two distinct communities	
Percent open water? less than 5%	

Wildlife	
List wildlife species observed within the wetland:	As with much of the rest of the study area, the wetland is well used by moose and bears. Migratory birds have been identified in or near the wetland. Beaver activity was noted at two locations.
Indicate any indirect evidence of notable wildlife use.	
Likelihood of fish-bearing	High
☑ Fish observed?	☐ High quality amphibian habitat?

Invasive species	
List any invasive species that are present within the wetland:	No invasive species were observed in the wetland.
Are any of these invasives dominant or clearly becoming dominant? (list)	

Anthropogenic influences	
Is the wetland anthropogenic in origin?	No
List any direct anthropogenic influences on the wetland.	A culvert crossing on a forestry road provides beavers with easy impoundment opportunities which appears to occur periodically at that location.
List any evidence of scientific, recreational, cultural, educational, conservational use:	N/A

Summary of wetland functions	
Hydrological functions Based on the observable features of the wetland, summarize any notable hydrological functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	The topography of the central drainage in this watershed is more pronounced than the others within the Study Area, and the flow in Sisson Brook at the eastern end of the Study Area appears flashier than the other major outflows in the Study Area. There is also less wetland in this watershed than in the others (12% vs. 17%-38%). This is largely a product of topography but the lack of wetland may also further contribute to the flashiness. NBENV wetland 4637667033 appears to be strongly groundwater fed, and seepages were noted along the toes of the steeper embankments near the watercourses. This wetland is of limited landscape level important due to its relatively small size compared to other wetlands in the area, and the small catchment area.
Water quality functions Based on the observable features of the wetland, summarize any notable water quality-related functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	This wetland is well vegetated, helping to limit erosion along this often fast-moving watercourse, and providing shade to prevent warming. Groundwater inputs supply cool, clean water to the watercourse at multiple locations. Beaver impoundments in various states of repair slow flow enough to allow sediments introduced from nearby forestry roads to settle from the watercourse. However, the small size of the wetland and watershed limit the importance of this function on a landscape scale where large wetland complexes are abundant.
Ecological functions Based on the observable features of the wetland, summarize any notable ecological or habitat functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	The wetlands in this watershed are generally more minerotrophic than those in other watersheds, which is a product of the proximity to the watercourse, and stronger mineral input from seepages along steep embankments and more erosive upland slopes. Species richness in this wetland is not exceptional relative to other wetlands in the area, and no notable wildlife occurrences were recorded with the exception of Canada Warbler. Sisson Brook and its tributaries provide highly productive habitat for brook trout. However, given the abundance of wetlands in the area, this relatively small wetland complex is not exceptional.
Social Functions Summarize the wetland's importance for use by humans in a commercial, recreational, scientific, cultural, conservational, or educational capacity if present.	This wetland may occasionally be used for hunting and fishing, but there was little evidence that it provides any noteworthy social function.

Surveyor: Greg Quinn, Krystal Mathieson	
NBWLID: 4636267063 and 4636067062	Date: 7/28/2011
Project Name: Sisson	Project Number: 121810356
Wetland Type: Forested	Secondary Type: Fen
☑ Riparian?	☐ Provincially Significant?

Wetland description overview: Wetland 5

These NBENV wetlands are part of a large, sprawling wetland complex that occupies a large portion of the southern Study Area and is associated with McBean Brook and its tributaries. Most of the greater complex is of the OFW wetland type. The NBENV mapped portions are comprised of SRW, BIW and fen with some bog habitat. This wetland complex is characterized by substantial groundwater inputs which are obvious at many locations: particularly at Christmas and Trouser lakes. Despite this groundwater input, the wetland is not highly minerotrophic, and much of the wetland area outside the NBENV mapped portions is oligotrophic. Despite this, the groundwater input and beaver activity in combination with the underlying bedrock and soils, makes this complex the richest in the Study Area, although relative to more northerly wetlands in the Central Uplands, it is still relatively poor.

Inlets and outlets / watercourses	
Inlet present?	Type: Watercourse Number: Multiple
Beaver dam(s) present?	Number: Multiple ☑ Is beaver activity ongoing?
Primary watercourse	Permanent or intermittent flow? Permanent
	Wet width? 2-3 m at outlet
	☐ Inflow larger than outflow? ☑ Outflow present?
	Fluctuating water level? Low
	Rate degree of braiding in the channel(s): Low
	Under which condition does the watercourse appear to overflow its normal channel? Only during spring freshet

Stormwater retention and water quality features	
Rate capacity to store stormwater:	High
Restrictions at outflow?	Beaver dams at multiple locations retain surface water.
Estimate position in watershed:	Middle position
Vegetation density	Slows drainage? Effectively
	Stabilizes shoreline/banks? Yes
	Provides shade for watercourse? Somewhat
Is there sedimentation occurring within the wetland?	Minor/ periodic occurrences

Species of Conservation Concern	
	☑ SOCC present?
List species observed:	Canada Warbler
	Rusty Blackbird
	Olive-sided flycatcher, Common Nighthawk.
Does the wetland support appropriate habitat for SOCC known to occur in the area?	

Community characteristics	
☑ Uncommon or unique community?	If "yes", describe briefly:
Most of this community is very common throughout the province, but the Christmas Lake LSW community is uncommon, although not rare.	
☑ Does this wetland have strong potential for carbon storage?	
Rate the structural diversity of this wetland: High	
Are there are variety of distinct vegetation communities within the wetland? Three distinct communities	
Percent open water? 5 to 25%	

Wildlife	
List wildlife species observed within the wetland:	As with much of the rest of the study area, the wetland is well used by moose and bears. Two moose were observed as well as abundant moose sign.
Indicate any indirect evidence of notable wildlife use.	
Likelihood of fish-bearing	High
☑ Fish observed?	☐ High quality amphibian habitat?

Invasive species	
List any invasive species that are present within the wetland:	No invasive species were observed in the wetland.
Are any of these invasives dominant or clearly becoming dominant? (list)	None noted

Anthropogenic influences	
Is the wetland anthropogenic in origin?	No
List any direct anthropogenic influences on the wetland.	Forestry roads cross the wetland at multiple locations.
List any evidence of scientific, recreational, cultural, educational, conservational use:	There is evidence of moose hunting (ATV trails and blinds)

Summary of wetland functions	
Hydrological functions Based on the observable features of the wetland, summarize any notable hydrological functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	The most noteworthy hydrological features of these wetlands are the groundwater inputs that are occasionally large and obvious. Christmas Lake has only one small surface inflow that is spring fed at its source, but the lake is located at the site of a large groundwater output. The outflow of this lake has a wet width between 2 and 3 metres wide, providing an indication of the volume of input. Similar but lesser inputs were noted at various locations around the greater wetland complex, particularly at or near the fen locations. Around these central, slightly minerotrophic areas that comprise the NBENV mapped wetland polygons, there are wide fringing, unmapped areas of OFW and MFW that are fed by rainwater and small localized groundwater inputs. These wetlands tend to be managed for forestry but are generally well-vegetated and mitigate peaks in surface runoff from snow melt and heavy precipitation events. The large size of this wetland and notable groundwater input make this wetland important at a landscape level for the maintenance of base flow in McBean Brook and its contribution to the health of the upper Nashwaak River watershed.
Water quality functions Based on the observable features of the wetland, summarize any notable water quality-related functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	The groundwater inputs to these wetlands is cool and clean, and sedimentation is effectively mitigated by the large wetland complex with multiple beaver impoundments which allow sediment to settle out of flowing water. The watercourse embankments are typically well-vegetated for shade and erosion prevention. The large peaty complexes and coniferous dominated headwaters likely reduce pH in McBean Brook. The greater wetland complex forms much of the headwaters for McBean Brook and the associated groundwater inputs supply much of the water in that Brook. In this regard, the wetland complex should be considered important at the landscape level.
Ecological functions Based on the observable features of the wetland, summarize any notable ecological or habitat functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	Avian species at risk were recorded within this wetland (Canada Warbler, Olive-sided Flycatcher, Common Nighthawk and Rusty Blackbird). These species were found at many locations inside and outside the Study Area and it does not appear that habitat for any of these species is limiting in the area. This wetland provides habitat and food source (e.g. an abundance of blueberries) for moose, bear, and other wildlife of the region, in conjunction with the surrounding upland and other nearby wetlands. No plant SOCC were found although some uncommon species were identified in the Trouser Lake and Christmas Lake area. In general this wetland is typical to this area where wetlands in general are abundant, and while it does not appear to be highly productive in terms of plant diversity or wildlife.
Social Functions Summarize the wetland's importance for use by humans in a commercial, recreational, scientific, cultural, conservational, or educational capacity if present.	There is evidence of moose hunting activities in and around this wetland in the form of ATV trails and moose blinds. This wetland also plays an important role in the maintenance of McBean Brook which is used for angling. Much of the forested portions of the wetland are intensively managed for forestry. There was no evidence found of scientific or cultural use.

Surveyor: Greg Quinn, Krystal Mathieson	
NBWLID: 4640567081, 4640767081, 4640967086, 4641167081, and 4641167084	Date: 7/5/2011
Project Name: Sisson	Project Number: 121810356
Wetland Type: Forested	Secondary Type: Shrub
☑ Riparian?	☐ Provincially Significant?

Wetland description overview: Wetland 6

A riparian wetland complex associated with two tributaries to West Branch Napadogan Brook. The eastern portion of the wetland associated with the confluence of two first order tributaries (W1F, W1G to W2B) is comprised of old beaver meadow (SRW) dominated by speckled alder and recently formed beaver meadow (BIW) dominated by graminoids. The western portion of the wetland associated with a first order tributary (W1H) is comprised of active beaver pond, with beaver meadow margins dominated by graminoids. Outside of the NBENV wetland boundary, the wetland is comprised of black spruce-dominated oligotrophic forested wetland, which dominates the complex.

Inlets and outlets / watercourses	
Inlet present?	Type: Watercourse Number: 3
Beaver dam(s) present?	Number: Multiple ☑ Is beaver activity ongoing?
Primary watercourse	Permanent or intermittent flow? Permanent
	Wet width? 2-3 m at outflow
	☐ Inflow larger than outflow? ☑ Outflow present?
	Fluctuating water level? Medium
	Rate degree of braiding in the channel(s): Medium
	Under which condition does the watercourse appear to overflow its normal channel? Only during spring freshet

Stormwater retention and water quality features	
Rate capacity to store stormwater:	Medium
Restrictions at outflow?	Multiple beaver dams in various states of maintenance restrict outflow to varying degrees.
Estimate position in watershed:	Upper position
Vegetation density	Slows drainage? Moderately
	Stabilizes shoreline/banks? Yes
	Provides shade for watercourse? Yes
Is there sedimentation occurring within the wetland?	Severe sedimentation

Species of Conservation Concern	
	☐ SOCC present?
List species observed:	
Does the wetland support appropriate habitat for SOCC known to occur in the area?	The wetland could support habitat for Canada Warbler, Olive-sided Flycatcher and Rusty Blackbird, which have been sighted in the Study Area in similar habitat.

Community characteristics	
☑ Uncommon or unique community?	If "yes", describe briefly:
This mix of communities is very common throughout the province.	
☐ Does this wetland have strong potential for carbon storage?	
Rate the structural diversity of this wetland: Medium	
Are there are variety of distinct vegetation communities within the wetland? Three distinct communities	
Percent open water? less than 5%	

Wildlife	
List wildlife species observed within the wetland:	As with much of the rest of the study area, the wetland is well used by moose and bears. Nothing unusual; noted.
Indicate any indirect evidence of notable wildlife use.	
Likelihood of fish-bearing	High
☑ Fish observed?	☐ High quality amphibian habitat?

Invasive species	
List any invasive species that are present within the wetland:	No invasive species were observed in the wetland.
Are any of these invasives dominant or clearly becoming dominant? (list)	

Anthropogenic influences	
Is the wetland anthropogenic in origin?	No
List any direct anthropogenic influences on the wetland.	The watercourse crosses a road through a culvert near the southern end of the wetland. This crossing washed out in 2010 creating a large sedimentation event.
List any evidence of scientific, recreational, cultural, educational, conservational use:	This wetland has a small campsite near the southern end where cleaned trout remains were seen, indicating use for fishing.

Summary of wetland functions	
Hydrological functions Based on the observable features of the wetland, summarize any notable hydrological functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	This wetland is located at the top of a small catchment area, and most of the wetland is rain fed, although the tributary that runs through it is partially groundwater fed near its source. Groundwater contribution from this wetland is probably minimal due to the low fragmentation of the local bedrock. The wide flat, well-vegetated wetland with its series of beaver dams is effective at lowering flow energy and releasing snow melt and heavy precipitation slowly into the receiving watershed. This wetland is likely of moderate hydrological function largely due to its large size. However, it is contiguous with a very large complex outside the Study Area that is many times its size and the relative importance of this lobe is small.
Water quality functions Based on the observable features of the wetland, summarize any notable water quality-related functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	The wetland contains shrub vegetation at a density that would slow water and contribute to water quality enhancement, and provides cool water to downstream wetland from groundwater inputs and surface runoff that percolates slowly through the soils of the fringing forested wetlands. The beaver impoundments allow sediments to settle out of the flowing water. These dams were particularly important in mitigating the sedimentation event from the woods road in 2010, but beaver at the culvert may have also been the cause of the washout. The vicinity of the Study Area is particularly rich in wetland habitat, particularly down-flow from this wetland to the north. This wetland is relatively small in comparison, and its hydrological importance is proportionately small.
Ecological functions Based on the observable features of the wetland, summarize any notable ecological or habitat functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	This wetland provides habitat and food source (e.g. an abundance of blueberries) for moose, bear, and other wildlife of the region, in conjunction with the surrounding upland and other nearby wetlands, but is not of any particular importance relative to these other surrounding habitats. There is a potential for avian SOCC to occur within this wetland although none were noted. The associated watercourses have abundant brook trout.
Social Functions Summarize the wetland's importance for use by humans in a commercial, recreational, scientific, cultural, conservational, or educational capacity if present.	This wetland is used for fishing, as evident from the fish heads found at the campsite at the south end of the wetland. Like other wetlands in the Study Area, it may occasionally be used for hunting, but there was little evidence that it provides important social function.

Surveyor: Greg Quinn, Krystal Mathieson	
NBWLID: 4638767055, 4638867052	Date: 7/12/2011
Project Name: Sisson	Project Number: 121810356
Wetland Type: Shrub	Secondary Type: Forested
☐ Riparian?	☐ Provincially Significant?

Wetland description overview: Wetlands 8 and 9

A pair of small OFW wetlands dominated by ericaceous shrub with black spruce forested margins, and patches of black spruce in the centre. Soils are comprised of thin peat over stoney basal till with larger stones near wetland margins. The water level appears to vary widely but gradually throughout the season. The wetland drains subsurface through basal till to a BIW to the southeast. The two wetlands are connected by subsurface flow which crosses a forestry road between the wetlands through a culvert in an eastward direction. These wetlands are greater than 30m apart so according to our methods they are separate, but due to their similarity, they are assessed for function together.

Inlets and outlets / watercourses	
Inlet present?	Type: Number:
Beaver dam(s) present?	Number: No ☐ Is beaver activity ongoing?
Primary watercourse	Permanent or intermittent flow? NA
	Wet width?
	☐ Inflow larger than outflow? ☑ Outflow present?
	Fluctuating water level? NA
	Rate degree of braiding in the channel(s): NA
	Under which condition does the watercourse appear to overflow its normal channel? NA

Stormwater retention and water quality features	
Rate capacity to store stormwater:	Medium
Restrictions at outflow?	No restrictions exist within the NBDNR portion of the wetland, but at the boundary, the wetland drains through basal till, which has somewhat of a restrictive effect. Beyond the NBDNR portion of the wetland, there is a beaver dam restricting outflow.
Estimate position in watershed:	Upper position
Vegetation density	Slows drainage? Moderately
	Stabilizes shoreline/banks? NA
	Provides shade for watercourse? NA
Is there sedimentation occurring within the wetland?	No

Species of Conservation Concern	
	☐ SOCC present?
List species observed:	
Does the wetland support appropriate habitat for SOCC known to occur in the area?	No SOCC are known to occur in the greater area, and the wetland represents low overall potential for SOCC.

Community characteristics	
☐ Uncommon or unique community?	If "yes", describe briefly:
☑ Does this wetland have strong potential for carbon storage?	
Rate the structural diversity of this wetland: Low	
Are there are variety of distinct vegetation communities within the wetland? No, fairly uniform	
Percent open water? less than 5%	

Wildlife	
List wildlife species observed within the wetland:	As with much of the rest of the study area, the wetland is well used by moose and bears.
Indicate any indirect evidence of notable wildlife use.	
Likelihood of fish-bearing	
☐ Fish observed?	☐ High quality amphibian habitat?

Invasive species	
List any invasive species that are present within the wetland:	No invasive species were observed in the wetland.
Are any of these invasives dominant or clearly becoming dominant? (list)	

Anthropogenic influences	
Is the wetland anthropogenic in origin?	No
List any direct anthropogenic influences on the wetland.	The area surrounding the wetland has been pre-commercially thinned, which may have a minimal effect on the wetland.
List any evidence of scientific, recreational, cultural, educational, conservational use:	N/A

Summary of wetland functions	
Hydrological functions Based on the observable features of the wetland, summarize any notable hydrological functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	These connected wetlands collect rainwater and surface runoff throughout the season and hold snowmelt in the spring. The wetlands have formed in shallow basins that have porous basal till restricting outflow, but allowing it to release slowly into the lower watershed to the east. The water level appears to fluctuate widely but gradually in these wetlands making them effective at mitigating peaks in snowmelt and runoff from heavy precipitation events. There appears to be little groundwater interaction at these locations. The small size of these wetlands limits their relative importance on the landscape which is dominated by large wetland complexes.
Water quality functions Based on the observable features of the wetland, summarize any notable water quality-related functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	The pair of wetlands contain shrub vegetation at a density that would slow water and contribute to water quality enhancement, and may provide cool water to downstream wetlands as the water in this wetland is held below the surface. However, the small size of the wetland limits the importance of this function on a landscape scale.
Ecological functions Based on the observable features of the wetland, summarize any notable ecological or habitat functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	This wetland provides habitat and food source (e.g. an abundance of blueberries) for moose, bear, and other wildlife of the region, in conjunction with the surrounding upland and other nearby wetlands, but is not of any particular importance relative to these other surrounding habitats.
Social Functions Summarize the wetland's importance for use by humans in a commercial, recreational, scientific, cultural, conservational, or educational capacity if present.	This wetland may occasionally be used for hunting, but there was little evidence that it provides any significant social function.

Surveyor: *Greg Quinn*, *Krystal Mathieson*	
NBWLID: *4638767040; 4638767036*	Date: *7/12/2011*
Project Name: *Sisson*	Project Number: 121810356
Wetland Type: *Shrub*	Secondary Type: *Fresh Marsh*
☑ Riparian?	☐ Provincially Significant?

Wetland description overview: Wetland 8

A relatively smaller riparian wetland complex that follows a section of Bird Brook (B3A), The NBENV mapped portion is largely shrub riparian wetland (SRW) dominated by speckled alder and multiple areas of recently formed beaver meadow dominated by graminoids, The upland and margins are black spruce and balsam fir forest. This wetland is receives the surface runoff from the large Bird Brook headwaters wetland to the west. An unnamed second order tributary converged with Bird Brook just below this wetland. The southern side of the wetland is fed by obvious seepage from the toe of the embankment. This seepage is predominant on the Mesotrophic Forested Wetland (MFW) that separates the two open beaver meadow areas upstream and downstream.

Inlets and outlets / watercourses	
Inlet present?	Type: *Watercourse* Number: *2*
Beaver dam(s) present?	Number: *Multiple* ☑ Is beaver activity ongoing?
Primary watercourse	Permanent or intermittent flow? *Permanent*
	Wet width? *2-3 m at outflow*
	☐ Inflow larger than outflow? ☑ Outflow present?
	Fluctuating water level? *Medium*
	Rate degree of braiding in the channel(s): *Low*
	Under which condition does the watercourse appear to overflow its normal channel? *Only under heavy rainfall events*

Stormwater retention and water quality features	
Rate capacity to store stormwater:	*Low*
Restrictions at outflow?	*Multiple beaver dams retain some water,*
Estimate position in watershed:	*Middle position*
Vegetation density	Slows drainage? *Moderately*
	Stabilizes shoreline/banks? *Yes*
	Provides shade for watercourse? Choose an item.
Is there sedimentation occurring within the wetland?	Minor/ periodic occurrences

Species of Conservation Concern	
	☐ SOCC present?
List species observed:	
Does the wetland support appropriate habitat for SOCC known to occur in the area?	The habitat has potential suitability for olive-sided flycatcher and rusty blackbird, which are known to occur in the area.

Community characteristics	
☐ Uncommon or unique community?	If "yes", describe briefly:
☐ Does this wetland have strong potential for carbon storage?	
Rate the structural diversity of this wetland: *Medium*	
Are there are variety of distinct vegetation communities within the wetland? Three distinct communities	
Percent open water? *5 to 25%*	

Wildlife	
List wildlife species observed within the wetland:	Beaver activity is widespread. Productive salmonid habitat, and abundant passerines (noted but not listed- no SOCC here)
Indicate any indirect evidence of notable wildlife use.	Beaver dams in various states
Likelihood of fish-bearing	*High*
☑ Fish observed?	☐ High quality amphibian habitat?

Invasive species	
List any invasive species that are present within the wetland:	No invasive species were observed in the wetland.
Are any of these invasives dominant or clearly becoming dominant? (list)	

Anthropogenic influences	
Is the wetland anthropogenic in origin?	*No*
List any direct anthropogenic influences on the wetland.	
List any evidence of scientific, recreational, cultural, educational, conservational use:	N/A

Summary of wetland functions	
Hydrological functions Based on the observable features of the wetland, summarize any notable hydrological functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	This wetland has a large catchment area, but much of the water passing through is from Bird Brook and has limited interaction with the wetland due to distinct channel and high rate of flow. The series of beaver dams serves to reduce flow energy in Bird Brook to a limited extent. Obvious seepages at the toe of the bank along the southern border of the wetland feed the MFW portion, forming two channels that flow into a small mapped tributary that begins within the wetland. The flow may play a small role in sustaining base flow, but it may be seasonal. Given it's relatively small size, this wetland is of limited importance for hydrological functions on a landscape scale.
Water quality functions Based on the observable features of the wetland, summarize any notable water quality-related functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	The wetland contains shrub vegetation at a density that would slow water during flood conditions and contribute to water quality enhancement. Likewise the active beaver ponds in this area and relatively flat topography help to reduce flow energy so that suspended particulate can settle from the water. Cool clean water seeps from the southern bank into the wetland although this flow may be seasonal. The relatively small size of the wetland limits the importance of this function on a landscape scale.
Ecological functions Based on the observable features of the wetland, summarize any notable ecological or habitat functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	This wetland is considered to support productive salmonid habitat and beaver activity is prolific. No SOCC or SAR were observed. This wetland does not have high importance at the landscape level.
Social Functions Summarize the wetland's importance for use by humans in a commercial, recreational, scientific, cultural, conservational, or educational capacity if present.	This wetland may occasionally be used for fishing, but there was little evidence that it provides any significant social function. The fish habitat that it supports may help to improve recreation fishing conditions in other areas of the greater watershed to a limited extent.

Surveyor: *Greg Quinn*, *Krystal Mathieson*	
NBWLID: *4640267036*	Date: *7/6/2011*
Project Name: *Sisson*	Project Number: 121810356
Wetland Type: *Shrub*	Secondary Type: *Fresh Marsh*
☑ Riparian?	☐ Provincially Significant?

Wetland description overview: Wetland 11

This wetland is located at the confluence between Bird Brook (B3A) and West Branch Napadogan Brook (W4A), and is comprised of both speckled alder-dominated old beaver meadow and recent beaver meadow dominated by graminoids. There is a small patch of coniferous forested wetland near the centre. Only a small portion of this NBDELG wetland falls within the study area. The NBDELG wetland is the southern limit of a very large wetland complex that encompasses the majority of the upstream portion of Napadogan Brook and its headwater tributaries. This form refers to the portion that fall within the study area.

Inlets and outlets / watercourses	
Inlet present?	Type: *Watercourse* Number: *1*
Beaver dam(s) present?	Number: *Multiple* ☑ Is beaver activity ongoing?
Primary watercourse	Permanent or intermittent flow? *Permanent*
	Wet width? *3-4 m*
	☐ Inflow larger than outflow? ☑ Outflow present?
	Fluctuating water level? *Medium*
	Rate degree of braiding in the channel(s): *Low*
	Under which condition does the watercourse appear to overflow its normal channel? *Only under heavy rainfall events*

Stormwater retention and water quality features	
Rate capacity to store stormwater:	*Low*
Restrictions at outflow?	
Estimate position in watershed:	*Middle position*
Vegetation density	Slows drainage?
	Stabilizes shoreline/banks?
	Provides shade for watercourse?
Is there sedimentation occurring within the wetland?	

Species of Conservation Concern	
	☑ SOCC present?
List species observed:	*Canada warbler*
Does the wetland support appropriate habitat for SOCC known to occur in the area?	Three Canada warbler sightings were recorded within the wetland and the habitat has potential suitability for olive-sided flycatcher and rusty blackbird, which are known to occur in the area.

Community characteristics	
☐ Uncommon or unique community?	If "yes", describe briefly:
☐ Does this wetland have strong potential for carbon storage?	
Rate the structural diversity of this wetland: *Medium*	
Are there are variety of distinct vegetation communities within the wetland? Two distinct communities	
Percent open water? *5 to 25%*	

Wildlife	
List wildlife species observed within the wetland:	Canada Warbler, OBF Atlantic salmon
Indicate any indirect evidence of notable wildlife use.	Moose tracks, otter tracks.
Likelihood of fish-bearing	*High*
☑ Fish observed?	☐ High quality amphibian habitat?

Invasive species	
List any invasive species that are present within the wetland:	No invasive species were observed in the wetland.
Are any of these invasives dominant or clearly becoming dominant? (list)	

Anthropogenic influences	
Is the wetland anthropogenic in origin?	*No*
List any direct anthropogenic influences on the wetland.	
List any evidence of scientific, recreational, cultural, educational, conservational use:	N/A

Summary of wetland functions	
Hydrological functions Based on the observable features of the wetland, summarize any notable hydrological functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	This wetland has large catchment area, but the portion within the study area is small. However, the series of beaver dams in this portion of the wetland would have some effect on reducing flow energy, although during periods of high flow, there would be little effect at this position within the watercourse. This wetland is of minimal hydrological function on a landscape scale.
Water quality functions Based on the observable features of the wetland, summarize any notable water quality-related functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	The series of small beaver impoundments would provide some opportunity for sediments to settle out before converging with Napadogan Stream. During periods of high flow, there would be minimal effect, however. The small size of the portion of wetland within the study area limits the importance of this function on a landscape scale.
Ecological functions Based on the observable features of the wetland, summarize any notable ecological or habitat functions (demonstrated or potential) if present. Is this wetland of particular importance on a provincial or landscape level in this capacity?	The watercourse associated with this wetland (Bird Brook) is productive salmonid habitat. A Canada warbler was recorded within this wetland and the habitat has potential to support other avian SOCC that are known to occur within the area, although the habitat conditions present are common in the area, and there is little to distinguish this wetland as important functionally.
Social Functions Summarize the wetland's importance for use by humans in a commercial, recreational, scientific, cultural, conservational, or educational capacity if present.	This wetland may occasionally be used for fishing, but there was little evidence that it provides any significant social function.